

# TECHNOLOGY SYSTEMS MANAGEMENT (TSM)

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*Any experimental courses offered by TSM can be found at:*

registrar.iastate.edu/faculty-staff/courses/explistsings/ (<http://www.registrar.iastate.edu/faculty-staff/courses/explistsings/>)

**Courses primarily for undergraduates:**

## **TSM 110: Introduction to Technology**

(1-0) Cr. 1. F.

*Prereq: Agricultural Systems Technology or Industrial Technology major*

Team-oriented introduction to agricultural systems technology and industrial technology. Internships, careers, competencies, academic success strategies, transition to academic life.

## **TSM 111: Experiencing Technology**

(1-0) Cr. 1. F.S.

*Prereq: Agricultural Systems Technology or Industrial Technology major*

Team-oriented experiences in a spectrum of topics common to the practice of technology. Internships, faculty and alumni panels, industry visits, and lab demonstrations.

## **TSM 115: Solving Technology Problems**

(2-2) Cr. 3. F.S.

*Prereq: Credit or concurrent enrollment in MATH 140 or higher*

Solving technology problems using modern hardware and software tools for data-driven solutions. Problem solving cycle, unit conversion, unit factor method, SI and engineering units, significant figures, data collecting and cleaning, error analysis, data visualization, curve fitting, and computer coding fundamentals (data types, flow control, I/O handling, visualization, debugging). Strong emphasis on critical thinking, systematic problem solving, and effective communication.

## **TSM 116: Introduction to Design in Technology**

(2-2) Cr. 3. F.S.

Use of parametric solid modeling software to create three dimensional solid models and document parts and assemblies. Includes national and international standards for documentation, design projects, and teamwork. Rapid prototyping design creation, 3D printing, assemblies, rendering, and detailing technical drawings.

## **TSM 201: Preparing for Workplace Seminar**

(Cross-listed with A B E). (1-0) Cr. 1. F.S.

*Prereq: Major in AE, AST, BSE, or I TEC; Sophomore classification*

8 week course. Professionalism in the context of the engineering/technical workplace. Development of intrapersonal and interpersonal qualities including talent assessment; key workplace competency demonstration; leadership practice assessment; preparation of resume; cover letter preparation and behavioral-based interviewing; readiness for internship attainment.

## **TSM 210: Fundamentals of Technology**

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

*Prereq: (TSM 115, ENGR 160, A B E 160, AER E 160, C E 160, CH E 160, CPR E 185, E E 185, I E 148, M E 160, or S E 185); MATH 140 or higher*

Introduction to problem solving related to fundamental agricultural and/or industrial technology systems and mathematical tools needed for data analysis. Basic laws of energy, force, and mass applied to technology systems such as: mechanical power transmission; heating, ventilation and air conditioning; electrical circuits. Introduction to engineering economics: using the time value of money to make economic decisions.

## **TSM 214: Managing Technology Projects**

(2-0) Cr. 1. F.S.

*Prereq: (A B E 201 or TSM 201); Sophomore classification*

8 week course. Introduction to project management principles. Use of project management in technology-based projects for academic, industry, and personal use.

## **TSM 216: Advanced Technical Graphics, Interpretation, and CAD**

(1-2) Cr. 2. F.S.

*Prereq: TSM 116*

Advanced computer-aided-design topics incorporating 3D design and documentation used in manufacturing settings. Topics include: geometric dimensioning and tolerancing, weldments, sheet metal parts, advanced visualization, feature based design of parts and assemblies.

## **TSM 240: Introduction to Advanced Manufacturing and Metals Processing**

(2-2) Cr. 3. F.S.

*Prereq: MATH 145*

A study of selected materials, properties, and related processes used in metals manufacturing including: CNC lathes, Aluminum die casting, and welding. Introduction to engineering economic tools and their use in financial decision making. Lecture and laboratory activities focus on metals manufacturing processes.

**TSM 241: Introduction to Manufacturing Processes for Plastics**

(Cross-listed with FS HN). (1-2) Cr. 2. F.S.

*Prereq: MATH 145*

A study of selected materials and related processes used in plastics manufacturing. Lecture and laboratory activities focus on materials, properties, and processes.

**TSM 270: Principles of Injury Prevention and Safety**

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

Basic foundations of injury causation and prevention from a personal perspective in home, motor vehicle, and the public environment, and a management perspective within the work environment. Offered online only.

**TSM 310: Total Quality Improvement**

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

*Prereq: (STAT 101 or STAT 104); Junior classification*

Introduction to the fundamental concepts of TQM - Deming style of management, statistical studies to understand the behavior of products, processes, or services, and how to define and document processes and customer focus. Introduction to continuous improvement tools and methods - emphasis on critical thinking and problem solving skills.

**TSM 322: Preservation of Grain Quality**

(3-0) Cr. 3. S.

*Prereq: MATH 140 or higher*

Principles and management for grain quality preservation: quality measurement; drying and storage; fans and airflow through grain; handling methods; insect pest control; and grain quality monitoring.

**TSM 322L: Preservation of Grain Quality Laboratory**

(0-3) Cr. 1. S.

*Prereq: Credit or concurrent enrollment in TSM 322*

Hands-on experiences in the principles and management for grain quality preservation: Quality measurement; drying and storage; fans and airflow through grain; handling methods; system planning; insect pest control; grain quality monitoring. Industry tour.

**TSM 324: Soil and Water Conservation Management**

(2-2) Cr. 3. S.

*Prereq: MATH 140 or MATH 151*

Introduction to engineering and conservation principles applied to the planning of erosion control systems, water control structures, water quality management, and drainage and irrigation systems.

**TSM 325: Biorenewable Systems**

(Cross-listed with A B E). (3-0) Cr. 3. F.

*Prereq: CHEM 163 or higher; MATH 140 or higher*

Converting biorenewable resources into bioenergy and biobased products. Biorenewable concepts as they relate to drivers of change, feedstock production, processes, products, co-products, economics, and transportation/logistics.

**TSM 327: Livestock and Poultry Production: Facilities, Technology, and Management**

(2-2) Cr. 3. F.

Systems-based planning and assessment of confined livestock facilities. Housing evaluation, planning, and management of ventilation, water, and feed systems. Principles of nutrient management planning, manure handling/storage design. Evaluating animal responses to their environment with traditional metrics and precision livestock technologies to enhance welfare and production. Species-specific assessment of production economics, environmental impact, and sustainability.

**TSM 330: Agricultural Machinery and Power Management**

(2-3) Cr. 3. S.

*Prereq: (MATH 145 or MATH 151); TSM 210*

Selection, sizing, and operational principles of tractors and machinery systems. Cost analysis and computer techniques applied to planning and management of agricultural machine systems. Principles, operation, and application of agricultural machinery.

**TSM 335: Tractor Power**

(3-3) Cr. 4. F.

*Prereq: MATH 145; TSM 210*

Theory and construction of tractor engines, mechanical power trains and hydraulic systems. Introduction to traction, chassis mechanics, and hydraulic power.

**TSM 337: Fluid Power Systems Technology**

(2-2) Cr. 3. F.S.

*Prereq: TSM 210*

Fundamental fluid power principles, symbols and schematics. Function and performance of components such as pumps, valves, actuators, and hydro static transmissions. Analysis of fluid power circuits and systems. Introduction to electrohydraulics. Hands on laboratory experiences building and troubleshooting hydraulic circuits.

**TSM 340: Advanced Automated Manufacturing Processes**

(2-2) Cr. 3. F.S.

*Prereq: MATH 151; TSM 210; TSM 216; TSM 240*

NC programming operations and machining practices for CNC mills and lathes. Transfer of part descriptions into detailed process plans, tool selection, and NC codes. Use of CAD/CAM for automated NC programming in 2D/3D machining operations of student designed parts.

**TSM 363: Electrical Power and Control Systems for Agriculture and Industry**

(3-3) Cr. 4. F.S.

*Prereq: MATH 145; TSM 210*

Fundamental electrical theory and application, code requirements, and safety considerations. Single-phase, split-phase, and three-phase circuit design, analysis, and safety considerations; electric motor performance and selection; reactive power and correction; safety devices and circuits; transformer selection and configuration; industrial and motor controls; conductor characteristics, selection and safety; system troubleshooting; and schematic development and analysis. Emphasis on agricultural and industrial applications.

**TSM 370: Occupational Safety**

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

*Prereq: TSM 270; Junior classification*

Identifies safety and health risks in industrial work environments. Focus on how managers and supervisors meet their responsibilities for providing a safe workplace for their employees. Includes the identification and remediation of workplace hazards.

**TSM 371: Occupational Safety Management**

(2-0) Cr. 2. S.

Introduction to occupational safety and health administration and management. Focus on development and management of safety programs and obtaining employee involvement in occupational safety programs.

**TSM 372: Legal Aspects of Occupational Safety and Health**

(2-0) Cr. 2. F.

*Prereq: TSM 371*

A review of the common legal issues facing safety practitioners in the workplace. Includes OSHA, EPA and DOT regulations; workers' compensation, as well as common liability issues.

**TSM 376: Fire Protection and Prevention**

(3-0) Cr. 3. F.

An overview of the current problems and technology in the fields of fire protection and fire prevention, with emphasis on industrial needs, focusing on the individual with industrial safety responsibilities.

**TSM 380: Fundamentals, Applications, and Modeling of Biological Systems**

(2-2) Cr. 3.

*Prereq: BIOL 212; MICRO 201*

Analysis of biological systems, through the study of mass, energy, and information transport in microbial, plant, animal, and human systems. Fundamentals, applications and modeling of biological processes, ecological interactions, and biomanufacturing operations.

**TSM 393: Topics in Technology**

Cr. 1-4. F.S.SS.

Offered as demand warrants. Web-based instruction.

**TSM 393A: Topics in Technology: Agriculture and Biosystems Management**

Cr. 1-4. F.S.SS.

Offered as demand warrants. Web-based instruction.

**TSM 393B: Topics in Technology: Machine Systems**

Cr. 1-4. F.S.SS.

Offered as demand warrants. Web-based instruction.

**TSM 393C: Topics in Technology: Manufacturing**

Cr. 1-4. F.S.SS.

Offered as demand warrants. Web-based instruction.

**TSM 393D: Topics in Technology: Occupational Safety**

Cr. 1-4. F.S.SS.

Offered as demand warrants. Web-based instruction.

**TSM 393E: Topics in Technology: Chemical Application Systems**

Cr. 1-4. F.S.SS.

Offered as demand warrants. Web-based instruction.

**TSM 393F: Topics in Technology: Agricultural Safety and Health**

Cr. 1-4. F.S.SS.

Offered as demand warrants. Web-based instruction.

**TSM 393G: Topics in Technology: Electronic Integration for Agriculture and Production Systems**

Cr. 1-4. F.S.SS.

Offered as demand warrants. Web-based instruction.

**TSM 393I: Topics in Technology: Irrigation Systems Management**

Cr. 1-4. F.S.SS.

Offered as demand warrants. Web-based instruction.

**TSM 393J: Topics in Technology: Machinery Management Using Precision Agriculture Technology**

Cr. 1-4. F.S.SS.

Offered as demand warrants. Web-based instruction.

**TSM 397: Summer Internship in Technology**

Cr. R. Repeatable. SS.

*Prereq: Sophomore or higher classification; AST or ITEC major; Permission of Instructor*

A supervised summer work experience in an approved learning setting with application to technology practices and principles. Written reports, self and employer evaluation, and reflection required. Minimum GPA requirement.

**TSM 399: Internship in Technology**

Cr. R. Repeatable. F.S.

*Prereq: At least 45 credits of coursework; AST or ITEC major; Approval of Internship Coordinator*

A supervised work experience that occurs during the fall or spring semester in an approved learning setting with application to technology practices and principles. Reporting during work experience, self and employer evaluation, and reflection required. Minimum GPA requirement.

**TSM 415: Applied Project Management in Technology**

(1-2) Cr. 2. F.S.

*Prereq: Senior classification; TSM 214; credit or concurrent enrollment in TSM 310*

Implementation of project management principles using case studies and teamwork; problem definition in a technology context; oral and written communication skills development; development of a charter for a technology capstone project.

**TSM 416: Technology Capstone**

(1-4) Cr. 3. F.S.

*Prereq: TSM 415*

Application of project management tools to a technology capstone project; development and evaluation of potential solutions using tools from the technology curriculum; problem resolution emphasizing communication, critical analysis, and planning techniques; presentation of project through oral presentation and written reports with input from client, faculty, and other stakeholders.

**TSM 433: Precision Agriculture**

(Dual-listed with TSM 533). (2-2) Cr. 3. F.

*Prereq: Junior classification*

Geographic information systems (GIS) and global positioning systems (GPS). Hardware systems for precision farming emphasized. Autosteering and automatic implement control systems. Collection and management of yield data. Sampling strategies for precision farming. Introduction to building fertilizer prescriptions and recommendations. Economic benefits of precision farming systems.

**TSM 440: Cellular Lean Manufacturing Systems**

(2-2) Cr. 3. F.S.

*Prereq: TSM 310*

Introduction to lean manufacturing tools and principles, which may include Just-In-Time (JIT), Value Stream Mapping (VSM), Kaizen, Single Minute Exchange of Die (SMED), 5S, Total Productive Maintenance, Standardized Work, Takt Time, and A3. Emphasis on minimizing waste and improving operational performance through tools such as Assembly Line Balancing, Little's Law, and Queuing Theory. Competency development through application using discrete event simulations, case studies, teamwork, industry-related lean projects, and industry guests.

**TSM 443: Statics and Strength of Materials for Technology**

(2-2) Cr. 3. F.S.

*Prereq: PHYS 131 or above; (MATH 145 or MATH 151)*

Application of standard analytic and computer based techniques of solving problems related to force and moments. The properties of materials and how to select appropriate materials for a particular design are reviewed.

**TSM 444: Facility Planning**

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

*Prereq: (STAT 101 or STAT 104); TSM 216; TSM 240*

Fundamental principles and practices in designing, evaluating, and organizing new or existing facilities. Emphasis on AutoCAD-based facility design and production flow analysis, activity relationship analysis, lighting analysis, time studies, materials handling, supporting services design, and optimal facility location analysis.

**TSM 449: Applied Nondestructive Testing and Evaluation.**

(Dual-listed with TSM 549). (2-3) Cr. 3. F.

*Prereq: PHYS 131 or above; MATH 145; (MATH 151 or MATH 165)*

Scientific principles and rationale for non-destructive testing and evaluation. Assessment of material condition and detection of defects in manufacturing or in service. Testing methods and their application to agriculture and industry. Research project required for graduate credit.

**TSM 455: Feed Processing and Technology**

(Dual-listed with TSM 555). (2-3) Cr. 3. F.

*Prereq: Junior classification*

Introduction to formula feed manufacturing and the animal feed industry. Overview of feed ingredients and formulation, understanding and operation of feed production processing equipment including principles of conveying, grinding, mixing, conditioning, pelleting, and other processing techniques, and the formulation of concentrates, premixes, and rations. Students will become knowledgeable about the manufacturing of various animal feed types such as pelleted and extruded feed, aqua (fish) feed, liquid feeds, poured and pressed blocks, steam flaked feed, and pet food, and their effect on animal performance and health. Students will gain hands-on experience in feed manufacturing during weekly lab sessions at a full-scale university owned feed mill and grain science complex.

**TSM 457: Feed Safety, Ingredient Quality and Analytics**

(Dual-listed with TSM 557). (2-3) Cr. 3. S.

*Prereq: Junior classification*

Concepts of feed and grain safety and quality, including hazards and risks associated with common feeds and feed ingredients. Methods to monitor, manage, and mitigate hazards and risks in the context of feed and grain industries. Government regulations applicable to feed and grain safety. Differences between safety and quality factors, how they are measured and then used for decision-making (marketing, processing, or safe-use).

**TSM 465: Automation Systems**

(2-2) Cr. 3. F.S.

*Prereq: TSM 363*

Theory and applications of automation systems. Emphasizes features, capabilities, design and programming skills of Programmable Logic Controller (PLC) based industrial control systems. Introduction to industrial robots and sensors.

**TSM 470: Industrial Hygiene: Physical, Chemical, and Biological Hazards**

(Dual-listed with TSM 570). (3-0) Cr. 3. S.

*Prereq: MATH 151 or higher*

A qualitative and quantitative introduction to health effects of chemical, biological, and physical hazards in a workplace.

**TSM 471: Safety Laboratory**

(Dual-listed with TSM 571). (0-2) Cr. 1. S.

*Prereq: Credit or concurrent enrollment in TSM 470 or TSM 570*

Introduction to equipment, methods, and strategies to measure, evaluate, control, and research hazards and risk in the workplaces.

**TSM 477: Risk Analysis and Management**

(Dual-listed with TSM 577). (3-0) Cr. 3. F.

*Prereq: MATH 151; (STAT 101 or STAT 104)*

Risk analysis and management focuses on developing a risk oriented pattern of thinking that is appropriate for today's complex world. The tools that will be gained in this course will be helpful in recognizing, understanding, and analyzing hazards and risks in modern complex systems.

**TSM 490: Independent Study**

Cr. 1-4. Repeatable.

*Prereq: Junior or Senior classification; Department Permission; Instructor Permission*

A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

**TSM 490H: Independent Study: Honors**

Cr. 1-4. Repeatable.

*Prereq: Junior or Senior classification; Department Permission; Instructor Permission*

A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

**TSM 490I: Independent Study: Manufacturing**

Cr. 1-4. Repeatable.

*Prereq: Junior or Senior classification; Department Permission; Instructor Permission*

A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

**TSM 490J: Independent Study: Agriculture and Biosystems Management**

Cr. 1-4. Repeatable.

*Prereq: Junior or Senior classification; Department Permission; Instructor Permission*

A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

**TSM 490M: Independent Study: Machine Systems**

Cr. 1-4. Repeatable.

*Prereq: Junior or Senior classification; Department Permission; Instructor Permission*

A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

**TSM 490O: Independent Study: Occupational Safety**

Cr. 1-4. Repeatable.

*Prereq: Junior or Senior classification; Department Permission; Instructor Permission*

A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

**TSM 493: Workshop in Technology**

Cr. 1-4. Repeatable.

Offered as demand warrants.

**TSM 493A: Workshop in Technology: Agriculture and Biosystems Management**

Cr. 1-4. Repeatable.

Offered as demand warrants.

**TSM 493B: Workshop in Technology: Machine Systems**

Cr. 1-4. Repeatable.

Offered as demand warrants.

**TSM 493C: Workshop in Technology: Manufacturing**

Cr. 1-4. Repeatable.

Offered as demand warrants.

**TSM 493D: Workshop in Technology: Occupational Safety**

Cr. 1-4. Repeatable.

Offered as demand warrants.

**TSM 495: Agricultural and Biosystems Engineering Department Study Abroad Preparation or Follow-up**

(Cross-listed with A B E). Cr. 1-2. Repeatable. F.S.SS.

*Prereq: Advisor Permission*

Preparation for, or follow-up of, study abroad experience (496). For preparation, course focuses on understanding the tour destination through readings, discussions, and research on topics such as the regional industries, climate, crops, culture, economics, food, geography, government, history, natural resources, and public policies. For follow-up, course focuses on presentations by students, report writing, and reflection. Students enrolled in this course intend to register for 496 the following term or have had taken 496 the previous term.

Meets International Perspectives Requirement.

**TSM 496: Agricultural and Biosystems Engineering Department Study Abroad**

(Cross-listed with A B E). Cr. 1-4. Repeatable. F.S.SS.

*Prereq: Advisor Permission*

Tour and study at international sites relevant to disciplines of industrial technology, biological systems engineering, agricultural systems technology, and agricultural engineering. Location and duration of tours will vary. Trip expenses paid by students. Pre-trip preparation and/or post-trip reflection and reports arranged through 495.

Meets International Perspectives Requirement.

**Courses primarily for graduate students, open to qualified undergraduates:**

**TSM 533: Precision Agriculture**

(Dual-listed with TSM 433). (2-2) Cr. 3. F.

*Prereq: Junior classification*

Geographic information systems (GIS) and global positioning systems (GPS). Hardware systems for precision farming emphasized. Autosteering and automatic implement control systems. Collection and management of yield data. Sampling strategies for precision farming. Introduction to building fertilizer prescriptions and recommendations. Economic benefits of precision farming systems.

**TSM 540: Advanced Design and Manufacturing**

(3-0) Cr. 3. S.

*Prereq: Permission of instructor*

Application of manufacturing process improvement and control methodologies; exploration of advanced manufacturing strategies and equipment; function and operation of advanced automated manufacturing equipment including water jets, wire EDMs and 5-axis mills.

**TSM 549: Applied Nondestructive Testing and Evaluation.**

(Dual-listed with TSM 449). (2-3) Cr. 3. F.

*Prereq: PHYS 131 or above; MATH 145; (MATH 151 or MATH 165)*

Scientific principles and rationale for non-destructive testing and evaluation. Assessment of material condition and detection of defects in manufacturing or in service. Testing methods and their application to agriculture and industry. Research project required for graduate credit.

**TSM 555: Feed Processing and Technology**

(Dual-listed with TSM 455). (2-3) Cr. 3. F.

*Prereq: Junior classification*

Introduction to formula feed manufacturing and the animal feed industry. Overview of feed ingredients and formulation, understanding and operation of feed production processing equipment including principles of conveying, grinding, mixing, conditioning, pelleting, and other processing techniques, and the formulation of concentrates, premixes, and rations. Students will become knowledgeable about the manufacturing of various animal feed types such as pelleted and extruded feed, aqua (fish) feed, liquid feeds, poured and pressed blocks, steam flaked feed, and pet food, and their effect on animal performance and health. Students will gain hands-on experience in feed manufacturing during weekly lab sessions at a full-scale university owned feed mill and grain science complex.

**TSM 557: Feed Safety, Ingredient Quality and Analytics**

(Dual-listed with TSM 457). (2-3) Cr. 3. S.

*Prereq: Junior classification*

Concepts of feed and grain safety and quality, including hazards and risks associated with common feeds and feed ingredients. Methods to monitor, manage, and mitigate hazards and risks in the context of feed and grain industries. Government regulations applicable to feed and grain safety. Differences between safety and quality factors, how they are measured and then used for decision-making (marketing, processing, or safe-use).

**TSM 570: Industrial Hygiene: Physical, Chemical, and Biological Hazards**

(Dual-listed with TSM 470). (3-0) Cr. 3. S.

*Prereq: MATH 151 or higher*

A qualitative and quantitative introduction to health effects of chemical, biological, and physical hazards in a workplace.

**TSM 571: Safety Laboratory**

(Dual-listed with TSM 471). (0-2) Cr. 1. S.

*Prereq: Credit or concurrent enrollment in TSM 470 or TSM 570*

Introduction to equipment, methods, and strategies to measure, evaluate, control, and research hazards and risk in the workplaces.



**TSM 575: Safety and Public Health Issues in Modern Society**

(2-0) Cr. 2. Repeatable, maximum of 2 times.

Exploration and analysis of current safety and public health issues impacting society. The focus will be on topics that impact individuals in work, public, and home environments.

**TSM 577: Risk Analysis and Management**

(Dual-listed with TSM 477). (3-0) Cr. 3. F.

*Prereq: MATH 151; (STAT 101 or STAT 104)*

Risk analysis and management focuses on developing a risk oriented pattern of thinking that is appropriate for today's complex world. The tools that will be gained in this course will be helpful in recognizing, understanding, and analyzing hazards and risks in modern complex systems.

**TSM 590: Special Topics in Technology**

Cr. 1-4. Repeatable, maximum of 4 credits.

*Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor*

**TSM 590A: Special Topics in Technology: Agriculture and Biosystems Management**

Cr. 1-4. Repeatable, maximum of 4 credits.

*Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor*

**TSM 590B: Special Topics in Technology: Machine Systems**

Cr. 1-4. Repeatable, maximum of 4 credits.

*Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor*

**TSM 590C: Special Topics in Technology: Manufacturing**

Cr. 1-4. Repeatable, maximum of 4 credits.

*Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor*

**TSM 590D: Special Topics in Technology: Occupational Safety**

Cr. 1-4. Repeatable, maximum of 4 credits.

*Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor*

**TSM 593: Workshop in Technology**

Cr. 1-3. Repeatable.

*Prereq: Permission of instructor*

**TSM 599: Creative Component**

Cr. 1-3. Repeatable, maximum of 6 credits.

A discipline-related problem to be identified and completed under the direction of the program advisor. Three credits required for all nonthesis master's degree students.

**Courses for graduate students:****TSM 601: Graduate Seminar**

(Cross-listed with A B E). (1-0) Cr. 1. F.

Keys to starting a successful graduate research project. Effective literature review, formulating research questions, and setting goals. Practicing effectively communicating research and science. Effective strategies for scholarly writing, professional development, responding to feedback, peer-reviewing, successful publishing in journals, and curating scholarly output.

**TSM 652: Program and Learner Evaluation**

(3-0) Cr. 3.

*Prereq: STAT 587 or equivalent*

Techniques for evaluating learners, facilities, programs, and staff utilizing theories for developing measurement instruments. Outcomes assessment is emphasized.

**TSM 655: Academic Leadership in Technology and Engineering**

(3-0) Cr. 3.

*Prereq: Permission of instructor*

A discussion of faculty roles in technology and engineering disciplines, including strategies for dealing with programs, personnel, and constituencies. Leadership skills involving team formation, team operation, and conflict resolution are addressed. Emphasis is placed on the servant leadership model.

**TSM 657: Curriculum Development in Technology and Engineering**

(3-0) Cr. 3.

*Prereq: Permission of instructor*

Basic concepts, trends, practices, and factors influencing curriculum development, techniques, organization and procedures. Emphasis will be given to course development using the backward design process.

**TSM 694: Teaching Practicum**

(Cross-listed with A B E). Cr. 1-3. F.S.

*Prereq: Graduate classification and permission of instructor*

Graduate student experience in the agricultural and biosystems engineering departmental teaching programs.

**TSM 697: Internship in Technology**

Cr. R.

*Prereq: permission of major professor and approval by department chair,  
graduate classification*

One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

**TSM 699: Research**

Cr. arr.