

# TECHNOLOGY SYSTEMS MANAGEMENT (TSM)

---

Courses primarily for undergraduates:

## **TSM 1100: Introduction to Technology**

Credits: 1. Contact Hours: Lecture 1.

*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. (Typically Offered: Fall)

## **TSM 1110: Experiencing Technology**

Credits: 1. Contact Hours: Lecture 1.

*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. (Typically Offered: Fall, Spring)

## **TSM 1150: Solving Technology Problems**

Credits: 3.

*Prereq: Credit or enrollment in MATH 1400 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. (Typically Offered: Fall, Spring)

## **TSM 1160: Introduction to Design in Technology**

Credits: 3.

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. (Typically Offered: Fall, Spring)

## **TSM 1230X: Artificial Intelligence in Agriculture and Life Sciences**

(Cross-listed with ANS 1230X/ DPA 1230X/ AGRON 1230X).

Credits: 1. Contact Hours: Lecture 1.25.

Introduction to artificial intelligence applications in agriculture and life sciences through hands-on learning experiences. Covers fundamental AI concepts, terminology, and machine learning approaches using agricultural examples and no-code tools. Students explore AI applications in crop monitoring, livestock management, precision agriculture, soil analysis, and agricultural robotics. Emphasis on practical problem-solving, interdisciplinary collaboration, and ethical considerations in agricultural AI implementation. No programming experience required. (Typically Offered: Fall)

## **TSM 2010: Preparing for Workplace Seminar**

(Cross-listed with ABE 2010).

Credits: 1. Contact Hours: Lecture 1.

*Prereq: Major in AE, AST, BSE, or ITEC; 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. (Typically Offered: Fall, Spring)

## **TSM 2020: Introduction to Digital and Precision Agriculture**

(Cross-listed with AGRON 2020/ DPA 2020).

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

Introduction to the principles, practices, and technologies used in digital and precision agricultural. An integrated approach to data interpretation for making cropping and land use decisions. Utilizing tools such as global positioning systems, geographic information systems, equipment monitors, variable rate technologies, spatial data storage, plant and soil sensors, drones, remote sensing, and satellites. (Typically Offered: Fall, Spring)

## **TSM 2100: Fundamentals of Technology**

Credits: 3. Contact Hours: Lecture 3.

*Prereq: (TSM 1150, ENGR 1600, ABE 1600, AERE 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1600, ME 1600, or SE 1850); MATH 1400 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. (Typically Offered: Fall, Spring)

**TSM 2140: Managing Technology Projects**

Credits: 1. Contact Hours: Lecture 2.

*Prereq: Credit or enrollment in ABE 2010 or TSM 2010*

8 week course. Introduction to project management principles. Use of project management in technology-based projects for academic, industry, and personal use. (Typically Offered: Fall, Spring)

**TSM 2160: Advanced Technical Graphics, Interpretation, and CAD**

Credits: 2.

*Prereq: TSM 1160*

Advanced computer-aided-design topics incorporating 3D design, industrial drawings, and documentation used in manufacturing settings. Topics include geometric dimensioning and tolerancing, standard dimensioning and tolerancing, machined hole specifications, surface texture callouts, sheet metal parts, weldments, drawing revision systems, model-based design, advanced visualization, feature based design of parts and assemblies. . (Typically Offered: Fall, Spring)

**TSM 2400: Introduction to Advanced Manufacturing: Metals and Plastics Processing**

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

*Prereq: Credit or enrollment in MATH 1400 or higher*

A study of selected materials, properties, and related processes used in additive and subtractive manufacturing including CNC lathes, plastic injection molding, 3D printing, aluminum die casting, welding, and assembly. Introduction to engineering economic tools and their use in financial decision making. Lecture and laboratory activities focus on manufacturing processes. (Typically Offered: Fall, Spring)

**TSM 2415: Introduction to Lean Manufacturing Systems**

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

*Prereq: (TSM 1150, ENGR 1600, ABE 1600, AERE 1600, CE 1600, CHE 1600, CPRE 1850, EE 1850, IE 1600, ME 1600, or SE 1850); MATH 1400 or higher*

Introduction to Lean manufacturing tools and principles. Emphasis on minimizing waste and improving operational performance using Lean tools, concepts, and theories Lab will emphasize application of these topics using hands-on projects. (Typically Offered: Fall, Spring)

**TSM 2700: Principles of Injury Prevention and Safety**

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Fall, Spring)

**TSM 3100: Total Quality Improvement**

Credits: 3. Contact Hours: Lecture 3.

*Prereq: (STAT 1010 or STAT 1040); 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. (Typically Offered: Fall, Spring)

**TSM 3220: Preservation of Grain Quality**

Credits: 3. Contact Hours: Lecture 3.

*Prereq: MATH 1400 or Higher*

Principles and management for grain quality preservation; quality measurements; drying and storage; fans and airflow through grain; handling methods; grain quality monitoring. (Typically Offered: Spring)

**TSM 3220L: Preservation of Grain Quality Laboratory**

Credits: 1. Contact Hours: Laboratory 3.

*Prereq: Credit or enrollment for credit in TSM 3220*

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. (Typically Offered: Spring)

**TSM 3240: Soil and Water Conservation Management**

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

*Prereq: MATH 1400 or higher.*

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. (Typically Offered: Spring)

**TSM 3241: Food Processing for Companion Animals**

(Cross-listed with ANS 3241).

Credits: 3. Contact Hours: Lecture 3.

*Prereq: ANS 2190 or ANS 3190*

Food processing and nutrition for carnivorous companion animals. Topics covered include meat processing and meat preservation for companion animal diets, regulatory standards, cutting edge technologies for processing meat for companion animals, dietary needs of carnivorous companion animals, effect of different processing methods on safety and nutrient bioavailability. (Typically Offered: Fall)

**TSM 3250: Biorenewable Systems**

(Cross-listed with ABE 3250).

Credits: 3. Contact Hours: Lecture 3.

*Prereq:* CHEM 1630 or higher; MATH 1400 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. (Typically Offered: Fall)

**TSM 3270: Livestock and Poultry Production Systems, Technology, and Management**

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

*Prereq:* TSM 2100 or (credit or concurrent enrollment in ABE 2160)

Study and evaluation of modern animal production systems (livestock and poultry), with a focus on facilities, technologies, and management practices. Key topics include ventilation system strategies, precision livestock farming (PLF), animal welfare, manure management, ASABE/NRCS standards, nutrient planning, and emission control, with an emphasis on production economics, environmental impact, and sustainability. (Typically Offered: Fall)

**TSM 3300: Agricultural Machinery and Power Management**

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

*Prereq:* MATH 1450 or higher; TSM 2100

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. (Typically Offered: Spring)

**TSM 3350: Tractor Power**

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

*Prereq:* MATH 1450 or higher; TSM 2100

Theory and construction of tractor engines, mechanical power trains and hydraulic systems. Introduction to traction, chassis mechanics, and hydraulic power. (Typically Offered: Fall)

**TSM 3370: Fluid Power Systems Technology**

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

*Prereq:* TSM 2100

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. (Typically Offered: Fall, Spring)

**TSM 3400: Advanced Automated Manufacturing Processes**

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

*Prereq:* MATH 1510 or higher; TSM 2100; TSM 2160; TSM 2400

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. (Typically Offered: Fall, Spring)

**TSM 3630: Electrical Power and Electrical Machinery Systems**

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

*Prereq:* MATH 1450 or higher; TSM 2100

Fundamentals of electrical theory, parameters, application, and safety. Measurement, design, and assessment of single-phase, split-phase, and three-phase circuits. AC motor selection and performance. Reactive power and correction. Circuit design, ladder logic, controls, and safety systems. Emphasis on agricultural and industrial applications. . (Typically Offered: Fall, Spring)

**TSM 3631: Electrical Power, Control, and Sensor Systems**

Credits: 4. Contact Hours: Laboratory 2, Lecture 3.

*Prereq:* TSM 2100

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. (Typically Offered: Fall, Spring)

**TSM 3650: Electrical Controls and Sensor Systems**

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

*Prereq:* TSM 3630

Fundamentals and applications of ladder and digital logic. Electric motors and controls. Sizing and measurement of sensory circuitry, including circuit conductors, breakers, and relays. Applications to agriculture and industry. . (Typically Offered: Fall, Spring)

**TSM 3700: Occupational Safety**

Credits: 3. Contact Hours: Lecture 3.

*Prereq:* TSM 2700; 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. (Typically Offered: Fall, Spring)

**TSM 3710: Occupational Safety Management**

Credits: 2. Contact Hours: Lecture 2.

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. (Typically Offered: Spring)

**TSM 3720: Legal Aspects of Occupational Safety and Health**

Credits: 2. Contact Hours: Lecture 2.

*Prereq:* TSM 3710

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. (Typically Offered: Fall)

**TSM 3760: Fire Protection and Prevention**

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Fall)

**TSM 3800: Fundamentals, Applications, and Modeling of Biological Systems**

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

*Prereq:* BIOL 2120; MICRO 2010

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 3930A: Topics in Technology: Agriculture and Biosystems Management**

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

**TSM 3930B: Topics in Technology: Machine Systems**

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

**TSM 3930C: Topics in Technology: Manufacturing**

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

**TSM 3930D: Topics in Technology: Occupational Safety**

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

**TSM 3930E: Topics in Technology: Chemical Application Systems**

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

**TSM 3930F: Topics in Technology: Agricultural Safety and Health**

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

**TSM 3930G: Topics in Technology: Electronic Integration for Agriculture and Production Systems**

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

**TSM 3930I: Topics in Technology: Irrigation Systems Management**

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

**TSM 3930J: Topics in Technology: Machinery Management Using Precision Agriculture Technology**

Credits: 1-4. Contact Hours: Lecture 4.

Offered as demand warrants. Web-based instruction. (Typically Offered: Fall, Spring, Summer)

**TSM 3970: Summer Internship in Technology**

Credits: Required. Repeatable.

*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. (Typically Offered: Summer)

**TSM 3990: Internship in Technology**

Credits: Required. Repeatable.

*Prereq: Internship Coordinator Permission*

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. (Typically Offered: Fall, Spring)

**TSM 4020: Digital and Precision Agricultural Systems**

(Cross-listed with AGRON 4020/ DPA 4020).

Credits: 4. Contact Hours: Laboratory 4, Lecture 2.

*Prereq:* DPA 2020 *and* (AGRON 3920 *or* TSM 4330)

An integrated approach to data collection, visualization, and interpretation for designing and implementing cropping and land use decisions, using tools such as global positioning, geographic information systems, equipment monitors, variable rate technologies, spatial data storage, plant and soil sensors, drones, remote sensing, and satellites. Case studies will be emphasized. (Typically Offered: Fall, Spring)

**TSM 4150: Applied Project Management in Technology**

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

*Prereq:* Senior classification; TSM 2140; credit or concurrent enrollment in TSM 3100

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. (Typically Offered: Fall, Spring)

**TSM 4160: Technology Capstone**

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

*Prereq:* TSM 4150

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. (Typically Offered: Fall, Spring)

**TSM 4330: Precision Agriculture**

(Dual-listed with TSM 5330).

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

*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. (Typically Offered: Fall)

**TSM 4400: Cellular Lean Manufacturing Systems**

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

*Prereq:* TSM 3100

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. (Typically Offered: Fall, Spring)

**TSM 4415: Lean Manufacturing Systems**

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

*Prereq:* TSM 2415

Review of principles and concepts required for manufacturing system design to meet customer demand in production, quality, and on-time delivery, while continuously reducing manufacturing costs. Emphasis on application of Lean Manufacturing principles, simulation techniques, and Kaizen methodologies with hands-on projects. (Typically Offered: Fall, Spring)

**TSM 4430: Statics and Strength of Materials for Technology**

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

*Prereq:* PHYS 1310 *or above*; MATH 1450 *or higher*

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. (Typically Offered: Fall, Spring)

**TSM 4440: Facility Planning**

Credits: 3. Contact Hours: Lecture 3.

*Prereq:* (STAT 1010 *or* STAT 1040); TSM 2160; TSM 2400

Fundamental principles and practices in designing, evaluating, and organizing new or existing facilities. Emphasis on computer-based facility design and production flow analysis, activity relationship analysis, lighting analysis, time studies, materials handling, supporting services design, and optimal facility location analysis. (Typically Offered: Fall, Spring)

**TSM 4550: Feed Processing and Technology**

(Dual-listed with ABE 5550/ TSM 5550).

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

*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. (Typically Offered: Fall)

**TSM 4570: Feed Safety, Ingredient Quality and Analytics**

(Dual-listed with ABE 5570/ TSM 5570).

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

*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). (Typically Offered: Spring)

**TSM 4650: Automation Systems**

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

*Prereq: TSM 3630 or TSM 3631X*

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. (Typically Offered: Fall, Spring)

**TSM 4700: Basics of Industrial Hygiene**

(Dual-listed with TSM 5700).

Credits: 3. Contact Hours: Lecture 3.

*Prereq: MATH 1510 or higher.*

A qualitative and quantitative introduction to health effects of chemical and physical hazards in a workplace. . (Typically Offered: Spring)

**TSM 4710: Safety Laboratory**

(Dual-listed with TSM 5710).

Credits: 1. Contact Hours: Laboratory 2.

*Prereq: Credit or enrollment in TSM 4700*

Introduction to equipment, methods, and strategies to measure, evaluate, control, and research hazards and risk in the workplaces. (Typically Offered: Spring)

**TSM 4770: Risk Analysis and Management**

(Dual-listed with TSM 5770).

Credits: 3. Contact Hours: Lecture 3.

*Prereq: MATH 1510; (STAT 1010 or STAT 1040)*

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. (Typically Offered: Fall)

**TSM 4900H: Independent Study: Honors**

Credits: 1-4. Repeatable.

*Prereq: Junior or Senior classification; Department Permission; Membership in the University Honors Program*

Arranged: Additional meetings or activity required. (Typically Offered: Fall, Spring, Summer)

**TSM 4900I: Independent Study: Manufacturing**

Credits: 1-4. Repeatable.

*Prereq: Junior or senior classification; permission of department*

Arranged: Additional meetings or activity required. (Typically Offered: Fall, Spring, Summer)

**TSM 4900J: Independent Study: Agriculture and Biosystems Management**

Credits: 1-4. Repeatable.

*Prereq: Junior or senior classification; permission of department*

Arranged: Additional meetings or activity required. (Typically Offered: Fall, Spring, Summer)

**TSM 4900M: Independent Study: Machine Systems**

Credits: 1-4. Repeatable.

*Prereq: Junior or senior classification; permission of department*

Arranged: Additional meetings or activity required. (Typically Offered: Fall, Spring, Summer)

**TSM 4900O: Independent Study: Occupational Safety**

Credits: 1-4. Repeatable.

*Prereq: Junior or senior classification; permission of department*

Graduation Restriction: A maximum of 4 credits of TSM 4900 may be used toward the total credits required for graduation. (Typically Offered: Fall, Spring, Summer)

**TSM 4930A: Workshop in Technology: Agriculture and Biosystems Management**

Credits: 1-4. Contact Hours: Lecture 3.7.

Repeatable.

Offered as demand warrants. (Typically Offered: Fall, Spring, Summer)

**TSM 4930B: Workshop in Technology: Machine Systems**

Credits: 1-4. Repeatable.

Offered as demand warrants. (Typically Offered: Fall, Spring, Summer)

**TSM 4930C: Workshop in Technology: Manufacturing**

Credits: 1-4. Repeatable.

Offered as demand warrants. (Typically Offered: Fall, Spring, Summer)

**TSM 4930D: Workshop in Technology: Occupational Safety**

Credits: 1-4. Repeatable.

Offered as demand warrants. Offered on a satisfactory-fail basis only.

**TSM 4950: Agricultural and Biosystems Engineering Department Study Abroad Preparation or Follow-up**

(Cross-listed with ABE 4950).

Credits: 1-2. Repeatable.

Preparation for, or follow-up of, study abroad experience (4960). 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 4960 the following term or have had taken 4960 the previous term. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

**TSM 4960: Agricultural and Biosystems Engineering Department Study Abroad**

(Cross-listed with ABE 4960).

Credits: 1-4. Repeatable.

*Prereq: Academic Advisor Permission for Course*

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 4950. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring, Summer)

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

**TSM 5330: Precision Agriculture**

(Dual-listed with TSM 4330).

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

*Prereq: Graduate Standing or Permission of Instructor*

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. (Typically Offered: Fall)

**TSM 5400: Advanced Design and Manufacturing**

Credits: 3. Contact Hours: Lecture 3.

*Prereq: Graduate Standing or 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. (Typically Offered: Spring)

**TSM 5550: Feed Processing and Technology**

(Dual-listed with ABE 4550/ TSM 4550).

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

*Prereq: Graduate Standing or Permission of Instructor*

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. (Typically Offered: Fall)

**TSM 5570: Feed Safety, Ingredient Quality and Analytics**

(Dual-listed with ABE 4570/ TSM 4570).

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

*Prereq: Graduate Standing or Permission of Instructor*

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). (Typically Offered: Spring)

**TSM 5700: Industrial Hygiene: Physical, Chemical, and Biological Hazards**

(Dual-listed with TSM 4700).

Credits: 3. Contact Hours: Lecture 3.

*Prereq: Graduate Standing or Permission of Instructor*

A qualitative and quantitative introduction to health effects of chemical, biological, and physical hazards in a workplace. (Typically Offered: Spring)

**TSM 5710: Safety Laboratory**

(Dual-listed with TSM 4710).

Credits: 1. Contact Hours: Laboratory 2.

*Prereq: Graduate Standing or Permission of Instructor*

Introduction to equipment, methods, and strategies to measure, evaluate, control, and research hazards and risk in the workplaces. (Typically Offered: Spring)

**TSM 5750: Safety and Public Health Issues in Modern Society**

Credits: 2. Contact Hours: Lecture 2.

Repeatable, maximum of 2 credits.

*Prereq: Graduate Standing or Permission of Instructor*

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 5770: Risk Analysis and Management**

(Dual-listed with TSM 4770).

Credits: 3. Contact Hours: Lecture 3.

*Prereq: Graduate Standing or Permission of Instructor*

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. (Typically Offered: Fall)

**TSM 5900A: Special Topics in Technology: Agriculture and Biosystems Management**

Credits: 1-4. Repeatable, maximum of 4 credits.

*Prereq: Instructor Permission for Course*

Special Topics in Technology: Agriculture and Biosystems Management. (Typically Offered: Fall, Spring, Summer)

**TSM 5900B: Special Topics in Technology: Machine Systems**

Credits: 1-4. Repeatable, maximum of 4 credits.

*Prereq: Instructor Permission for Course*

Special Topics in Technology: Machine Systems. (Typically Offered: Fall, Spring, Summer)

**TSM 5900C: Special Topics in Technology: Manufacturing**

Credits: 1-4. Repeatable, maximum of 4 credits.

*Prereq: Instructor Permission for Course*

Special Topics in Technology: Manufacturing. (Typically Offered: Fall, Spring, Summer)

**TSM 5900D: Special Topics in Technology: Occupational Safety**

Credits: 1-4. Repeatable, maximum of 4 credits.

*Prereq: Instructor Permission for Course*

Special Topics in Technology: Occupational Safety. (Typically Offered: Fall, Spring, Summer)

**TSM 5930: Workshop in Technology**

Credits: 1-3. Contact Hours: Lecture 3.

Repeatable.

*Prereq: Graduate Standing or Permission of Instructor*

Workshop in Technology.

**TSM 5990: Creative Component**

Credits: 1-3. Repeatable, maximum of 6 credits.

*Prereq: Instructor Permission for Course*

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. (Typically Offered: Fall, Spring, Summer)

**Courses for graduate students:**

**TSM 6010: Graduate Seminar**

(Cross-listed with ABE 6010).

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

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. (Typically Offered: Fall)

**TSM 6520: Program and Learner Evaluation**

Credits: 3. Contact Hours: Lecture 3.

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

**TSM 6550: Academic Leadership in Technology and Engineering**

Credits: 3. Contact Hours: Lecture 3.

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 6570: Curriculum Development in Technology and Engineering**

Credits: 3. Contact Hours: Lecture 3.

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 6940: Teaching Practicum**

(Cross-listed with ABE 6940).

Credits: 1-3.

Graduate student experience in the agricultural and biosystems engineering departmental teaching programs. (Typically Offered: Fall, Spring)

**TSM 6970: Internship in Technology**

Credits: Required. Repeatable.

One semester and one summer maximum per academic year professional work period. (Typically Offered: Fall, Spring, Summer)

**TSM 6990: Research**

Credits: 1-15. Repeatable.

*Prereq: Instructor Permission for Course*

Research. (Typically Offered: Fall, Spring, Summer)