Agricultural and Biological Engineering Courses

**ABE 100** Intro Agric & Biological Engrg  credit: 1 Hour.
Introduction to the engineering profession with career opportunities in the agricultural and biological engineering discipline. Concepts necessary for becoming a successful engineer including time management, design concepts, ethics, and teambuilding. Familiarization with laboratories, computer facilities, internships, and other opportunities. Team design experience. Emphasis on technical communication and problem-solving skills as well as career planning.

**ABE 141** ABE Principles: Biological  credit: 2 Hours.
Principles of biology relevant to agriculture, food, energy, and the environment, including microbiology, biochemistry, genetics, plant and animal systems, and ecosystems. Case studies of engineering applications where these biological principles have been taken into account or leveraged for the purpose of design.

**ABE 199** Undergraduate Open Seminar  credit: 1 to 5 Hours.
May be repeated to a maximum of 12 hours.

**ABE 223** ABE Principles: Machine Syst  credit: 2 Hours.
Machinery systems for off-road applications: internal combustion engines; fluid power; tractors, and traction; chemical application; grain harvesting. Prerequisite: One of MATH 220, MATH 221, MATH 234.

**ABE 224** ABE Principles: Soil & Water  credit: 2 Hours.
Engineering principles and methods of design and management of natural resources and environmental systems; watershed and hydrologic cycle; infiltration and surveying; runoff and erosion; water quality; non-point source pollution. Prerequisite: One of MATH 220, MATH 221, MATH 234.

**ABE 225** ABE Principles: Bioenvironment  credit: 2 Hours.
Principles of environmental control for biological structures: psychrometrics; mass and heat transfer through buildings; ventilation requirements. Prerequisite: One of MATH 220, MATH 221, MATH 234.

**ABE 226** ABE Principles: Bioprocessing  credit: 2 Hours.
Principles of bioprocess engineering applied to food and agricultural products: material balances; fluid flow; heat and mass transfers; drying; evaporation; fermentation; distillation; process simulation. Prerequisite: One of MATH 220, MATH 221, MATH 234.

**ABE 341** Transport Processes in ABE  credit: 3 Hours.
Principles of transport processes involving momentum, heat, and mass as applied to biological systems in agriculture, food, energy, and the environment. Credit is not given for both ABE 341 and CHBE 421. Prerequisite: ABE 223, ABE 224, ABE 225, ABE 226, and PHYS 213.

**ABE 361** Off-Road Machine Design  credit: 3 Hours.
Design and development concepts of agricultural and industrial machines; analysis and synthesis of tillage, planting, harvesting, chemical application, material handling mechanisms, and precision farming tools. Prerequisite: ABE 223 and TAM 212.

**ABE 397** Independent Study  credit: 1 to 4 Hours.
Individual research, special problems, thesis, development or design work under the supervision of a member of the faculty. May be repeated to a maximum of 8 hours. Prerequisite: Consent of instructor.

**ABE 398** Special Topics  credit: 1 to 3 Hours.
Subject offerings of new and developing areas of knowledge in agricultural and biological engineering intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites. May be repeated in the same or separate term if topics vary to a maximum of 12 hours.

**ABE 425** Engrg Measurement Systems  credit: 4 Hours.
Principles of instrumentation systems, including sensing, signal conditioning, computerized data acquisition, test design, data analysis and synthesis. Additional fees may apply. See Class Schedule. 4 undergraduate hours. 4 graduate hours. Credit is not given for both ABE 425 and ME 360. Prerequisite: ECE 205.

**ABE 430** Project Management  credit: 2 Hours.
Engineering team effectiveness; project definition; assessing related technologies; marketing and business planning related to engineering; budgeting and financial analyses of engineering projects; safety, ethics and environmental considerations; intellectual property; engineering proposal presentation. Same as TSM 430. 2 undergraduate hours. 2 graduate hours.

**ABE 436** Renewable Energy Systems  credit: 3 or 4 Hours.
Renewable energy sources and applications, including solar, geothermal, wind, and biomass. Renewable energy's role in reducing air pollution and global climate change. Capstone project to design a system for converting renewable energy into thermal or electrical energy. 3 undergraduate hours. 4 graduate hours. Credit is not given for both ABE 436 and TSM 438. Prerequisite: PHYS 211.

**ABE 440** Applied Statistical Methods I  credit: 4 Hours.
Same as ANSC 440, CPSC 440, FSHN 440, and NRES 440. See CPSC 440.
ABE 445  Statistical Methods  credit: 4 Hours.
Same as ANSC 445 and NRES 445. See ANSC 445.

ABE 446  Biological Nanoengineering  credit: 3 or 4 Hours.
Nanodevice design through organization of functional biological components; bio-molecular function and bioconjugation techniques in nanotechnology; modulation of biological systems using nanotechnology; issues related to applying biological nanotechnology in food energy, health, and the environment. 3 or 4 graduate hours. Prerequisite: MCB 150.

ABE 454  Environmental Soil Physics  credit: 3 Hours.
Provides the theoretical basis for understanding and quantifying the physical, hydrological, geotechnical, and thermal properties of soil in relation to environmental processes. Topics include general soil properties as a porous media, particle size, soil structure and aggregation, water retention and potential, flow in saturated soil, flow in an unsaturated soil, soil temperature and heat flow, soil mechanics, infiltration, and soil-plant-water relations. 3 undergraduate hours. 3 graduate hours. Prerequisite: TAM 335 or NRES 201 or consent of instructor.

ABE 455  Erosion and Sediment Control  credit: 2 Hours.
Processes, estimation, and control of soil erosion by water, wind and resultant sedimentation. Upland, in-channel, urban, agricultural, disturbed (both military training and mining), and forested environments. Capstone experience in site planning and design. 2 undergraduate hours. 2 graduate hours. Prerequisite: CEE 350 or NRES 401, CEE 380 or NRES 201.

ABE 456  Land & Water Resources Engrg  credit: 3 or 4 Hours.
Hydrology, hydraulics, design, construction and cost estimating of structures for the conservation and quality control of soil and water resources; relationship of topography, soils, crops, climate, and cultural practices in conservation and quality control of soil and water for agriculture. 3 or 4 graduate hours. Prerequisite: Consent or concurrent registration in TAM 335.

ABE 457  NPS Pollution Processes  credit: 2 Hours.
Principles, concepts, and analysis of processes for nonpoint source pollution involving sediment, inorganic and organic chemicals, and microbial pathogens; hydrologic and pollutant interactions, pollutant fate and transport processes from storm water runoff and percolation; impact of pollutant transport on receiving water and ecosystems. 2 undergraduate hours. 2 graduate hours. Prerequisite: ABE 224 or CEE 350.

ABE 458  NPS Pollution Modeling  credit: 2 Hours.
Concepts, principles, and application of modeling for assessment and management of agricultural nonpoint source pollution. Modeling of agroecosystems and land use impacts on hydrologic and water quality response of upland catchments. Model selection, calibration, validation, and application for comparative analysis. Case studies in current watershed management issues, with a focus on agricultural waste and nutrient management, using existing field and watershed nonpoint source pollution models. 2 undergraduate hours. 2 graduate hours. Prerequisite: ABE 457.

ABE 459  Drainage and Water Management  credit: 3 or 4 Hours.
Design, construction, performance, and maintenance of agricultural drainage systems to meet both production and water quality objectives. Modeling drainage systems. Principles of conservation drainage. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: Credit or concurrent registration in TAM 335.

ABE 463  Electrohydraulic Systems  credit: 3 Hours.
Engineering principles of electrohydraulic control systems related to off-road vehicles. Basics of fluid power systems, concepts of electrohydraulic systems and controls, analysis and design of electrohydraulic control systems, and applications of electrohydraulic control. Additional fees may apply. See Class Schedule. 3 undergraduate hours. 3 graduate hours. Prerequisite: ECE 110 or both ECE 205 and ECE 206; ME 310 or TAM 335.

ABE 466  Engineering Off-Road Vehicles  credit: 3 Hours.
Design and application of off-road vehicles for farm and construction use; thermodynamics of engines; measurement of power and efficiencies; power transmission and traction; chassis mechanics; operator environment. 3 undergraduate hours. 3 graduate hours. Credit is not given for both ABE 466 and TSM 464. Prerequisite: ME 300.

ABE 469  Industry-Linked Design Project  credit: 4 Hours.
Industry-submitted and sponsored design projects which utilize principles of design, engineering analysis and functional operation of engineering systems. Design teams develop concepts, evaluate alternatives, model and analyze solutions, and build and test a final product. Emphases on communication skills, technical writing, and interaction with industry representatives. 4 undergraduate hours. 4 graduate hours. Prerequisite: One of ABE 361, CHBE 421, TAM 335; or credit or concurrent registration in ME 370. This course satisfies the General Education Criteria for: Advanced Composition

ABE 474  Indoor Environmental Control  credit: 3 or 4 Hours.
Analysis of indoor environments and relationship with humans, animals and plants. Interactions between facilities operation and both human comfort and animal plant production. Psychrometrics, occupant health and comfort, structural heat transfer, heating and cooling loads, and energy and mass balances as related to indoor environment, air properties, and ventilation. 3 or 4 graduate hours. Prerequisite: TAM 335, and ME 300 or CHBE 321, or consent of instructor.

ABE 476  Indoor Air Quality Engineering  credit: 4 Hours.
Principles and applications of indoor air quality. Particle mechanics, gas kinetics, air quality sampling principles and techniques, air cleaning technologies such as filters, cyclones, electrostatic precipitation for indoor environments; ventilation effectiveness for pollutant control. Research or design project. 4 undergraduate hours. 4 graduate hours. Prerequisite: PHYS 213, MATH 285, and TAM 335.

ABE 482  Package Engineering  credit: 3 Hours.
Same as FSHN 469. See FSHN 469.

ABE 483  Engrg Properties of Food Matls  credit: 3 Hours.
Physical properties of foods and biological materials; properties relating to equipment design and the sensing and control of food processes; thermal, electromagnetic radiation, rheological, and other mechanical properties. 3 undergraduate hours. 3 graduate hours. Prerequisite: TAM 251; either CHBE 421 or both ME 330 and TAM 335.

ABE 488  Bioprocessing Biomass for Fuel  credit: 3 Hours.
Engineering and scientific principles governing bioprocessing of biomass for production of ethanol and other fermentation products. Process unit operations; conventional and alternative feed stock materials; recovery of value-added coproducts and other variables involved in producing fuel ethanol; process simulation; economic analysis. 3 undergraduate hours. 3 graduate hours. Prerequisite: CHBE 321 and TAM 335.
Technical Systems Management Courses

TSM 100 Technical Systems in Agr  credit: 3 Hours.
Examples, problems, discussions, and laboratory exercises pointing to present and potential engineering applications in agriculture; emphasis on power and machinery, soil and water control, electricity, and structures.

TSM 130 Basics of CAD  credit: 1 Hour.
Introduction to Computer Aided Drawing and Design (CAD). Application of two and three dimensional CAD tools in construction systems for creating project plans, structures and building floor plans with fixtures and layers representing electrical and plumbing configurations. Self-paced learning through on-line tutorials with instructor guidance. Prerequisite: TSM 100.

TSM 199 Undergraduate Open Seminar  credit: 1 to 5 Hours.
Open seminar or experimental course on a topic in technical systems management. May be repeated to a maximum of 12 hours.

TSM 232 Materials and Construction Sys  credit: 3 Hours.
Selection, use, and maintenance of hand and power tools; shop safety; selection of building and roofing materials; concrete masonry construction; and site preparation. Includes laboratory. Priority is given to technical systems management majors.

TSM 233 Metallurgy & Welding Process  credit: 3 Hours.
Selecting and using metal-arc, inert-gas, submerged arc, oxyacetylene welding and plasma cutting processes for construction and maintenance. Includes laboratory. Additional fees may apply. See Class Schedule.

TSM 234 Wiring, Motors and Control Sys  credit: 3 Hours.
Selecting and using wiring materials, electric motors and controls in lighting, heating, ventilation, and materials handling problems. Includes laboratory. Prerequisite: TSM 100.

TSM 262 Off-Road Equipment Management  credit: 3 Hours.
Performance, costs, application, selection, and replacement of off-road machinery and field implements; analysis of mechanized field operations. Includes laboratory. Prerequisite: TSM 100.

TSM 293 Off-Campus Internship  credit: 1 to 4 Hours.
Supervised off-campus experience in a field directly pertaining to technical systems management. May be repeated to a maximum of 6 hours. Prerequisite: Sophomore standing and consent of instructor.

TSM 295 Undergrad Research or Thesis  credit: 1 to 4 Hours.
Individual research, special problems, thesis, development and/or design work under the supervision of an appropriate member of the faculty. May be repeated to a maximum of 12 hours. Prerequisite: Sophomore standing, cumulative GPA of 2.5 or above at the time the activity is arranged, and consent of instructor.

TSM 311 Humanity in the Food Web  credit: 3 Hours.
The human food web is the complex network of technologies, environments, people, and social institutions that produces, processes, and distributes the world’s food supply. Students will study the food webs of the past, present, and future and will explore various human roles, including their own, in the global technology-environment-society-food system. Course topics include domestication, mechanization, urbanization, the green revolution, biotechnology, food safety, the environment, and appropriate technologies for developing countries. Additional fees may apply. See Class Schedule. This course satisfies the General Education Criteria for: Advanced Composition Humanities - Hist Phil

TSM 352 Land and Water Mgt Systems  credit: 3 Hours.
Principles of planning, implementing and utilizing land and water practices for Illinois land uses, especially agriculture. Includes laboratory. Prerequisite: Completion of Quantitative Reasoning requirement.

TSM 363 Fluid Power Systems  credit: 2 Hours.
Emphasizes basic principles of fluid power systems related to off-road vehicles. Topics include fundamentals of fluid power systems, principles of key fluid power components, and maintenance of fluid power systems. Credit is not given for both TSM 363 and ABE 223.

TSM 371 Residential Housing Design  credit: 3 Hours.
Principles and practices in residential housing; space planning, house types, structures, materials, utilities, environmental control, energy conservation, remodeling, and economic influences. Includes laboratory.

TSM 372 Environ Control & HVAC Systems  credit: 3 Hours.
Introduction to heating, ventilating, and air-conditioning (HVAC) systems for building environment control. Topics include: psychrometrics, basic calculation of heating and cooling loads, human comfort and ventilation requirements, typical HVAC and control systems.

TSM 381 Grain Drying & Storage Systems  credit: 3 Hours.
Grain drying fundamentals, air-moisture relationships, grain drying systems for efficient energy use, fans, grain-handling devices and systems, planning of grain handling systems, grain standards, moisture measurement, grain storage, fungi and insect problems, aeration, processing and milling of corn and soybeans. Includes laboratory.

TSM 396 UG Honors Research or Thesis  credit: 1 to 4 Hours.
Individual research, special problems, thesis, development and/or design work under the direction of the Honors advisor. May be repeated to a maximum of 12 hours. Prerequisite: Junior standing, admission to the ACES Honors Program, and consent of instructor.

TSM 421 Ag Safety-Injury Prevention  credit: 3 Hours.
Issues associated with agricultural injuries and their prevention. Areas include: agricultural injury situation; injury causation; injury intervention strategies and their applications to agricultural issues; and, specific safety issues in the areas of farm machinery, grain and forage systems, animals, materials handling, electricity, fire safety, special populations, and emergency preparedness. Course Information: 3 undergraduate hours. 3 graduate hours.
TSM 422  Ag Health-Illnesses Prevention  credit: 3 Hours.
Overview of occupational illnesses and diseases in the agricultural industry and its practices. Hazards within agricultural production are examined and potential hazards to non-farm populations and those interacting with production personnel are explored. Agricultural industry practices are summarized and potential human health effects of specific practices identified. Specific preventative measures are outlined to reduce exposures and remediate exposure symptoms. Interaction with health/medical professionals is on-going during the semester to familiarize students with medical procedures pertinent to agricultural occupational medicine. 3 undergraduate hours. 3 graduate hours.

TSM 425  Managing Ag Safety Risk  credit: 3 Hours.
Management aspects of farm and agriculturally related business safety and health. Topics include: orientation to farm and agricultural related business safety and health issues, legal and ethical responsibilities, liability issues, injury/illness incident investigation, agricultural safety and health resources, how to approach and organize a safety and health management plan, and safety and health worker education and training. Case study approach to devise a safety and health management plan for an existing farm or agricultural related business. Team work to emulate development of safety management programs in general industry. Student exposure through class discussion exercises to recent agricultural safety and health research studies conducted in North America and Europe. 3 undergraduate hours. 3 graduate hours. Prerequisite: Credit or concurrent registration in TSM 421 or TSM 422, or consent of instructor.

TSM 430  Project Management  credit: 2 Hours.
Same as ABE 430. See ABE 430.

TSM 435  Elec Computer Ctrl Sys  credit: 3 Hours.
Microcomputer and electrical control applications; electrical fundamentals; solid-state devices; relays; biosensors; motor types and characteristics; three-phase power; logic devices; analog/digital convertors; and interfacing for agricultural control applications. Includes laboratory. 3 undergraduate hours. 3 graduate hours.

TSM 438  Renewable Energy Applications  credit: 3 Hours.
Renewable energy sources and applications, including solar, geothermal, wind, and biomass. Environmental consequences of energy conversion including how renewable energy can reduce air pollution and global climate change. Economics of alternative energy systems. 3 undergraduate hours. 3 graduate hours. Credit is not given for both TSM 438 and ABE 436. Prerequisite: Junior, senior, or graduate standing required.

TSM 464  Engine and Tractor Power  credit: 3 Hours.
Construction, performance and maintenance of internal combustion engines, power trains, and hydraulic systems for off-road equipment; methods and equipment for performance testing; and weight transfer and traction. Includes laboratory. 3 undergraduate hours. 3 graduate hours. Credit is not given for both TSM 464 and ABE 466.

TSM 465  Chemical Applications Systems  credit: 3 Hours.
Hydraulic principles; liquid application systems including pumps, controls, and spray nozzles; granular application systems; safe storage, handling, and disposal of pesticides and fertilizers; federal and state legal requirements. Includes laboratory. 3 undergraduate hours. 3 graduate hours.

TSM 467  Precision Agric Technology  credit: 3 Hours.
Practices and equipment used in precision agriculture. Global positioning systems; geographic information systems; mapping; grid sampling of soil fertility and physical properties; yield monitoring; remote sensing; variable-rate technologies. 3 undergraduate hours. 3 graduate hours.

TSM 486  Grain Bioprocessing Coproducts  credit: 3 Hours.
Bioprocessing of cereals and oilseeds by milling, fermentation and extraction processes in the production of a wide variety of coproducts used in animal foods. Includes the effects of the process variables and bioprocess on coproduct quality and the post-processing of coproducts. 3 undergraduate hours. 3 graduate hours.

TSM 496  Independent Study  credit: 1 to 4 Hours.
Individual research, special problems, thesis, development and/or design work under the supervision of a faculty member. 1 to 4 undergraduate hours. 1 to 4 graduate hours. May be repeated to a maximum of 6 hours. Prerequisite: consent of instructor.

TSM 499  Seminar  credit: 1 to 3 Hours.
Group discussion or an experimental course on a special topic in technical systems management. 1 to 3 undergraduate hours. 1 to 3 graduate hours. May be repeated to a maximum of 12 hours.