AGRICULTURAL AND BIOLOGICAL ENGINEERING

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Agricultural and biological engineering is the application of mathematics, physical and biological science, and engineering to agriculture, food systems, energy, natural resources, the environment, and related biological systems. This ABET-accredited program has special emphasis on environmental protection and the biological interface of plants, animals, soils, and microorganisms with the design and performance of environments, machines, mechanisms, processes, and structures.

The Department of Agricultural and Biological Engineering offers programs through the College of ACES and the College of Engineering.

- Technical Systems Management, B.S (http://catalog.illinois.edu/undergraduate/aces/departments/ag-bio-eng/major-technical-systems-management), through the College of ACES.
- Agricultural and Biological Engineering, B.S. through the College of Engineering with concentrations:
  - Agricultural Engineering (http://catalog.illinois.edu/undergraduate/engineer/departments/ag-bio-eng/conc-ag-engineering)
  - Biological Engineering (http://catalog.illinois.edu/undergraduate/engineer/departments/ag-bio-eng/conc-bio-engineering)
- Agricultural and Biological Engineering, B.S. and Agricultural Engineering and Agricultural Science, B.S.A.G (http://catalog.illinois.edu/undergraduate/aces/departments/ag-bio-eng/dual-major-agricultural-biological-engineering-sciences) through both the College of Engineering and the College of ACES.
- Agricultural Safety and Health Minor (http://catalog.illinois.edu/undergraduate/aces/departments/ag-bio-eng/minor-agricultural-safety-health)

Plans of Study are available for:

Agricultural and Biological Engineering, B.S. – Agricultural Engineering (http://catalog.illinois.edu/undergraduate/engineer/departments/ag-bio-eng/pos-abe-ae) through the College of Engineering.

Agricultural and Biological Engineering, B.S. – Biological Engineering (http://catalog.illinois.edu/undergraduate/engineer/departments/ag-bio-eng/pos-abe-ag) through the College of Engineering.

Agricultural and Biological Engineering Courses

ABE 100 Intro Agric & Biological Engng credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/ABE/100)
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 team building. 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. (https://courses.illinois.edu/schedule/terms/ABE/141)
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. (https://courses.illinois.edu/schedule/terms/ABE/199)
May be repeated to a maximum of 12 hours.

ABE 223 ABE Principles: Machine Syst credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/ABE/223)
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. (https://courses.illinois.edu/schedule/terms/ABE/224)
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-source pollution. Prerequisite: One of MATH 220, MATH 221, MATH 234.

ABE 225 ABE Principles: Bioenvironment credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/ABE/225)
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. (https://courses.illinois.edu/schedule/terms/ABE/226)
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. (https://courses.illinois.edu/schedule/terms/ABE/341)
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. (https://courses.illinois.edu/schedule/terms/ABE/361)
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.

Information listed in this catalog is current as of 11/2018
ABE 397 Independend Study credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/ABE/397)
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. (https://courses.illinois.edu/schedule/terms/ABE/398)
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 Engineering Measurement Systems credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ABE/425)
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. (https://courses.illinois.edu/schedule/terms/ABE/430)
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. (https://courses.illinois.edu/schedule/terms/ABE/436)
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. (https://courses.illinois.edu/schedule/terms/ABE/440)
Same as ANSC 440, CPSC 440, FSHN 440, and NRES 440. See CPSC 440.

ABE 445 Statistical Methods credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ABE/445)
Same as ANSC 445 and NRES 445. See ANSC 445.

ABE 446 Biological Nanoengineering credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ABE/446)
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 undergraduate hours. 4 graduate hours. Prerequisite: MCB 150.

ABE 454 Environmental Soil Physics credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ABE/454)
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. (https://courses.illinois.edu/schedule/terms/ABE/455)
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 Engineering credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ABE/456)
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: Credit or concurrent registration in TAM 335.

ABE 457 NPS Pollution Processes credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/ABE/457)
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. (https://courses.illinois.edu/schedule/terms/ABE/458)
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. (https://courses.illinois.edu/schedule/terms/ABE/459)
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 or 4 graduate hours. Prerequisite: Credit or concurrent registration in TAM 335.
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TSM 233 Metallurgy & Welding Process credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/TSM/233)
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. (https://courses.illinois.edu/schedule/terms/TSM/234)
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. (https://courses.illinois.edu/schedule/terms/TSM/262)
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. (https://courses.illinois.edu/schedule/terms/TSM/293)
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. (https://courses.illinois.edu/schedule/terms/TSM/295)
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 and consent of instructor.

TSM 311 Humanity in the Food Web credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/TSM/311)
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

TSM 352 Land and Water Mgt Systems credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/TSM/352)
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. (https://courses.illinois.edu/schedule/terms/TSM/363)
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. (https://courses.illinois.edu/schedule/terms/TSM/371)
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. (https://courses.illinois.edu/schedule/terms/TSM/372)
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. (https://courses.illinois.edu/schedule/terms/TSM/381)
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. (https://courses.illinois.edu/schedule/terms/TSM/396)
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. (https://courses.illinois.edu/schedule/terms/TSM/421)
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. (https://courses.illinois.edu/schedule/terms/TSM/422)
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. (https://courses.illinois.edu/schedule/terms/TSM/425)
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. (https://courses.illinois.edu/schedule/terms/TSM/430)
Same as ABE 430. See ABE 430.
TSM 435  Elec Computer Ctrl Sys  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/TSM/435)
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. (https://courses.illinois.edu/schedule/terms/TSM/438)
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. (https://courses.illinois.edu/schedule/terms/TSM/464)
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. (https://courses.illinois.edu/schedule/terms/TSM/465)
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. (https://courses.illinois.edu/schedule/terms/TSM/467)
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. (https://courses.illinois.edu/schedule/terms/TSM/486)
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. 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. Course Information: 3 undergraduate hours. 3 graduate hours. Credit is not be given for both TSM 486 and TSM 586.

TSM 496  Independent Study  credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/TSM/496)
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. (https://courses.illinois.edu/schedule/terms/TSM/499)
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.