ABE - AGRICULTURAL AND BIOLOGICAL ENG

ABE Class Schedule (https://courses.illinois.edu/schedule/DEFAULT/DEFAULT/ABE/)

Courses

ABE 127 Introduction to Agricultural & Biological Engineering credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/ABE/127/)
Introduction to the engineering profession with career opportunities in the agricultural and biological engineering disciplines. Interactive class activities include concepts necessary for becoming a successful engineer including time management, design concepts, ethics, and team building. Students become familiar with laboratories, computer facilities, and other opportunities that are available to agricultural and biological engineering students. Class emphasis is on problem-solving skills, information synthesis, and technical communication. May not receive credit for both ABE 100 and ABE 127.

ABE 128 Applied Biology for Agricultural and Biological Engineers credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ABE/128/)
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. Credit not given for both ABE 128 and ABE 141.

ABE 152 Water in the Global Environment credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ABE/152/)
This course develops a comprehensive understanding and appreciation of water and its impact in a global context. The course emphasizes cultural practices associated with water and its use, especially for regions in non-western cultures. Students will develop critical knowledge of: 1) water availability, water quality, and global challenges; 2) historical perspectives of water use; 3) past, present, and future environmental sustainability in relation to water, food, and energy; and 4) conduct analysis of cultural practices and their sustainability based on water in a global context. Students attend 3-4 field trips related to the course.
This course satisfies the General Education Criteria for:
Cultural Studies - Non-West
Nat Sci Tech - Phys Sciences

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 227 Computer-Aided Problem-Solving for ABE I credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ABE/227/)
Approaches to solving problems in the field of Agricultural and Biological Engineering (ABE) using computer aids. Case studies will consider traditional and new domains in ABE such as: off-highway vehicle engineering, natural resources and environmental systems, control of indoor air environments, bioprocessing of food and agricultural materials, digital and urban agriculture, renewable energy, and sustainability. Typical approaches to problem solving include spreadsheets, GUI based programming, scripting, geospatial platforms, solid modeling, visual programming, dynamic modeling, biological modeling. Prerequisite: One of MATH 220, MATH 221, MATH 234.

ABE 228 Computer-Aided Problem-Solving for ABE II credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ABE/228/)
Case studies from traditional and new domains in ABE will be considered, such as: off-highway vehicles, natural resources and environmental systems, control of indoor air environments, bioprocessing of food and agricultural materials, digital and urban agriculture, renewable energy, sustainability, and synthetic biology. Typical approaches to problem solving include spreadsheets, GUI based programming, scripting, geospatial platforms, solid modeling, visual programming, dynamic modeling, biological modeling. ABE 228 considers complementary approaches and topics covered in ABE 227. Prerequisite: One of MATH 220, MATH 221, MATH 234.

ABE 232 Context in International Interventions credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ABE/232/)
This multi-disciplinary course will examine a new approach to infrastructure engineering for alternately developed societies that seeks to counteract the disconnects and differing objectives among project stakeholders that result in lack of infrastructure sustainability and resiliency. Using a case study from Western Africa, the course will consider the impact of globalization, the attitudes of industrialized societies, and the role of place-based knowledge in designing and implementing infrastructure interventions for rural societies. Same as AFST 233.
This course satisfies the General Education Criteria for:
Cultural Studies - Non-West
Social Beh Sci - Soc Sci

ABE 340 Thermodynamics for Agricultural and Biological Engineering credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ABE/340/)
Fundamental concepts of thermodynamics will be presented and applied to the discipline of Agricultural and Biological Engineering. Topics include: forms of energy, first and second laws of thermodynamics, energy balances on closed and open systems, entropy, refrigeration and cooling. Thermodynamic principles will be applied to Agricultural and Biological Engineering systems: thermodynamics of flow processes, mass and energy balances for non-reacting systems, mechanical energy balances, thermodynamics of food drying, freezing and reaction kinetics of biological systems. Credit is not given toward graduation for ABE 340 and either ME 200 or CHBE 321. Prerequisite: MATH 241.

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 227 and ABE 228.

ABE 361 Functional Analysis and Design of Agricultural Machine Systems credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ABE/361/)
Design and development concepts of agricultural machines; analysis and synthesis of tillage, planting, harvesting, chemical application, material handling mechanisms, and precision farming tools. Prerequisite: TAM 212.

ABE 397 Independent 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 412 Applied Data Science for Agricultural and Biological Engineering credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ABE/412/)
Use of data to study problems unique to agricultural and biological engineering, identify patterns, and make actionable insights. Course includes (1) exploratory data analysis including data profiling, missing data, description, and data visualization; (2) data processing techniques including singular value decomposition, dimensionality reduction, and Fourier and wavelet transforms; (3) machine learning techniques including regression, classification, feature selection, clustering, and neural networks. 3 undergraduate hours. 3 graduate hours. Prerequisite: CS101 or equivalent and MATH 257.

ABE 425 Engrg 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 426 Principles of Mobile Robotics credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ABE/426/)
Prepares students in design, navigation, control, and autonomy of aerial and ground robots that operate in harsh, uncertain, and changing field environments. Covers three primary aspects of field robotics: perception (sensing), motion control, and data analytics, and bring everything together through labs involving ground robots and flying unmanned aircraft (drones). Same as ECE 426. 4 undergraduate hours. 4 graduate hours. Prerequisite: MATH 221, MATH 257, and MATH 285, IE 300 or ECE 313 or STAT 400, CS 101 or CS 124 or ECE 220, or graduate standing.

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 ETMA 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 ETMA 438. Prerequisite: PHYS 211.

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 452 Engineering for Disaster Resilience credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ABE/452/)
Project-based design of resilient food, energy, and water supply chains for disaster-prone regions. Students investigate factors that provide context for specific disaster-prone regions and viable design solutions. Students quantify reliability and resilience of potential solutions, work with communities, aid organizations, and peer institutions identifying designs, eventually seeking pathways to implement solutions. Students will emerge with skills for managing such projects, collaborating closely with communities where local factors have impacts on sustainable engineering designs. 3 OR 4 undergraduate hours. 4 graduate hours. May be repeated one time by undergraduate students if the term project differs from previous term, up to total credit of 7 hrs. Not repeatable for graduate credit. Credit is not given toward graduation for: ABE 452 and ETMA 452.

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 Engrg 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 undergraduate hours. 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 undergraduate hours. 3 or 4 graduate hours. Prerequisite: Credit or concurrent registration in TAM 335.

ABE 466 Engineering Off-Road Vehicles credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ABE/466/)
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 ETMA 464. Prerequisite: ABE 340 or ME 200.

ABE 469 Capstone Design Experience credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ABE/469/)
Design projects which utilize principles of design, engineering analysis and functional operation of engineering systems. Projects originate from industry, nonprofit entities and federal agencies. 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. No graduate credit. Prerequisite: Current senior standing in an engineering major. Restricted to undergraduate students.
This course satisfies the General Education Criteria for:
Advanced Composition

ABE 476 Indoor Air Quality Engineering credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ABE/476/)
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. (https://courses.illinois.edu/schedule/terms/ABE/482/)
Same as FSHN 469. See FSHN 469.

ABE 483 Engineering Properties of Food Materials credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ABE/483/)
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: Restricted to Grainger Engineering Seniors or Graduate students.

ABE 488 Bioprocessing Biomass for Fuel credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ABE/488/)
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. 4 undergraduate hours. 4 graduate hours. Prerequisite: ABE 340 or ME 200 or CHBE 321. Restricted to Junior, Senior or Graduate student status.

ABE 497 Independent Study credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/ABE/497/)
Individual research, special problems, thesis, development or design work under the supervision of a member of the faculty. 1 to 4 undergraduate hours. No graduate credit. May be repeated to a maximum of 8 hours. Prerequisite: Consent of instructor.

ABE 498 Special Topics credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/ABE/498/)
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. 1 to 4 undergraduate hours. 1 to 4 graduate hours. May be repeated in the same or separate terms if topics vary to a maximum of 16 hours.

ABE 501 Graduate Seminar: Foundations of Success credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/ABE/501/)
Basic research orientation, degree program requirements, literature review techniques, peer review of journal articles, presentation skills, safe laboratory practices, case studies, time management and productivity. Prerequisite: Restricted to ABE or ETMAS programs.

ABE 502 Graduate Seminar: Advanced Career Skills credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/ABE/502/)
Introduction to managing time and stress, completing degree program requirements, research methods, data collection techniques, professional ethics, presentation and communication skills, and project management. Prerequisite: Restricted to ABE or ETMAS programs.

ABE 503 Graduate Seminar: Integrity, Teaching and Research credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/ABE/503/)
Introduction to teaching and pedagogy, strategies for engaging students, presentation techniques, feedback, research integrity and thesis preparation. Prerequisite: Restricted to ABE or ETMAS programs.

ABE 526 Autonomous Systems and Robots credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ABE/526/)
The objective of this course is to cover theory and techniques essential for building cyber-physical systems capable of autonomous decision making in the real-world. This course will lay a foundation for theory and techniques in autonomous planning, machine learning, and adaptive sequential decision making. Topics covered include Planning under uncertainty, Bayesian Nonparametric machine learning, Deep learning and Neural Networks, Markov Decision Processes, and Reinforcement Learning. A key emphasis of the course is placed on transition of fundamental aspects of autonomous decision making to application on robotics systems. Prerequisite: MATH 225; MATH 416, or equivalent; STAT 400, MATH 461 or equivalent. An introductory course in machine learning (e.g. CS 446), control (e.g. SE 422), robotics (e.g. ABE 424, ECE 470), OR Artificial Intelligence (CS 440) is required. An introductory software programming course is recommended. Restricted to graduate students in Engineering.

ABE 532 Advanced Contextual Design credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ABE/532/)
Contextual Engineering addresses the loss of infrastructure usability, sustainability, and resiliency in non-industrialized societal settings that often results from disconnects and differing objectives among stakeholders. Using case studies and technical infrastructure designs, the impacts of globalization, Western attitudes, power dynamics, and place-based knowledge are explored and applied to infrastructure design and implementation processes, particularly when serving rural societies. Application of these concepts will then be conducted for specific design efforts associated with the student's own engineering discipline.

ABE 597 Independent Study credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/ABE/597/)
Individual investigations or studies of any phases of agricultural engineering selected by the student and approved by the advisor and the faculty member who will supervise the study. May be repeated to a maximum of 16 hours. Prerequisite: Consent of instructor.

ABE 598 Special Topics credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/ABE/598/)
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 terms if topics vary to a maximum of 8 hours.

ABE 599 Thesis Research credit: 0 to 16 Hours. (https://courses.illinois.edu/schedule/terms/ABE/599/)
Approved for S/U grading only. May be repeated in the same term or in separate terms.