

Biological Engineering - Technical Electives

Department	Course	Course Title	Hours	Course Description
AGSYSMT	5560	UAS and Remote Sensing in Agriculture	3	Introduction to the fundamentals of remote sensing within the framework of Geographic Information System, and Unmanned Aerial Systems (UAS), and their applications in production agriculture. Topics include remote sensing technologies, FAA regulations and rulemaking, UAS types, mission planning, image collection, processing and interpretation, and their applications in agriculture. Prereq: HCS 2260, AnimSci 2260, ENR 2000, AEDEcon 2005, ComLdr 3537, or Stat 1450; and Sr standing; or permission of instructor.
BIOMEDE	2000	Introduction to BME	3	Introduction to the application of engineering to modern healthcare utilizing lectures from engineering, medicine, and life science. Prereq: Math 1172, Engr 1182 or equiv., Chem 1220, Physics 1250, and enrollment in the BiomedE major or pre-major. Concur: Biology 1113, MechEng 2040, and Math 2173 or equiv. Email Lindsay Tolchin.6@osu.edu to request permission for this course.
BIOMEDE	4310	Biomaterials	3	Principles of materials science; biocompatibility and biological reactions to implanted materials; natural biomaterials and synthetic materials used in biological applications. Prereq: 2000, MatScEn 2010, and Math 2177. Concur: EEOB 3510, or permission of instructor.
BIOMEDE	4410	Biomechanics	3	Mechanical characterization of biological tissues at the cellular, organ, and system level; exploration of biomechanical factors of physiological and pathological conditions. Prereq: 2000, Math 2174, and MechEng 2040. Concur: EEOB 3510, or permission of instructor.
BIOMEDE	4510	Cell, Molecular, and Tissue Engineering	3	Application of engineering methods to study, measure, repair, or replace biological functions and the molecular cellular or tissue-level length scales. Prereq: 2000, Math 2174, or permission of instructor. Concur: Biochem 4511 and EEOB 3510.
BIOMEDE	4610	Biomedical Micro/Nanotechnology	3	Introduction to micro/nanotechnology in biomedical settings, including micro/nanotechnologies used to investigate biological systems, physiological responses to nanotherapeutics, and first principles of microfluidics and microfabrication. Prereq: 2000, MatScEn 2010, and Biochem 4511, or permission of instructor.
BIOMEDE	5639	Medical Device Development and Regulation	3	Basic principles and essential steps for medical device design and commercialization. Prereq: Sr standing in Engineering, or permission of instructor.
CBE	3610	Kinetics and Reactor Design	4	Chemical and engineering principles for the design and operation of chemical reactors; kinetics of simple homogeneous systems and introduction to heterogeneous catalysis. Prereq or concur: 3508 or FABE 3120; and enrollment in CBE, or FABEng, or EngPhysics major; or permission of instructor.
CBE	5765	Principles of Biochemical Engineering	3	The application of biochemical engineering principles for modern bioprocesses and in the area of industrial biotechnology. Prereq: 2523 or 3610 or permission of instructor.
CBE	5766	Biotechnology and Bioprocess Engineering	3	Fundamentals of biotechnology and their applications to bioprocessing with emphasis on fermentation and bioseparation. Completion of Bio 1113 or 2100 is recommended. Prereq: Jr standing in CBE, or permission of instructor.
CBE	5771	Air Pollution	3	Introduction to principal aspects of air pollution, including engineering control of stationary sources, atmospheric chemistry, aerosol behavior, transport and dispersion modeling. Prereq: Sr standing or permission of instructor.

CBE	5772	Principles of Sustainable Engineering	3	Introduces the principles, techniques, and challenges of environmentally conscious decision making in chemical engineering. A study of systematic methods for the analysis and development of sustainable industrial products and processes. Prereq: 3508 or equivalent, or permission of instructor.
ECE	5050	Humanitarian Engineering	3	Poverty and underdevelopment. Goal of social justice. Development strategies. Engineering for the poor, weak, and developing communities. Humanitarianism in the university and engineering enterprise. Prereq: 1182 or 1282; or permission of instructor.
ENGR	4375	Inclusive Leadership Practice for Emerging Professionals	1	To provide engineering students with the tools and techniques that allow them to develop their confidence, leadership style, and community of support in their academic and professional careers. Prereq: None
ENGR	4692.01(S)	Service Learning in Engineering	1-3	Experimental education characterized by participation in an organized service activity connected to specific learning outcomes. Meets community needs and includes student reflection. Prereq: Permission of instructor.
ENGR	5710	Engineering Research Communications	3	Engineering technical communications for academic writing and professional presentations, including authoring refereed journal articles and authoring and presenting conference papers in engineering disciplines. Prereq: Sr standing.
ENGR	5797.XX	Engineering Study Abroad	3	Study Abroad. Locations vary. Must be related to engineering and/or your specialization. Faculty advisor approval needed to count for technical elective. This course is graded S/U.
ENR	3000	Soil Science	3	Introduction to soil physical, chemical, and biological properties related to land use, environmental quality, and crop production. Prereq: None.
ENR	3001	Soil Science Laboratory	1	Observation and quantitative determination of soil properties. Prereq or concur: 3000
FABENG	3200S	Engineering for Community Development in Ohio	3	Service-learning course applying engineering to address contemporary issues related to food security in Central Ohio. In consultation with local social organizations, students will merge best practices for community development with resilient and sustainable design toward a semester long engineering design project that addresses a need or an opportunity to alleviate poverty and hunger. Prereq: Engr 1181.01, 1181.02, 1186.01, 1187, 1188, 1281.01H, 1281.02H, or 1281.03H, or permission of instructor.
FABENG	3610	Utilization of Energy in Agriculture	3	Study of motive and stationary power needs in agriculture, mechanics of traction, characteristics and selection of power sources, power transmission, principles and design of hydraulic systems. Prereq: 2110.
FABENG	3810	Agricultural Structures	3	Analysis and design of frames and members for agricultural structures. Prereq: MechEng 2020 or 2040.
FABENG	4998	Undergraduate Research	1-5	Individually supervised research and project work. Prereq: 6 cr hrs taken at 3000 level or above in Engineering. This course is graded S/U.
FABENG	4999	Undergraduate Thesis	1-5	Research leading to an undergraduate thesis. Prereq: 6 cr hrs taken at 3000 level or above in Engineering. This course is graded S/U.
FABENG	5200	Appropriate Technology for Developing Countries	3	Introduction to Appropriate Technology product design and development for people in developing countries and the business related topics necessary for commercialization. The focus will be on market driven solutions that help ensure the long term sustainability of the solutions developed. Prereq: Engr 1182.01, 1182.02, 1182.03, 1282.01H, 1282.02H, 1282.03H, or 1282.04H; or permission of instructor.

FABENG	5260.02	Safe Water on Tap	3	This problem-centered design course focuses on major water quality challenges both nationally and internationally. Human and context-driven design principles are applied to drinking water contaminants with global public health impact. We develop design algorithms from first principles whenever possible and explore novel solutions. Prereq: 2110, CivilEn 3130, CBE 2420, or MechEng 3503; and Engr 1221 or CSE 1222; or permission of instructor.
FABENG	5310	Ecological Engineering and Science	4	Definition, classification, and practice of ecological engineering. Course explores ecological ecosystems, ecosystem restoration, and the utilization of natural processes to provide societal services and benefits to nature. Prereq: At least one course in Biology, Ecology, Engineering, or Geology, and Jr standing. Cross-listed in EnvEng and ENR.
FABENG	5330	Environmental Biophysics	3	Environmental Biophysics provides an overview of the interactions between the physical microenvironment and the organisms that reside in that environment. This class will examine the roles of different environmental factors on the functioning of terrestrial vegetation, and scaling the exchange of heat and mass (i.e. water and carbon dioxide) from leaf to canopy scales. Prereq: Engr 1221 or CSE 1222 or 2021, or equiv.; or permission of instructor.
FABENG	5335	Advances in High Throughput Phenotyping	3	High-Throughput Phenotyping (HTP) is an emerging field that integrates remote sensing and simulation and modeling technologies to advance selection in plant breeding programs. Advances in High Throughput Phenotyping provides an overview of the sensing and modeling tools that are being integrated into modern HTP platforms. Prereq: CSE 1222 or Engr 1221 or 1181.xx or 1281.xx or 1187 or HCS 2260 or AnimSci 2260 or ENR 2000 or AEDEcon 2005 or ComLdr 3537 or Stat 1450, and Jr or Sr standing; or permission of instructor.
FABENG	5405	Kinetics of Reactions and Reactor Design for Food and Biological Systems	4	Basics of reaction kinetics and reactor design. Material balances in a reactor. Applications of kinetic models to describe changes in food quality attributes and food safety as a function of process parameters. Shelf life estimation of foods based on kinetics. Design, selection and sizing of reactors. Prereq: 2110, 3120, and Math 2177.
FABENG	5510	Introduction to Polymer Science: A Bio-based Approach	3	This course introduces polymer chemistry through polymers found in nature. It is designed as a unique introduction to the subject, which connects natural and synthetic polymers by exploring the chemistry of natural polymers from plants, animals and humans and self-assembled macromolecular structures. Chapters cover the basic concepts of polymer chemistry. Prereq: Chem 2310, or permission of instructor.
FABENG	5520	Phytotechnology and Phytoremediation	3	Engineering principles of using plants for remediation of contaminated sites and treating polluted soil and water. Traditional methods as well as new trends and current research in phytoremediation technologies will be presented. Can be used as either a technical elective or an advanced biology/applied science elective. Prereq: 3500 or EnvEng 3200, or permission of instructor.
FABENG	5540	Biomass Conversion to Bioenergy	3	An exploration of the science and technologies used for energy production from bio-based materials, including agricultural biomass and solid waste sources. Prereq: 3130 or equiv.
FABENG	5550	Sustainable Waste Management	3	A comprehensive examination of waste generation, treatment and reuse including the impacts of pollution on the environment and human health. The focus will be on agricultural residues, manure, domestic wastewater, and municipal solid waste streams. Prereq: Sr standing in Engineering.
FABENG	5760	Design of Urban Stormwater Control Measures	3	Fundamental and advanced hydrologic and water quality design of stormwater controls for urban areas. Students will be expected to solve multi-objective, real-world engineering problems in a team setting. Prereq: 2720 or CivilEn 3160, or permission of instructor.
FABENG	5797.XX	Study at a Foreign Institution	3	An opportunity for students to study at a foreign institution and receive Ohio State credit for that work. Prereq: Permission of department chairperson.

FABENG	5820	Environmental Controls and Air Quality	3	Heating, ventilation, and air conditioning (HVAC) engineering applied to agricultural, residential, and commercial structures; analysis of factors affecting energy utilization and air quality; green and sustainable HVAC technologies. Prereq: 3130, MechEng 510, or ChBE 521.
ISE	3800	Engineering Project Management	3	Project management for engineers, including project life cycle, planning, optimization models, management of change and scheduling and budgeting. Prereq: 2400, and enrollment in ISE major; or enrollment in Engineering Physics major; or permission of ISE Academic Advisor.
ISE	4500	Manufacturing Process Engineering	3	A thorough quantitative understanding of contemporary manufacturing processes; exposure to laboratory exercises and computer simulations in major manufacturing processes; design for manufacturing and assembly. Prereq: Option 1: MechEng 3670. Prereq or concur: MechEng 4510, Or Option 2: MechEng 2020 or 2040, and WeldEng 4201 or MechEng 3500; or permission of instructor.
ISE	5710	Behind Human Error: Safety and Complex Systems	3	Covers how complex systems fail and the human contribution to success and failure by studying actual disasters in diverse fields. Prereq: Sr standing, or permission of instructor.
ISE	5820	Systems Thinking in Engineering and Design	3	Concepts and heuristics in systems thinking and complex systems analysis and how these concepts apply to engineering and design projects. Prereq: Sr standing, or permission of instructor.
MATSCEN	2010	Introduction to Engineering Materials	3	Introduction to the properties (mechanical, electrical, thermal, diffusive, degradative, magnetic, optical), structure, and processing of engineering materials, including ceramic, metals, polymers, biological, and composite materials. Prereq: Physics 1250 or 1260, Math 1151 or 1161, and Chemistry 1210 or 1250 or 1910H; or permission of instructor
MATSCEN	3611	Biological Response to Biomaterials	3	The biological response to biomaterials implanted within the human body. Prereq: 2010; or permission of instructor.
MECHENG	5180	Mechanics of Biomolecular Systems	3	Introduction to biomolecules and systems in the context of cellular functions. In particular the course focuses on the physical properties of biomolecules and the physical interactions that mediate their functions. Prereq: Sr standing in Engineering, or permission of instructor.
MECHENG	5541	Heating, Ventilating, and Air Conditioning	3	Analysis of components and systems for heating, ventilating and air-conditioning. Prereq: 4510.
MECHENG	5682.01	Fundamentals of Product Design Engineering	3	Lecture covering the fundamentals of the product design process, from concept creation to final implementation, including product architecture and design for manufacture and assembly. An optional, corresponding project-based lab course (ME/ISE 5683) offers practical application of this material. Only open to students enrolled in majors in the College of Engineering. Prereq: Jr or Sr standing in the College of Engineering, or permission of instructor.
STAT	3470.01/02	Introduction to Probability and Statistics for Engineers	3	Introduction to probability, Bayes theorem; discrete and continuous random variables, expected value, probability distributions; point and interval estimation; hypotheses tests for means and proportions; least squares regression. Prereq: Math 1152, 1161.xx, 1172, 1181H, or equiv, or permission of instructor.