

Agricultural Engineering - Technical Electives

Department	Course	Course Title	Hours	Course Description
AGSYSMT or CONSYSTM	2240	Basic Metal Fabrication for Agriculture	3	A study of the principles and practices in basic metal fabrication using the current metallurgical and welding processes required in the agricultural industry. Prereq: AGSYSMT 1100 and FAES 1100 or other university survey course. If you've taken a different university survey course, email FABE academic advisor to be added.
AGSYSMT	4580	Precision Agriculture	2	Introduction to the principles and technologies of precision agriculture including: Global Positioning System (GPS), guidance systems, plant and soil sensors, soil sampling, yield mapping and related technologies. Prereq: None
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.
AGSTSMT	5580	Data Analytics in Production Agriculture	3	An overview of the principles of data management and analytics in support of field crop production. Lecture topics include: data generation and collection methods, and modeling, actionable spatial and temporal management recommendations at the sub-field level. Laboratory exercises include: broad overview and introduction to R, and its use in common data analyses in production agriculture. Prereq: 3580 or 4580, and ComLdr 3537 or AnimSci 2260 or HCS 2260 or ENR 2000 or AEDEcon 2005; or permission of instructor.
AGSYSMT	5600	Agricultural Safety and Health	3	Develops the knowledge, awareness and attitude necessary to becoming an effective safety manager in a non-traditional occupational environment. Includes hazard identification and mitigation; safety education, engineering, and enforcement strategies. Prereq: None
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.
CHEM	2310	Introductory Organic Chemistry	4	A condensed presentation of organic chemistry organized by functional groups with an emphasis on practical applications. Prereq: 1110, 1220, 1250, 1620, or 1920H.
CIVILENG	2810	Construction Engineering and Management: An Introduction	3	Basic engineering and management concepts of construction operations of various foundations, concrete, and steel buildings and bridges. Prereq: Enrollment in CivilEn major. Please Contact Barry at Tolchin.5@osu.edu if you do not meet the prereqs for this course.
CIVILENG	3160	Water Resources Engineering	3	Pipe systems, introduction to open channel flow, basic hydrology, demographic studies, water supply, and wastewater flows. Prereq: 3130; and CSE 1221 or 1222 or Engr 1221 or 1222 or 1281H or Engineer; and enrollment in CivilEn or EnvEng major. Please Contact Barry at Tolchin.5@osu.edu if you do not meet the prereqs for this course.

CIVILENG	3540	Geotechnical Engineering	2	The properties of soils as construction materials (e.g., for earth dams) and as foundations for building are introduced and state-of-the-art numerical techniques for the prediction of seepage and settlement are presented. Contemporary issues such as the impact of soil failure mechanisms and sustainability are covered. Prereq: MechEng 2020 or 2040, and enrollment in CivilEn or EnvEng or FABEng major program. Concur: CivilEn 3541. Prereq or concur: CivilEn 2050 or permission of instructor. Please Contact Barry at Tolchin.5@osu.edu if you do not meet the prereqs for this course.
CIVILENG	3541	Geotechnical Engineering Laboratory	1	Laboratory determination of soil properties including grain size distribution, plasticity, permeability, compaction and shear strength (both drained and undrained). Course must be taken concurrently with 3540, 5561, or 5571. The 3541 course requirement may be waived in 5561 and 5571 by the instructor, if the student demonstrates previous completion of a similar lab program. Concur: 3540, 5561, or 5571. Please Contact Barry at Tolchin.5@osu.edu if you do not meet the prereqs for this course.
CIVILENG	4320	Structural Steel Design	3	Design of steel tensile members, compression members, beams, beam-columns, and bolted and welded connections based on AISC Specifications. Design problem solving. Introduction to computer-aided design. Prereq: 3310 and enrollment in CivilEn major. Please Contact Barry at Tolchin.5@osu.edu if you do not meet the prereqs for this course.
CIVILENG	4350	Reinforced Concrete Design	3	Analysis and design of reinforced concrete beams, one-way slabs and columns under flexure, shear and axial loads. Prereq: 3310, and enrollment in CivilEn major. Please Contact Barry at Tolchin.5@osu.edu if you do not meet the prereqs for this course.
CIVILENG	5001	Introduction to Geographic Information Systems	4	Introduction to the basic principles of geographic information systems and their use in spatial analysis and information management. Prereq: 2050 and Sr standing; or permission of instructor. Please Contact Barry at Tolchin.5@osu.edu if you do not meet the prereqs for this course.
CIVILENG	5130	Applied Hydrology	3	Hydrologic cycle, meteorology, streamflow, evapotranspiration, hydrographs, runoff relations, runoff hydrographs, groundwater, unit hydrographs, flood routing, frequency and duration studies, and application of hydrologic techniques. Prereq: 3160 Please Contact Barry at Tolchin.5@osu.edu if you do not meet the prereqs for this course.
CIVILENG	5240	Groundwater Engineering	3	The role of groundwater in the hydrologic cycle, water supply, construction, and contamination. Includes principles describing subsurface water movement (seepage, saturated, and unsaturated flow). Emphasis on gaining a working knowledge of techniques used in applied engineering practice to estimate groundwater parameters for design purposes. Applications include well design, pumping, and drains. Prereq: 3130, or permission of instructor. Please Contact Barry at Tolchin.5@osu.edu if you do not meet the prereqs for this course.
CIVILENG	5420	Remote Sensing of Environment	3	The energies of the natural and cultural environment, current remote sensing systems and case histories of applications in measuring the environment. Prereq: 2410 or permission of instructor. Please Contact Barry at Tolchin.5@osu.edu if you do not meet the prereqs for this course.
CIVILENG	5820	Construction Estimating	3	Practical aspect in estimating real construction projects encompassing highway, foundation, buildings, and bridges. Prereq: 2810 or permission of instructor. Please Contact Barry at Tolchin.5@osu.edu if you do not meet the prereqs for this course.

CIVILENG	5830	Construction Scheduling	3	Practical aspects in identifying construction activities and their relations, establishing visual representation of a project schedule, and computing the completion date of the project. Prereq: 2810 or permission of instructor. Please Contact Barry at Tolchin.5@osu.edu if you do not meet the prereqs for this course.
CIVILENG	5840	Construction Contracts and Claims	3	Practical aspects of the development and interpretation of contracts and claims focusing on the construction industry. Prereq: 2810 or permission of instructor. Please Contact Barry at Tolchin.5@osu.edu if you do not meet the prereqs for this course.
EARTHSC	5651	Hydrogeology	4	Geologic and hydrologic factors controlling the occurrence, movement, storage, and chemical quality of surface water and ground water; exploration, evaluation, development and management of water resources. Prereq: 1100, 1105, 1108, 1121, 1151, 2203, or 2205; and Math 1152 or above.
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
ENR	5261	Environmental Soil Physics	3	Principally involves the state and transport of water, heat and gas within soil, and the associated soil physical properties. Prereq: None
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	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.
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	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. Prereq: 3510 or EnvEng 3200
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	5620	Fluid Power Systems	3	Analysis and design of fluid power systems used in mobile (off-road) agricultural, maintenance and earth moving equipment. Topics include: positive displacement components, control devices, actuators, fluids and fluid transmission electrohydraulics, system dynamics, and the use of state-of-the-art design and analysis tools. Prereq: 2110 or MechEng 3503; and MechEng 2020 or 2040
FABENG	5750	Stream Geomorphology and Watershed Hydrology	3	Fundamental and advanced topics in stream geomorphology and hydrologic processes. Solving multi-objective engineering problems in a team setting involving protection, enhancement, and restoration of streams, rivers, and watersheds. Prereq: 2110 or CivilEn 3130, and 2720, or equiv.
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	5810	Design of Timber and Wood-Framed Building Systems	3	Behavior and material properties of wood construction in structures. Design methodology of timber structural elements and connections. Analysis methods and design process of post-frame and stick-framed building structures for commercial, agricultural, or residential use. Continuous lateral load path and the design of wood diaphragms, shear walls, and anchorage to foundation. Prereq: 3810 or CivilEn 3130
ISE	2500	Introduction to Manufacturing Engineering	3	Fundamentals of common manufacturing processes, materials and tooling; relationship of product design to required processing sequences and steps, attributes of manufacturing systems. Prereq: None
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 3503, Or Option 2: MechEng 2020 or 2040, and WeldEng 4201 or MechEng 3500 or MatScEn 3151; 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.
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	5951	Corrosion	3	Introduction of basic principles underlying the electrochemical corrosion degradation of metals, role of corrosion in material failures, and experimental corrosion evaluation approaches. An understanding of the fundamental thermodynamics and kinetics of electrochemical corrosion processes will be developed and serve as scientific foundation for understanding these topics. Prereq: Sr standing in Engineering, or permission of instructor.
MECHENG	3360	System Integration and Control	3	Modeling of a variety of multi-domain systems, including electromechanical actuators, principles of feedback control, and analysis of control systems. Prereq: 3260 or 3261, and enrollment as MechEng-BS student, or permission of instructor. Prereq or concur: 3503 or 3504. If you've taken FABE 3150, email FABE academic advisor for override.
MECHENG	3670	Design and Analysis of Machine Elements I	2	Design of mechanisms. Application of general mechanical engineering principles to the design and analysis of mechanical components. Prereq: 2020 and 2030 and 2900 and 2850, and enrollment as MechEng-BS student; or permission of instructor.
MECHENG	3671	Design and Analysis of Machine Elements II	3	Continuation of 3670 and 3751. Prereq: 3670 or 3676, and 3751, and enrollment as MechEng-BS student; or permission of instructor.
MECHENG	3751	Kinematics and Mechanism Design	2	This course is intended to help students develop an intuitive understanding of the design concepts for machinery and mechanisms. Topics covered are: kinematic joints, mobility analysis, kinematic synthesis of planar linkages, computer-aided design of mechanisms, kinematic analysis, Cam motion program synthesis, and cam profile design. Prereq: 2030 and 2900, or permission of instructor. If you have taken MECHENG 2030 but not 2900, email FABE academic advisor for override.
MECHENG	5139	Applied Finite Element Method	3	Overview of finite element method, description of finite element software, modeling requirements and techniques, analysis using general purpose software, and case studies. Prereq: 2020, 2040, or equiv, and enrollment in MechEng major. If you've taken 2020 or 2040 and are senior standing, email FABE academic advisor for override.
MECHENG	5144	Engineering Fracture Mechanics	3	Fracture and fatigue of solids; stress intensity factors; stability of cracks; compliance and energy methods; plane stress, plane strain effects; crack propagation and arrest criteria. Prereq: 2020 or 2040, and Math 2174, 2177, or 2415.

MECHENG	5240	Mechanical Vibrations	3	Free and forced vibration analysis of single-degree-of-freedom systems with various forms of damping, vibration isolation and control methods and devices, vibration sensors, equations of motion of multi-degree of freedom systems using Lagrange's method, Eigen value problem, modal analysis method for free and forced vibration analysis, frequency-domain data analysis fundamentals. Prereq: 3260. Prereq or concur: 3360. If you've taken FABE 3150, email FABE academic advisor for override.
MECHENG	5372	Theory and Applications of Feedback Control	3	Introduction to multi-domain (mechanical, thermal, fluid, electrical, electronic, electro-mechanical) system design, dynamic modeling, and control system design and analysis techniques. Prereq: 3360 or 3361, or permission of instructor.
MECHENG	5427	Introduction to Turbomachinery	3	Introduction to analysis and design of turbomachinery. Prereq: 3503 or 3504.
MECHENG	5512	Design of Heat Exchangers	2	Design methods, heat transfer and pressure drop in single phase and two phase heat exchangers. Design of single phase and two phase heat exchangers. Prereq: 4510 or permission of instructor. If you've taken FABE 3130, email FABE academic advisor for override.
MECHENG	5530	Internal Combustion Engines	3	Design and operating characteristics of contemporary internal combustion engines, induction/exhaust breathing, boosting, variable valvetrains, combustion and knock, fuel economy, alternative fuels, and advanced powertrains. Prereq: 3501 or 3502 or permission of instructor. If you've taken FABE 3120, email FABE academic advisor for override.
MECHENG	5531	Automotive Powertrain Laboratory	3	This course focuses on analysis and testing of advanced automotive systems. These systems include advanced powertrain components like turbocharged GDI engines, electric powertrain components like electric motors, and autonomous vehicle sensing technologies like radar and lidar. Students will conduct labs and use supplied data to conduct analysis typical of practicing automotive engineers. Prereq: 3870 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. If you've taken FABE 3130, email FABE academic advisor for override.
MECHENG	5680	Computer Aided Design and Manufacturing	4	Design of machine components, surfaces, and assemblies using parametric and feature-based design principles and advanced design tools. Prereq: 3670 or permission of instructor.
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.
MECHENG	5683	Fundamentals of Product Design Engineering Laboratory	1	This course is an optional laboratory to go with ISE/ME5682.01. This project-based lab gives students hands-on experience with the product design process introduced in lecture. Students will work with real people to identify opportunities to create innovative, product-based solutions. Students will go through the design process from conducting user research all the way to constructing prototypes. Prereq or concur: 5682.01 or ISE 5682.01, and enrollment in a major within the College of Engineering.
STAT	3450.01/.02	Basic Statistics for Engineers	2	Introduction to probability; Normal distribution; Confidence intervals for means; Hypothesis tests for means; Multi-factor experiments; Experiments with blocking. Prereq: Math 1152, 1161.xx, 1172, or 1181, or equiv, 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.
WELDENG	4202	Welding Design	3	Fundamentals of design and application of codes and standards for welded structures. Prereq: 4201, and enrollment as a WeldEng-BS major; or permission of instructor.