

Fall 2026 Tech Elective List

By utilizing this list, I acknowledge that:

- This list is *not* all-inclusive.
- Just because I *can* take a class, does not mean I *should* take a class.
- I am responsible for ensuring I meet pre-requisites.
 - Pre-requisites are enforced by the department offering the course
- Class schedules and offerings may change; classes may not be available when I register.

[ABE 3160: Applied Numerical Methods for Agricultural and Biosystems Engineering](#)

Credits: 3.

Prereq: ABE 1600, MATH 2660 or MATH 2670.

Computer aided solution of engineering problems by use of numerical techniques and mathematical models. Systems analysis and optimization applicable to agricultural and biological systems.

[ABE 3880: Sustainable Engineering and International Development](#)

(Cross-listed with CE 3880 and EE 3880).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Junior Classification in any Engineering Major.

Multi-disciplinary approach to sustainable engineering and international development, sustainable development, appropriate design and engineering, feasibility analysis, international aid, business development, philosophy and politics of technology, and ethics in engineering. Engineering-based projects from problem formulation through implementation. Interactions with partner community organizations or international partners such as nongovernment organizations (NGOs). Course readings, final project/design report. Meets International Perspectives Requirement.

[ABE 4150: Agricultural & Biosystems Engineering Design I](#)

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

Prereq: ABE 3160 (majors only).

Engineering design process with emphasis on team delivery of: clearly defined deliverables; criteria and constraints; wide-field ideation; discipline-appropriate analysis methods; identification and application of relevant standards.

[ACCT 4420X: Generative AI in Business Decision-Making](#)

(Dual-listed with ACCT 5420X and MIS 5420X). (Cross-listed with MIS 4420X).

Credits: 3. Contact Hours: Lecture 3.

This intensive course is designed to equip students with the knowledge and skills to leverage generative AI in business decision-making. Through learning modules, interactive case studies, and practical assignments, students will learn to create effective prompts and use Generative AI to transform business processes and decision-making.

[ACCT 4610: Entrepreneurship and Accounting Information](#)

(Dual-listed with ACCT 5610). (Cross-listed with ENTSP 4610).

Credits: 3. Contact Hours: Lecture 3.

Accounting information recording, dissemination, and use by entrepreneurs. Introduces pro forma financials, venture capital, private equity, and state and federal regulations for business creation and formation. Other topics include intrapreneurship, intellectual property, information privacy, cybersecurity, and internal controls, including managing the risk of embezzlement.

[AERE 3640: Cyber-Physical Systems Application](#)

(Cross-listed with CPS 3640).

Credits: 3. Contact Hours: Laboratory 2, Lecture 2.

Prereq: ENGR 1600 or equivalent; credit or enrollment in MATH 2670.

Fundamental principles of cyber-physical systems and their system-level applications at an introductory level; introduction to radio control systems and control of actuators; computer programming of physical systems; data processing and communication; control loops; X-by-wire control systems; simulation; testing of control loops.

[AERE 4800: Ultrasonic Nondestructive Evaluation](#)

(Cross-listed with EM 4800 and MATE 4800).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240 or MATE 3190, MATH 2660 or MATH 2670, PHYS 2320.

Introduction to stress/strain, Hooke's law, and elastic wave propagation in two dimensions in isotropic media. Ultrasonic plane-wave reflection and transmission; and simple straight-crested guided waves. Transducer construction, behavior, and performance. Simple signal analysis and discrete signal processing. The last few weeks of the course are devoted to case studies.

[AFAS 3410: Leading People and Effective Communication](#)

Credits: 3. Contact Hours: Lecture 3.

Presents the complex issues of leadership and management in the U.S Air Force; a large and diverse organization. The theoretical aspects of leadership, management, communications, motivation and problem-solving are examined and studied against the backdrop of the U.S. Air Force.

[AGEDS 3880: Agricultural Mechanics Applications](#)

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Introduction to SMAW (Arc), GMAW (Mig), GTAW (Tig), Oxy-Fuel welding, Oxy-Fuel cutting, and Plasma cutting theories and applications. Emphasis will be on theoretical foundation of welding, safety, welding skill development, and management of equipment, and materials. Introduction to small engines and applications. Emphasis will be on theory of operating systems, maintenance, troubleshooting, failure analysis, and safety.

[AGRON 3420: World Food Issues: Past and Present](#)

(Cross-listed with ENVS 3420/ FSHN 3420).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior Classification.

Issues associated with global agricultural and food systems including ethical, social, economic, environmental, and policy contexts. Investigation of various causes and consequences of overnutrition/undernutrition, global health, poverty, hunger, access, and distribution. Meets International Perspectives Requirement.

[AGRON 3540: Soils and Plant Growth](#)

(Cross-listed with HORT 3540).

Credits: 3. Contact Hours: Lecture 3.

Prereq: AGRON 1820, 3 credits of BIOL.

Effects of chemical, physical, and biological properties of soils on plant growth, with emphasis on nutritive elements, pH, organic matter maintenance, and rooting development.

[ANS 3360: Domestic Animal Behavior and Well-being.](#)

Credits: 3. Contact Hours: Lecture 2, Laboratory: 2.

Prereq: ANS 2140.

Understand how managed animals cope and perceive the environment. Principles of behavior and well-being relative to animal care, management and housing. Methods to objectively assess animal well-being. Awareness of animal protection through education/assessments, audits and law.

[ASTRO 3420: Introduction to Solar System Astronomy](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 2320 and PHYS 2320L or PHYS 2420.

An introduction to the physics of the Solar System and the planetary systems discovered around other stars. General characteristics of planetary systems: dynamics, thermodynamics, internal and surface structure of planets and minor bodies, physics of their atmosphere. Discovery techniques and characterization of extrasolar planets, and planetary systems formation models. 'Grand tour' of the Solar System, using data and imagery from probes and telescopes that have visited these worlds. The origin and evolution of life on Earth, and the ongoing search for life in the Solar System and elsewhere in the universe.

[BBMB 3030: General Biochemistry](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 2310 or CHEM 3310.

Biochemistry for pre-health professions and biomedical engineering: structure and function of amino acids, proteins, carbohydrates, lipids and nucleic acids; enzyme activity; metabolism; DNA replication; RNA transcription; protein translation. Graduation Restriction: only one of BBMB 3010, 3030, or 3160 may count toward graduation; not acceptable for credit toward a major in Biochemistry.

[BBMB 4110: Techniques in Biochemical Research](#)

Credits: 4. Contact Hours: Lecture 2, Laboratory 8.

Prereq: Credit or enrollment in CHEM 3320.

Biochemistry laboratory grounded in inquiry-driven research methodologies. Laboratory techniques include molecular cloning, enzyme kinetics, electrophoresis, spectrophotometry, and chromatography. Emphasis on structure-function relationships, purification, characterization, and quantification of biomolecules. Multi-week projects promote collaboration, critical thinking, and advanced scientific/technical writing.

[BCBIO 3220: Introduction to Bioinformatics Computational Biology](#)

(Cross-listed with BIOL 3220 and GEN 3220).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120.

Genome sequencing, assembly, structural and functional annotation, and comparative genomics. Investigating these topics will develop skills in programming and scripting (Perl and/or Python), the use of biological databases, sequence alignment, similarity search, identification of sequence patterns, construction of phylogenetic trees, and comparative genomics.

[BIOL 3110X: Genome Editing and Engineering](#)

Credits: 1. Contact Hours: Laboratory 2.

Hands-on experiences in molecular cloning, CRISPR/Cas9 genome editing, and imaging techniques. Novel biological and cellular processes and disease-related pathways in mammalian cell culture and other model systems will be investigated through CRISPR/Cas9-mediated mutagenesis approaches. Offered on a satisfactory-fail basis only.

BIOL: 3120: Ecology

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: BIOL 2110; BIOL 2120 or BIOL 2510.

Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Laboratory and field exercises examine ecological principles and methods as well as illustrate habitats.

BIOL 3140: Principles of Molecular Cell Biology

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 and BIOL 2120.

Integration of elementary principles of metabolism, bioenergetics, cell structure, and cell function to develop a molecular view of how the cell works.

BME 2200: Introduction to Biomedical Engineering

(Cross-listed with CHE 2200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2120; (CHEM 1670 or CHEM 1770); (ABE 1600 or AERE 1600 or BME 1600 or CE 1600 or CHE 1600 or CPRE 1850 or EE 1850 or ENGR 1600 or IE 1600 or ME 1600 or SE 1850); MATH 1660; PHYS 2320.

Engineering analysis of basic biology and engineering problems associated with living systems and health care delivery. The course will illustrate biomedical engineering applications in such areas as: biotechnology, biomechanics, biomaterials and tissue engineering, and biosignal and image processing, and will introduce the basic life sciences and engineering concepts associated with these topics.

BME 3400: Computational Modeling in Biomechanical Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2670 and BME 2200; credit or enrollment in MATH 2650.

Principles and techniques for computational analysis of biomedical engineering problems; computational methods for integration, differentiation, interpolation, curve fitting, data analysis, sampling and estimation, and error analysis; analysis of ordinary differential equations, symbolic computation, and scientific visualization.

CHEM 3240: Introductory Quantum Mechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 1780, MATH 1660, PHYS 2320.

Quantum mechanics, atomic and molecular structure, spectroscopy, kinetic theory of gases, chemical kinetics.

CHEM 3250: Chemical Thermodynamics

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 1780, MATH 1660, PHYS 2320.

Classical thermodynamics 1st, 2nd, and 3rd laws with applications to gases and interfacial systems, multicomponent, multiphase equilibrium of reacting systems, surface chemistry, and electrochemical cells. Students taking a two-semester physical chemistry sequence are advised to take 3240 first; in the spring semester, a molecular-based section of this course, stressing statistical thermodynamics, is offered for which knowledge of 3240 is useful.

CE 3060: Project Management for Civil Engineers

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: Engineering Basic Program Courses.

Project management, including work breakdown structures, cost estimating, scheduling, and project control. Civil engineering project life cycle, including planning, design, construction, and maintenance processes. Techniques in interpretation of contract documents, plan reading, and in estimating quantities.

CE 3260: Principles of Environmental Engineering

(Cross-listed with ENVE 3260).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: [CHEM 1670 or (CHEM 1770 and CHEM 1780)] AND MATH 1660 AND (credit or concurrent enrollment in ABE 3780).

Introduction to environmental problems, water quality indicators and requirements, potable water quality and quantity objectives, water sources and treatment methods; water pollution control objectives and treatment methods; survey of solid and hazardous waste management and air pollution control.

CE 3320: Structural Analysis I

Credits: 3. Contact Hours: Lecture 3, Laboratory 1.

Prereq: EM 3240.

Loads, shear, moment, and deflected shape diagrams for beams and framed structures. Deformation calculations. Approximate methods. Application of consistent deformation methods to continuous beams and frames. Application of displacement or slope deflection methods to continuous beams and frames without sway. Influence lines for determinate and indeterminate structures. Computer applications to analyze beams and frames. Validation of computer results.

CE 3720: Engineering Hydrology and Hydraulics

Credits: 3. Contact Hours: Lecture 3.

Prereq: ABE 3780; (STAT 2310 or STAT 3050).

The hydrologic cycle: precipitation, infiltration, runoff, evapotranspiration, groundwater, and streamflow. Hydrograph analysis, flood routing, frequency analysis and urban hydrology. Applied hydraulics including pipe and channel flow with design applications in culverts, pumping, water distribution, storm and sanitary sewer systems. Design project required.

CE 4600: Foundation Engineering

Credits: 3. Contact Hours: Lecture 3.

Prereq: CE 3600.

Fundamentals of foundation engineering. Exploration, sampling, and in-situ tests. Shallow and deep foundations. Settlement and bearing capacity analyses. Stability of excavations and earth retaining structures. Design project.

COMS 3090: Software Development Practices

(Cross-listed with SE 3090).

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Practical introduction to methods for managing software development. Software engineering concepts, practices and tools. Requirements analysis, structured and object-oriented design, coding, testing, and maintenance. Software process models, software tools and environments. Programming projects that provide exposure to information management techniques, client/server model, networking and communication. Proficiency in the Java programming language required.

[COMS 3210: Introduction to Computer Architecture and Machine-Level Programming](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: Minimum of C- in (COMS 2280 and MATH 1650); (COMS 2300 or CPRE 2810); ENGL 2500.

Introduction to computer architecture and organization. Emphasis on evaluation of performance, instruction set architecture, datapath and control, memory-hierarchy design, and pipelining. Assembly language programming.

[CONE 3800: Engineering Law](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior Classification.

Introduction to law and judicial procedure as they relate to the practicing engineer. Contracts, professional liability, professional ethics, licensing, bidding procedures, intellectual property, products liability, risk analysis. Emphasis on development of critical thinking process, abstract problem analysis and evaluation.

[CPRE 3080: Operating Systems: Principles and Practice](#)

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: CPRE 3810 or COMS 3210.

Operating system concepts, processes, threads, synchronization between threads, process and thread scheduling, deadlocks, memory management, file systems, I/O systems, security, Linux-based lab experiments.

[CPRE 3100: Theoretical Foundations of Computer Engineering](#)

Credits: 3. Contact Hours: Lecture 2, Discussion 1.

Prereq: COMS 2280.

Propositional logic and methods of proof; basic discrete structures; mathematical induction and recurrence relations; functions and relations; and counting; trees and graphs; applications in computer engineering.

[CPRE 3250: Machine Learning for Electrical Computer and Cybersecurity Engineering](#)

(Cross-listed with EE 3250 and CYBE 3250).

Credits: 4. Contact Hours: Laboratory 3, Lecture 3.

Prereq: MATH 2070 and COMS 2270 or EE 2850.

Introduction to and use of machine learning (ML) as applied in the fields of Electrical, Computer, and Cybersecurity Engineering. Use of ML in the fields. Types and construction of ML models as applied in fields. Role and use of datasets. Basic testing of ML models. Professional and ethical issues related to use in field.

[CPRE 3390: Software Architecture and Design](#)

(Cross-listed with SE 3390).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SE 3190.

Modeling and design of software at the architectural level. Architectural styles. Basics of model-driven architecture. Object-oriented design and analysis. Iterative development and unified process. Design patterns. Design by contract. Component based design. Product families. Measurement theory and appropriate use of metrics in design. Designing for qualities such as performance, safety, security, reliability, reusability, etc. Analysis and evaluation of software architectures. Introduction to architecture definition languages. Basics of software evolution, reengineering, and reverse engineering. Case studies. Introduction to distributed system software.

CYBE 3310: Application of Cryptographic Concepts to Cyber Security

(Cross-listed with CPRE 3310).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: CPRE 2310 or CYBE 2310.

Basic cryptographic underpinnings used in modern cyber security encryption suites. Encryption benefits to cyber security and its use in protocols. Topics include cryptographically secure hash functions and pseudorandom numbers, key distribution techniques, secure authentication including single sign on. Detection and prevention of security threats such as covert communication, malicious code, and other security threats in protocols are included. In addition to laboratory experiments and exercises, students complete a project focused on cyber security problem and solution. Graduation Restriction: Only one of CPRE/CYBE 3310 and CPRE 4310 may count towards graduation.

DS 3010: Applied Data Modeling and Predictive Analysis

Credits: 3. Contact Hours: Lecture 3.

Prereq: DS 2020 and STAT 1010, STAT 1040, STAT

1050, STAT 2010, STAT 2260, STAT 2310, STAT 3050, STAT 3220 or STAT 3300.

Elements of predictive analysis such as training and test sets; feature extraction; survey of algorithmic machine learning techniques, e.g. decision trees, Naive Bayes, and random forests; survey of data modeling techniques, e.g. linear model and regression analysis; assessment and diagnostics: overfitting, error rates, residual analysis, model assumptions checking; communicating findings to stakeholders in written, oral, verbal and electronic form, and ethical issues in data science. Participation in a multi-disciplinary team project.

DS 3030: Concepts and Applications of Machine Learning

Credits: 3. Contact Hours: Lecture 3.

Prereq: DS 20210, DS 2020, MATH 2070, MATH 2650, STAT 3201.

Machine learning concepts such as training and test sets; feature extraction; principles of machine learning techniques; regression; pattern recognition methods; unsupervised learning techniques; assessment and diagnostics: overfitting, error rates, residual analysis, model assumptions checking, feature selection; ethical issues in data science; communicating findings to stakeholders in written, oral, visual and electronic form.

ECON 3010: Intermediate Microeconomics

Credits: 3-4. Contact Hours: Discussion 1, Lecture 3.

Prereq: ECON 1010 and ECON 2070 or MATH 1660.

Theory of consumer and business behavior; optimal consumption choices and demand; theory of firm behavior; costs, production, and supply; competitive and imperfectly competitive markets; theory of demand for and supply of factors of production; general equilibrium analysis. Fall and spring require recitation and are 4 credits; summer is 3.0 credits.

ECON 3340: Entrepreneurship in Agriculture

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010.

Introduction to the process of entrepreneurship within the agricultural and food sectors. Emphasis on opportunity recognition and creation of concept for new startup ventures. Students will develop a business plan for a startup business or non-profit organization.

[ECON 3530: Money, Banking, and Financial Institutions](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1020.

Theoretical and applied analysis of money, banking, and financial markets; interest rates and portfolio choice; the banking industry in transition; the money supply process; the Federal Reserve System and the conduct of monetary policy; macro implications of monetary policy; international finance.

[ECON 4310: Managerial Economics](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 3010.

Theory of the firm; organizational incentives and efficiency; moral hazard; role of information and decision making under uncertainty; ownership and control; business investment.

[EE 3030: Energy Systems and Power Electronics](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2670; PHYS 2320 or PHYS 2320H; credit or concurrent enrollment in EE 2300.

Structure of competitive electric energy systems. System operation and economic optimization. Mutual inductance, transformers. Synchronous generators. Balanced three-phase circuit analysis and power calculations. Network calculations and associated numerical algorithms. Two-port circuits. Voltage regulation. Resonance and power factor correction. DC and induction motors. Power electronic circuit applications to power supplies and motor drives.

[EE 3110: Electromagnetic Fields and Waves](#)

Credits: 4. Contact Hours: Lecture 4.

Prereq: EE 2010, MATH 2650, PHYS 2320, and Credit or concurrent enrollment in MATH 2670.

Fundamentals and applications of electric and magnetic fields and materials. Electrostatics and magnetostatics, potentials, capacitance and inductance, energy, force, torque. Uniform plane electromagnetic waves, Poynting vector. Transmission lines: transient and sinusoidal steady-state conditions, reflection coefficient.

[EE 4140: Microwave Engineering](#)

(Dual-listed with EE 5140).

Credits: 4. Contact Hours: Lecture 3, Laboratory 2.

Prereq: EE 2300, EE 3110.

Principles, analyses, and instrumentation used in the microwave portion of the electromagnetic spectrum. Wave theory in relation to circuit parameters. S parameters, couplers, discontinuities, and microwave device equivalent circuits. RF amplifier design, microwave sources, optimum noise figure and maximum power designs. Microwave filters and oscillators.

[EE 4280: Image Analysis using Machine Learning](#)

Credits: 3. Contact Hours: Laboratory 2, Lecture 2.

Visual recognition tasks such as image classification, localization and detection are core to applications in image understanding. Developments in neural network (aka 'deep learning') approaches have advanced the performance of these state-of-the-art visual recognition systems. Explore deep learning architectures with a focus on learning end-to-end models for tasks such as image classification. Implement, train and debug neural networks and gain a detailed understanding of research in computer vision. Image recognition problem set-up, the learning algorithms (e.g. backpropagation), practical engineering tricks for training and fine-tuning the networks. Final course project.

[EM 3270: Mechanics of Materials Laboratory](#)

Credits: 1. Contact Hours: Laboratory 2.

Prereq: EM 3240.

Experimental determination of mechanical properties of selected engineering materials. Experimental verification of assumptions made in 3240. Use of strain measuring devices. Preparation of reports.

[EM 3620: Principles of Nondestructive Testing](#)

(Cross-listed with MATE 3620).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 1320 OR PHYS 2320 or PHYS 2320H.

Radiography, ultrasonic testing, magnetic particle inspection, eddy current testing, dye penetrant inspection, and other techniques. Physical bases of nondestructive tests, materials to which applicable, effects of material condition, types of defects detectable, calibration standards, and reliability safety precautions.

[EM 4170: Experimental Mechanics](#)

(Dual-listed with EM 5140 and AERE 5170. Cross-listed with AERE 4170).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: EM 3240 and MATE 2730.

Introduction to fundamental concepts for force, displacement, stress and strain measurements for structures and materials applications. Strain gage theory and application. Full field deformation measurements with laser interferometry and digital image processing. Advanced experimental concepts at the micro- and nano-scale regimes. Selected laboratory experiments. Offered even-numbered years.

[ENGL 5200: Computational Analysis of English](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: English Graduate Students or Permission of Instructor.

Examination of the roles of the literary work, reader, and teacher in literary study. Responses to literature. Place of literature in language arts. Study and development of curriculum materials for middle school, high school, and college levels of instruction.

[ENGR 4300: Entrepreneurial Product Engineering](#)

(Cross-listed with IE 4300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior classification.

Process of innovative product development in both entrepreneurial and intra-preneurial settings. Define, prototype and validate a product concept based on competitive bench-marking, market positioning and customer requirement evaluation in a target market into a product design that is consistent with defined business goals and strategies. Combination of lecture, discussion, problem solving and case study review.

[ENTSP 3130: Feasibility Analysis for New Ventures](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENTSP 3100.

Focuses on the knowledge and practical skills required for developing an idea for a new business venture, researching potential markets, analyzing competition, conducting formal feasibility analyses, and considering business plan implications. Includes discussion of basic business functions in terms of their application to conducting feasibility analyses and to exploiting related business opportunities.

ENSCI 3700: GIS for Ecology and Environmental Science

(Cross-listed with BIOL 3700).

Credits: 1-6.

Prereq: 6 credits in BIOL or ENSCI.

Introduction to geographic information systems (GIS) with emphasis on ecological and environmental applications. No prior GIS experience required. Guided, individualized study of topics based on student background and interest. For students with prior experience, topics and activities are selected to build upon any previous experience and minimize duplication to previous GIS coursework. Potential topics include: basic concepts of GIS, data structures, database management, spatial analysis, modeling and visualization of ecological and environmental data. Case studies in ecological and environmental applications using ArcGIS. Offered on a satisfactory-fail basis only.

ENSCI 4040: Global Change

(Dual-listed with MTEOR 5040/ AGRON 5040/ ENSCI 5040). (Cross-listed with AGRON 4040/ MTEOR 4040/ ENVS 4040/ CLSCI 4040).

Credits: 3. Contact Hours: Lecture 3.

Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change.

ENVS 3450: Population and Society

(Cross-listed with SOC 3450).

Credits: 3. Contact Hours: Lecture 3.

History of present and future of human populations. How human population growth and structure impacts our world, influencing food and the environment, causes of death, fertility rates, and international migration. Compare the U.S. with other societies worldwide. Understand population policies and their impacts on climate, social and economic inequalities, and human well-being. Gain hands-on experience practicing demographic techniques and applying demographic data to real-world population problems. Meets International Perspectives Requirement.

FIN 3010: Principles of Finance

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010, ACCT 2840.

Introduction to financial management with emphasis on corporate financing and investment decision making, time value of money, asset valuation, capital budgeting decision methods, cash budgeting, and financial markets.

FIN 3200: Investments

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3010 or MATH 2400 and STAT 2260 and credit or enrollment in MATH 1510 or MATH 1600 or MATH 1650.

Introduction to securities and markets from the viewpoint of the individual investor. Emphasis on mechanics of trading, measurement of return and risk, behavior of security prices, valuation of stocks and bonds, mutual funds, portfolio selection techniques, and performance evaluation.

[FIN 4310: New Venture Financing](#)

(Cross-listed with ENTSP 4310).

Credits: 3. Contact Hours: Lecture 3.

Prereq: FIN 3010.

Real-world methods of financing startups from pre-seed through IPO. Covers the full investment cycle and includes financing methods, angel investors, venture capital investors, fund structures, term sheets, liquidation preferences, preferred stock, capitalization tables, dilution, and exit value calculations. Involves a main project to model and finance a company through the IPO level.

[FSHN 3110: Food Chemistry](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 2310 or CHEM 3310.

The structure, properties, and chemistry of food constituents and animal and plant commodities. Credit or enrollment in BBMB course 3000 or higher recommended.

[FSHN 3730: Science and Practice of Brewing](#)

(Cross-listed with ME 3730).

Credits: 3. Contact Hours: Lecture 1.5, Laboratory 1.5.

Prereq: 21 years of age and one course from this list: BIOL 2110, BIOL 2120, CHEM 1670, CHEM 1770, PHYS 2310, PHYS 2320.

Introduction to brewing science and technology. Understanding the role of malts, hops, water, and yeast in production of ale and lager beers. Unit operations in brewing. Health, safety, and environmental sustainability in alcohol production and consumption. Weekly laboratory in practical aspects of beer production.

[GEOL 3570: Geological Mapping and Field Methods](#)

Credits: 1. Contact Hours: Laboratory 3.

Prereq: GEOL 1000 or GEOL 2010 or equivalent experience.

Generation and interpretation of geological maps via a combination of laboratory and field exercises. Developing skills in 3D thinking, cross-section construction, stereonet analysis, field data collection, and communicating scientific results.

[GEOL 4790: Surficial Processes](#)

(Dual-listed with GEOL 5790 and ENSCI 5790. Cross-listed with ENSCI 4790).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

The study of physical processes that shape Earth's surface. Topics include weathering, sediment transport, and landform genesis with emphasis on fluvial, glacial, hillslope, eolian, and coastal processes. Applications to engineering and environmental problems. Laboratory includes topographic map interpretation and local field trips. An introductory course in geology is recommended as background.

[HCI 5200: Computational Analysis of English](#)

(Cross-listed with ENGL 5200/ LING 5200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Graduate Standing or Permission of Instructor.

Concepts and practices for analysis of English by computer with emphasis on the applications of computational analysis to problems in applied linguistics such as corpus analysis and recognition of learner language in computer-assisted learning and language assessment.

[HCI 5840: Python Application Development in HCI](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: Department Permission for Course.

Implement Python code and write design documents ("specs") and complement their code with sufficiently detailed documentation in development of a large Python project of the student's choosing. Typical development process: idea, specification, prototyping and implementation (including debugging, testing, refactoring) and documentation and result in a demo-able final product. Fulfills the implementation requirement of the HCI program.

[HORT 3510: Turfgrass Establishment and Management](#)

(Cross-listed with AGRON 3510).

Prereq: HORT 2210 or AGRON 1810 or BIOL 2110.

Principles and practices of turfgrass propagation, establishment, and management. Specialized practices relative to professional lawn care, golf courses, athletic fields, highway roadsides, and seed and sod production. The biology and control of turfgrass pests.

[HORT 4530: Sports Turf Management](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 3510.

Management techniques for today's specialized athletic fields. The horticultural and budgetary aspects of football, soccer, baseball, and softball fields will be presented. Field trips and laboratory exercises will develop a practical understanding of actual principles in field development, construction, and management. Offered even-numbered years.

[IE 3050: Engineering Economic Analysis](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1660.

Economic analysis of engineering decisions under uncertainty. Financial engineering basics including time value of money, cash flow estimation, and asset evaluation. Make versus buy decisions. Comparison of project alternatives accounting for taxation, depreciation, inflation, and risk.

[IE 4300: Entrepreneurial Product Engineering](#)

(Cross-listed with ENGR 4300).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Junior Classification.

Process of innovative product development in both entrepreneurial and intra-preneurial settings. Define, prototype and validate a product concept based on competitive bench-marking, market positioning and customer requirement evaluation in a target market into a product design that is consistent with defined business goals and strategies. Combination of lecture, discussion, problem solving and case study review.

[IE 4410: Industrial Engineering Design](#)

Credits: 3. Contact Hours: Lecture 1, Laboratory 6.

Prereq: IE 2480, IE 2710, IE 3610; (credit or enrollment in IE 3410, IE 4130, AND IE 4480)

A large, open-ended design project conducted for a real-world business. Application of engineering design principles including problem definition, analysis, synthesis, and evaluation.

IE 4500: Technical Sales for Engineers

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in IE 3050.

Technical sales process methodology, tools and techniques. Customer relationship management (CRM) sales automation applications, prospecting and lead qualification, market analysis and industry segmentation. Responding to prospective requests for quotation and proposal (RFQs and RFPs) in written and verbal form. Technical needs analysis, business value proposition development, proposal creation and competitive positioning. Evaluating organizational decision-making processes and people, being a trusted advisor, and practicing sales closing strategies.

INDD 3200: Design Research Methods

Credits: 3. Contact Hours: Lecture 3.

Qualitative and quantitative research methods with an emphasis on contextual user-centered research. Integration of user data collection, statistical visualization, and synthesis methods to inform data-based design solutions.

INDD 5300: Design Thinking

Credits: 3. Contact Hours: Lecture 3.

Prereq: Senior or Graduate Classification or Permission of Instructor.

Exploration of design thinking process, toolkits, and mindsets as creative problem solving approaches for systems, products, and processes, across diverse contexts. Strategies for problem-framing, creative solutions and co-evolution process, with a focus on collaborative and interdisciplinary design to investigate real-world problems and opportunities.

KIN 3550: Biomechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 1150 or PHYS 1310; Junior Classification or Above.

Mechanical basis of human performance; application of mechanical principles to exercise, sport and other physical activities.

KIN 3720: Motor Control and Learning Across the Lifespan

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2550, BBIOL 2560, PSYCH 1010 or PSYCH 2300, Junior Classification or above.

Introduction to major concepts of neuromotor control, behavioral motor control and motor learning in the child, adult and older adult, with emphasis on the adult system.

MATE 3620: Principles of Nondestructive Testing

(Cross-listed with EM 3620).

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 1320 OR PHYS 2320 or PHYS 2320H.

Radiography, ultrasonic testing, magnetic particle inspection, eddy current testing, dye penetrant inspection, and other techniques. Physical bases of nondestructive tests, materials to which applicable, effects of material condition, types of defects detectable, calibration standards, and reliability safety precautions.

MATE 4130: Materials Design and Professional Practice I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Senior Classification or above.

Fundamentals of engineering team behavior and professional preparation; Materials selection and design. Analysis of design problems, development of solutions, selected case studies. Oral presentation skills. Preparations for continued project in MATE 4140. MATE 4130-4140 sequence is intended for students in their final two semesters before graduation.

MGMT 3200: Corporate Entrepreneurship

(Cross-listed with ENTSP 3200).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore Classification.

Introduces entrepreneurial approaches aimed at the identification, development and exploitation of technical and organizational innovations, the management of new product or process developments, and the effective management of new ventures. Focuses on mid-size to large corporations, especially in the manufacturing and service industries. Develops an awareness and understanding of the range, scope, and complexity of issues related to the creation of a corporate environment that is supportive of entrepreneurial endeavors as well as the effective implementation of technological and organizational innovations in corporate settings.

MGMT 3700: Managing Organizations

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore Classification.

Introduction to management as a field and function within organizations. Provides an overview of what managers do in organizations, including how they deal with multiple stakeholders; make decisions about organizational goals, strategies, and structures that align with the external and internal environment; as well as how they lead and manage human resources effectively.

MGMT 3720: Ethical and Responsible Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore Classification.

Introduces the many aspects of ethical and responsible management in today's organization, including the ethical implications of business decision-making (and the implications of having multiple stakeholders); corporate social responsibility; ethical leadership and other leadership styles as they pertain to responsible management; and the role of corporate governance and ethical codes in developing and institutionalizing an ethical organization. Builds ethical decision-making strategies and awareness of one's own ethical leadership philosophy.

MGMT 3810: Managing Family Businesses

(Cross-listed with ENTSP 3810).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore Classification.

Introduction to the important role family businesses play in the domestic and global economies as well as the complex and unique challenges and opportunities encountered by such businesses and their family members and other employees. Explores best practices for successfully managing family businesses.

MIS 3010: Management Information Systems

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 1130.

The role of information technology in organizations. Overview of methodologies for design and development of systems including decision support systems, expert systems, data bases, end-user computing, etc. Computer applications relate concepts to practice. Lecture and laboratory work emphasizes the enabling role of IT in contemporary organizations.

MKT 3400: Principles of Marketing

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in ECON 1010.

The role of marketing in society. Markets, marketing institutions, and marketing functions with emphases on product, price, marketing communication, and marketing channel decisions.

MKT 3420: Foundation Of Personal Selling

Credits: 3. Contact Hours: Lecture 3.

Prereq: Sophomore Classification.

The process of selling and how to sell effectively. Focus on selling in a business environment and applying to concepts to general interpersonal settings in personal life. Students will actively participate in class, collaborate with teammates to develop skills to sell ideas and become more effective in representing themselves and their company and its products and services. Develop skills necessary to build long-term, profitable relationships with clients.

MKT 4950: Live Cases in Marketing

Credits: 3. Contact Hours: Lecture 3.

Prereq: MKT 3400.

Teamwork with companies to solve their current marketing challenges. Opportunity to gain critical thinking skills, experience with quantitative analysis, client management experience, professional presentation skills, strategies for effective teamwork, practice giving and receiving feedback, and practical marketing experience. Experience will strengthen student resume, make connections with industry, and practice applying marketing concepts in real-world situations. The companies and challenges will be different each semester. Graduation Restriction: Only 3 credits of MKT 4950 may count as a MKT major or minor choice elective.

MATH 2070: Matrices and Linear Algebra

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 1660 or MATH 1660H.

Systems of linear equations, determinants, vector spaces, linear transformations, orthogonality, least-squares methods, eigenvalues and eigenvectors. Emphasis on applications and techniques. Graduation Restriction: Only one of MATH 2070 and MATH 3170 may be counted toward graduation.

MATH 3850: Introduction to Partial Differential Equations

Credits: 3. Contact Hours: Lecture 3.

Prereq: MATH 2650 and one of MATH 2660, MATH 2670.

Method of separation of variables for linear partial differential equations, including heat equation, Poisson equation, and wave equation. Topics from Fourier series, Sturm-Liouville theory, Bessel functions, spherical harmonics, and method of characteristics.

[ME 4170: Advanced Machine Design](#)

(Dual-listed with ME 5170).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 3250, MATE 2730.

Stress life, strain life, and fracture mechanics approaches to fatigue life and design with metals, polymers and ceramics. Introduction to material selection in design of machine components. Thermal and structural considerations in design of machine components and hybrid materials. Course project and relevant literature review required for graduate credit.

[ME 4190: Computer-Aided Design](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: ME 3250.

Theory and applications of computer-aided design. Computer graphics programming, solid modeling, assembly modeling, and finite element modeling. Mechanical simulation, process engineering, rapid prototyping and manufacturing integration.

[ME 4260X: Mechanical Vibration](#)

(Dual-listed with ME 5260X).

Credits: 3. Contact Hours: Lecture 3.

Prereq: EM 3240 and ME 3450 and (MATH 2660 or MATH 2670).

Elementary vibration analysis; single and multiple degree of freedom systems, energy methods; response to common transient, harmonic and random excitation sources; numerical methods of solution; eigenvalues and modal analysis; introduction to testing methods, data sampling and signal processing; vibration isolation, absorption and coupling minimization.

[ME 4410: Fundamentals of Heating, Ventilating, and Air Conditioning](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3320.

Space conditioning and moist air processes. Application of thermodynamics, heat transfer, and fluid flow principles to the analysis of heating, ventilating, and air conditioning components and systems. Performance and specification of components and systems.

[MICRO 3020: Biology of Microorganisms](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in BIOL 2110 or BIOL 2120; 3 credits of CHEM

Basic cell biology, physiology, metabolism, genetics and ecology of microorganisms, with an emphasis on prokaryotes and viruses, as well as the roles of microorganisms in the environment, disease, agriculture, and industry.

[MICRO 3600: Global Health](#)

(Cross-listed with GLBOE 3600 and VMPM 3600).

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110.

Explores human health across the world with particular emphasis on low- and lower-middle-income countries. Attention is given to the interconnectedness of health determinants, problems, and solutions found in global health, including the role of animals and the environment. Broad in scope, highlighting different cultures and the historical foundations of global health. Topics include colonialism, poverty, emerging diseases, climate change, biodiversity, one health, maternal and child health, HIV, malaria, urbanization, noncommunicable diseases and more. Current events will be a feature of all class meetings. Meets International Perspectives Requirement.

[MTEOR 3010: General Meteorology](#)

Credits: 4. Contact Hours: Lecture 4.

Prereq: MATH 1660, credit or enrollment in PHYS 2320.

Global distribution of temperature, wind, and atmospheric constituents; atmospheric thermodynamics, radiative transfer, global energy balance, storms and clouds, introductory dynamics.

[MTEOR 4110: Synoptic Meteorology](#)

(Dual-listed with MTEOR 5110).

Credits: 3. Contact Hours: Lecture 1, Laboratory 4.

Prereq: MTEOR 3110.

Applications of atmospheric physics and dynamics to larger-scale weather systems, emphasizing forecasting of real-time weather situations.

[MUSIC 4460: Sound Synthesis Design for Electronic Music](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: MUSIC 2460 or Permission of Instructor.

Digital sound synthesis structures for creative musical applications. Includes modular sound synthesis techniques, software synthesizer design, and practical projects in electronic music composition.

[NREM 3150: Genetics for Natural Resource Managers](#)

Credits: 3. Contact Hours: Lecture 3.

Prereq: BIOL 2110 and BIOL 2120.

Introduction into how genetic techniques and technologies can aid the management of the earth's biotic resources. Topics include an overview of DNA structure, function and inheritance; tools and techniques for measuring genetic diversity; genetic management of wild and captive populations: DNA forensics as management tool. The goal of this course is to prepare managers/biologists to interpret genetic data as they relate to natural resource conservation.

[NREM 3900: Fire Ecology and Management](#)

Credits: 3. Contact Hours: Lecture 3.

Characteristics and role of fire in forest ecosystems. Major topics covered include fuels, fire weather, fire behavior, fire danger rating systems, fire control, prescribed burning, and fire dynamics in major ecosystem types.

[NS 3200: Naval Ship Systems I \(Engineering\)](#)

Credits: 3. Contact Hours: Lecture 3, Laboratory 3.

Prereq: PHYS 2310, PHYS 2310L, Sophomore Classification.

An introduction to naval engineering with emphasis on the equipment and machinery involved in the conversion of energy for propulsion and other purposes aboard the major ship types of the U.S. fleet. Basic concepts of the theory and design of steam, gas turbine, diesel, and nuclear propulsion. Introduction to ship design, stability, hydrodynamic forces, compartmentalization, electrical and auxiliary systems.

[NS 4100: Naval Operations and Seamanship](#)

Credits: 3. Contact Hours: Lecture 3, Laboratory 3.

Prereq: NS 23000, Senior Classification.

Study of tactical naval operations; employs practical use of maneuvering boards together with shiphandling principles to arrive at tactical shipboard maneuvering solutions. Study also of naval command and control, communications, and the Naval Warfare Doctrine.

PHYS 3210: Introduction to Modern Physics I

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or concurrent enrollment in MATH 2660 or MATH 2670, PHYS 2320 and PHYS 2310L, or PHYS 2420 or PHYS 2420H.

Quantum nature of matter: photons, de Broglie's postulate: wave-like properties of matter; Bohr's model of hydrogen atom; Schrodinger equations in one dimension: energy quantization; detailed solutions for potential steps, barriers and wells; one-electron atoms, spin and magnetic interactions; ground states, optical and x-ray excitations of multi-electron atoms.

PHYS 3620: Intermediate Mechanics

Credits: 3. Contact Hours: Lecture 3.

Prereq: PHYS 3610.

Rigid body motion; small oscillations, normal modes. Special relativity including length contraction, time dilation, simultaneity, Lorentz transformation, 4-vector covariant formalism, relativistic mechanics.

SCM 3010: Supply Chain Management

Credits: 3. Contact Hours: Lecture 3.

Prereq: ECON 1010.

Introduction to a wide range of supply chain management (SCM) terminology, analytical tools, and theories as related to the supply chain operations reference model (SCOR). The SCOR model focuses on planning, sourcing, making, delivering, returning, and integrating key aspects within SCM. Using an analytical approach to solve real world problems, specific topics include: strategic sourcing, supply management, demand forecasting, inventory management, process management, logistics, process integration, and returns.

SCM 3400: Project Management

(Cross-listed with MIS 3400).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Credit or enrollment in MIS 3010.

Equips students to support team activities in the general project management environment and better manage their careers. Practical experience using project management techniques and tools. Course topics include project initiation and execution, risk assessment, estimating and contracts, planning, human factors, and standard methods.

SE 3090: Software Development Practices

(Cross-listed with COMS 3090).

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in COMS 2280, MATH 1650.

Practical introduction to methods for managing software development. Software engineering concepts, practices and tools. Requirements analysis, structured and object-oriented design, coding, testing, and maintenance. Software process models, software tools and environments. Programming projects that provide exposure to information management techniques, client/server model, networking and communication.

SE 3190: Construction of User Interfaces

(Cross-listed with COMS 3190).

Credits: 3. Contact Hours: Lecture 3.

Prereq: COMS 2280.

Overview of user interface design. Evaluation and testing of user interfaces. Review of principles of object orientation, object-oriented design and analysis using UML in the context of user interface design. Design of windows, menus and commands. Developing Web and Windows-based user-interfaces. Event-driven programming. Introduction to Frameworks and APIs for the construction of user interfaces.

SE 3390: Software Architecture and Design

(Cross-listed with CPRE 3390).

Credits: 3. Contact Hours: Lecture 3.

Prereq: SE 3190.

Modeling and design of software at the architectural level. Architectural styles. Basics of model-driven architecture. Object-oriented design and analysis. Iterative development and unified process. Design patterns. Design by contract. Component based design. Product families. Measurement theory and appropriate use of metrics in design. Designing for qualities such as performance, safety, security, reliability, reusability, etc. Analysis and evaluation of software architectures. Introduction to architecture definition languages. Basics of software evolution, reengineering, and reverse engineering. Case studies. Introduction to distributed system software.

SE 3420: Principles of Programming Languages

(Cross-listed with COMS 3420).

Credits: 3. Contact Hours: Lecture 3, Discussion 1.

Prereq: Minimum of C- in COMS 2280 and MATH 1650, COMS 2300 or CPRE 3100.

Study of concepts in programming languages, especially functional programming concepts. Overview of major programming paradigms, their relationship, and tradeoffs among paradigms enabling sound choices of programming language for application-specific development. Programming projects.

STAT 3610: Statistical Quality Assurance

(Cross-listed with IE 3610).

Credits: 3. Contact Hours: Lecture 3.

Prereq: STAT 2310, STAT 3010, STAT 3260, or STAT 5101.

Statistical methods for process improvement. Simple quality assurance principles and tools. Measurement system precision and accuracy assessment. Control charts. Process capability assessment. Experimental design and analysis for process improvement. Significant external project in process improvement.

TSM 3250: Biorenewable Systems

(Cross-listed with ABE 3250).

Credits: 3. Contact Hours: Lecture 3.

Prereq: CHEM 1630 or higher, MATH 1400 or higher.

Converting biorenewable resources into bioenergy and biobased products. Biorenewable concepts as they relate to drivers of change, feedstock production, processes, products, co-products, economics, and transportation/logistics.

TSM 3700: Occupational Safety

Credits: 3. Contact Hours: Lecture 3.

Prereq: TSM 2700; Junior Classification.

Identifies safety and health risks in industrial work environments. Focus on how managers and supervisors meet their responsibilities for providing a safe workplace for their employees. Includes the identification and remediation of workplace hazards.

TSM 4330: Precision Agriculture

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Prereq: Junior Classification.

Geographic information systems (GIS) and global positioning systems (GPS). Hardware systems for precision farming emphasized. Autosteering and automatic implement control systems. Collection and management of yield data. Sampling strategies for precision farming. Introduction to building fertilizer prescriptions and recommendations. Economic benefits of precision farming systems.