College of Engineering

Dean

- Harriet Nembhard

Associate Dean, Academic Programs

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Interim Associate Dean, Graduate Programs and Research

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Undergraduate degree: B.S.E.
Undergraduate certificates: artificial intelligence, modeling and simulation in engineering; naval science and technology; technological entrepreneurship
Graduate degrees: M.S.; Ph.D.
Graduate certificates: artificial intelligence, modeling and simulation in engineering; sustainable water development
Website: https://engineering.uiowa.edu/

Courses

The engineering course requirements for engineering majors are outlined in the respective Catalog sections. Each undergraduate program builds upon a core program; see the Bachelor of Science in Engineering in the Catalog. Not all engineering core courses listed below are required for each engineering major. Core program courses are intended for College of Engineering students. Undergraduate students in other disciplines who wish to register for core engineering courses should contact Engineering Student Services.

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Engineering Courses

ENGR:0000 Engineering Internships and Co-ops 0 s.h.
For engineering students completing a semester-long internship experience while working 35-40 hours a week at a professional company.

ENGR:0001 Engineering Co-op 0 s.h.
Multiple-semester cooperative education experience for students working 35-40 hours a week at a professional company.

ENGR:0002 Engineering Half-Time Internship 0 s.h.
For engineering majors participating in the Cooperative Education and Internship Program and averaging 15-20 hours per week on assignment.

ENGR:0004 Engineering Academic Internship arr.
Academic credit for engineering majors participating in the Cooperative Education and Internship Program. Requirements: for international students—F-1 or J-1 visa, engineering undergraduate standing, full-time internship offer letter in hand (at least 40 hours/week and one semester in length), internship approved by International Student and Scholar Services for F-1 Curricular Practical Training (CPT) or J-1 Academic Training (AT), concurrent registration in approved 3 s.h. distance education or evening course, and preapproval of internship by Engineering Career Services; non-international students may be eligible on case-by-case basis.

ENGR:0006 Engineering Global Internship/Co-op 0 s.h.
For engineering majors participating in the Cooperative Education and Internship Program working on a global assignment.

ENGR:1000 Engineering Success for First-Year Students 1 s.h.
Introduction to engineering student life; electronic resources; keys to and skills for success; coping with adversity; selecting a major; advising; curriculum choices and career objectives; ethics; communication; internships and co-ops; job search skills.

ENGR:1029 First-Year Seminar arr.
Introduction to engineering fields of study; work closely with a faculty member or senior administrator; participation that eases the transition to college-level learning; cutting-edge research taking place in the College of Engineering.

ENGR:1100 Introduction to Engineering Problem Solving 3 s.h.
Development and demonstration of specific problem solving skills; directed project or case study involving actual engineering problems and their solutions.

ENGR:1300 Introduction to Engineering Computing 3 s.h.
Engineering problem solving using computers; introduction to digital computations, problem formulation using a procedural high-level language; structured, top-down program design methodology; debugging and testing; introduction to use of software libraries; examples from numerical analysis and contemporary applications in engineering. Corequisites: MATH:1550.

ENGR:1550 FIRST Tech Challenge - Introduction to Engineering Problem Solving 3 s.h.
Introduction to engineering problem solving and design; projects introduce students to common elements of engineering problem solving and design (e.g., application of organizing principles to describe engineered systems, economic analysis upon which to base decisions, technical presentation and analysis of data), and provides an opportunity for students to apply common elements of problem solving in the solution of engineering problems in context of a structured problem solving and design process. Taught in high schools by state certified teachers.

ENGR:2110 Statics 2-3 s.h.
Vector algebra, forces, couples, moments, resultants of force couple systems; friction, equilibrium analysis of particles and finite bodies, centroids; applications. Prerequisites: MATH:1550. Corequisites: MATH:1560 and PHYS:1611.

ENGR:2120 Electrical Circuits 3 s.h.
Kirchhoff's laws and network theorems; analysis of DC circuits; first order transient response; sinusoidal steady-state analysis; elementary principles of circuit design; SPICE analysis of DC, AC, and transient circuits. Corequisites: MATH:2560.

ENGR:2130 Thermodynamics 3 s.h.
Basic elements of classical thermodynamics including first and second laws, properties of pure materials, ideal gas law, reversibility and irreversibility, and Carnot cycle; control volume analysis of closed simple systems and open systems at steady state; engineering applications, including cycles. Prerequisites: PHYS:1611 and CHEM:1110. Corequisites: MATH:1560.

ENGR:2510 Fluid Mechanics 4 s.h.
Fluid properties; hydrostatics; transfer of mass, momentum, and energy in control-volume and differential forms; dimensional analysis and similitude; laminar and turbulent flow in conduits; flow past bluff bodies and airfoils; engineering applications; experimental laboratories, computer simulation projects. Prerequisites: MATH:2560 and ENGR:2710. Corequisites: ENGR:2130.

ENGR:2710 Dynamics 3 s.h.
Vector calculus, Newton's laws, 3D motion of particles and multiparticle systems, 2D motion of rigid bodies applications. Prerequisites: ENGR:2110 and MATH:1550.

ENGR:2720 Materials Science 3 s.h.
Concepts and examples of selection and applications of materials used by engineers; mechanical, electrical, and thermal properties that govern a material's suitability for particular applications; lectures supplemented by laboratory experiments. Prerequisites: CHEM:1110. Corequisites: MATH:1550.

ENGR:2730 Computers in Engineering 2-3 s.h.
Advanced programming; good software engineering techniques including pseudocode and documentation dynamic data structures, recursive programming, procedural and object-oriented computing, inheritance, and standard template library; C++. Prerequisites: ENGR:1300.

ENGR:2750 Mechanics of Deformable Bodies 3 s.h.
Elementary theory of deformable bodies, stress, strain; axial, transverse, bending, torsion, combined and buckling loads; deflection of beam. Prerequisites: ENGR:2110. Corequisites: MATH:2560.

ENGR:2995 Introduction to Artificial Intelligence and Machine Learning in Engineering 3 s.h.
Introduction to artificial intelligence (AI), machine learning, data science, and data driven problem solving across all engineering disciplines; topics include supervised and unsupervised learning, clustering, heuristics, feature selection, ethics of AI—fairness and privacy issues, and performance evaluation; first in a series. Prerequisites: ENGR:1300. Corequisites: MATH:2550. Requirements: practical knowledge of programming, rudimentary understanding of probability concepts, and sophomore standing.

ENGR:4000 Engineering Honors Seminar 1 s.h.
Completion of an approved project under the supervision of a faculty member. Requirements: engineering honors and junior or higher standing.

ENGR:4001 Leadership Seminar: Mediocrity is Not an Option 1 s.h.
Skills needed to gain competitive edge in professional world with understanding that mediocrity is not an option; importance of developing a career plan, power of networking, significance of soft skills, value of mentoring; participation in series of discussions and activities; deeper insight of strengths and weaknesses, how to enhance skills that employers desire, and become effective leaders in workplace; presentation by retired chief operating officer of a leading aerospace company.

ENGR:4003 Women in Science and Engineering Leadership Seminar 1 s.h.
WiSE peer mentors develop practical mentoring and leadership skills while participating in a one-on-one relationship with a first-year UI student in a STEM major; peer mentors meet monthly with mentees, submit meeting reflection/evaluations, and attend three educational or social events hosted by WiSE or another University entity during the semester.

ENGR:4005 Developing Cultural Intelligence for STEM Leadership 1 s.h.
How cultural values impact technological innovation; knowledge and strategies to develop skills for leadership in the global marketplace; activities include the Cultural Intelligence (CQ) assessment and mapping of cultural values and case studies for innovation; students use CQ dimensions to develop a plan to deepen CQ skills; exploration of culturally intelligent collaboration and problem solving in science, technology, engineering, and mathematics (STEM) fields; how to represent these skills in professional settings. Requirements: upper-level undergraduate or graduate standing.

ENGR:4010 Engineering Grand Challenges Program Fellow 0 s.h.
The Engineering Grand Challenges Program is designed to prepare tomorrow's engineering leaders to solve the grand challenges facing society during the next century; through completion of components of the program, students have the opportunity to engage in research relating to their selected grand challenge, explore interdisciplinary coursework, gain an international perspective, engage in entrepreneurship, and give back to the community through service learning; for students who have been accepted as a fellow into the Engineering Grand Challenges Program and are working on completion of the program requirements. Requirements: acceptance to the Engineering Grand Challenges Program.

ENGR:4011 Engineering Grand Challenges Program Scholar 0 s.h.
The Engineering Grand Challenges Program is designed to prepare tomorrow's engineering leaders to solve the grand challenges facing society during the next century; through completion of components of the program, students have the opportunity to engage in research relating to their selected grand challenge, explore interdisciplinary coursework, gain an international perspective, engage in entrepreneurship, and give back to the community through service learning; for students who have been accepted as a scholar to the Engineering Grand Challenges Program and are working on completion of the program requirements. Requirements: acceptance to the Engineering Grand Challenges Program.

ENGR:4012 Engineering Grand Challenges Program Final 0 s.h.
The Engineering Grand Challenges Program is designed to prepare tomorrow's engineering leaders to solve the grand challenges facing society during the next century; through completion of components of the program, students have the opportunity to engage in research relating to their selected grand challenge, explore interdisciplinary coursework, gain an international perspective, engage in entrepreneurship, and give back to the community through service learning; for students who have been accepted to the Engineering Grand Challenges Program and are in the final semester of completing the program requirements. Requirements: acceptance to the Engineering Grand Challenges Program.

ENGR:5270 Finding Truth in a Sea of Big Data (and Social Media) 1 s.h.
How to detect and defuse misinformation from mainstream and social media; recognition of where misinformation occurs, what makes it misinformation, and provide statisticians or fellow scientists with a technical explanation of why a particular claim is nonsense; content is noncommittal of any political orientation since misinformation comes in all shapes and sizes from all corners of political spectrum. Requirements: engineering graduate standing.

ENGR:7270 Engineering Ethics 1 s.h.
Introduction to practical issues associated with being a responsible scientist; topics in responsible conduct of research in engineering and the sciences using case studies, presentations, and discussions with visiting speakers; conforms to mandates set by the Office of the Vice President for Research and the Graduate College to train graduate students and postdoctoral scholars/fellows in responsible conduct of research. Requirements: first-year graduate standing in College of Engineering.

ENGR:7604 Engineering Ethics for Post Docs 0 s.h.
Introduction to practical issues associated with being a responsible scientist; topics in responsible conduct of research in engineering and the sciences using case studies, presentations, and discussions with visiting speakers; conforms to mandates set by the Office of the Vice President for Research and the Graduate College to train graduate students and postdoctoral scholars/fellows in responsible conduct of research. Requirements: new postdoctoral research scholar/fellow in College of Engineering.

Engineering and Information Technology Courses

EIT:5120 Modern Automation and Control 3 s.h.
Study of sensor, motors, control, process automation, and internet of things (IoT).

EIT:5135 Modern Information Systems 3 s.h.
Introduction to enterprise information systems; RESTful service model, cloud service models, data storage models, big data considerations, network basics, security and privacy considerations; blockchain technology and its applications.

EIT:5150 Applied Artificial Intelligence 3 s.h.
Artificial Intelligence (AI), search and logic, data science and analysis, advanced machine learning and deep learning, digital manufacturing and design, signal processing and fault diagnosis, AI robotics and computer vision, and applications in engineering.

EIT:5155 Cyber-Physical Systems 3 s.h.
Introduction to modern "smart" systems providing intelligent monitoring, control, and coordination of societal, environmental, and business infrastructure; layered architecture for, relevant applications of, and projects involving conceptual design of cyber-physical systems.

EIT:5211 Machine Learning and Scientific Computing in Engineering 3 s.h.
Numerical methods in scientific computing; root problems and optimization; linear algebraic equations; eigenvalue problems; numerical differentiation and integration; interpolation and curve fitting; initial value and boundary value problems; machine learning in regression, classification, and clustering problems; Python programming and scikit-learn packages.

EIT:5216 Manufacturing Process and Modeling 3 s.h.
Fundamental science, modeling, and simulation technologies in materials processing; essential knowledge in automation and control of manufacturing systems; material removal processes, forming, microfabrication, and nontraditional material processes; finite element modeling/simulation of material processes; automation and control of manufacturing systems and processes.

EIT:5220 Advanced Control Engineering 3 s.h.
State-space representation of linear systems, equilibrium points, linearization, controllability, observability, stability, state feedback control, linear observer design, and separation principle.

EIT:5224 Mechanical Design and Realization 3 s.h.
Solid modeling, assemblies, drawings, geometric dimensioning and tolerancing, and basic engineering design process; use of analysis tools (e.g., Finite Element Analysis), fatigue and durability, optimization software.

EIT:5240 Kinematics of Modern Robotics 3 s.h.
Robotics motion, configuration space, and path planning.

EIT:5298 Mechanical Component Durability and Integrity Analysis 3 s.h.
System and component design, stress analysis, static failure, fatigue, fracture mechanics, vibration, materials science, and product life cycle.

EIT:5351 Cybersecurity 3 s.h.
Taxonomy of security threats and attacks; chain-of-trust principle; authentication, access control, and security domains; perimeter security and defense in depth; cryptographic protocols; key management and distribution; security assessment, internet of things (IoT) security and privacy issues.

EIT:5352 Modern Database Systems 3 s.h.
Introduction to contemporary database architectures: relational, key-value, document store, and graph-based; relative strengths and weaknesses of database architectures; enterprise scalability issues; data aggregation and visualization; project work involving use of modern database systems (e.g., MySQL, Redis, MongoDB, Neo4j).

EIT:5353 Big Data and Machine Learning 3 s.h.
Storage, management, and analysis of very large data sets; distributed file systems and object stores; MapReduce framework for processing large data sets; machine learning techniques; classification and clustering; pattern recognition; projects involving big data and machine learning frameworks (e.g., Apache Hadoop).

EIT:5380 Software Engineering Methods, Tools, and Frameworks 3 s.h.
Modern agile software development practices for cloud and web-based applications using state-of-the-art software engineering languages, tools, and technologies; software as a service (SaaS) architecture; software testing; introduction to enterprise application development frameworks; team-based project.

EIT:5381 Enterprise Software Engineering 3 s.h.
Modern DevOps practices and toolchains for enterprise information systems; scalable architecture; cloud services (e.g., SaaS, PaaS, LaaS); load balancing/autoscaling; identity management and security; performance monitoring and tuning; continuous integration and hot deployment.

EIT:5382 Human-Computer Interaction Design and User Experience 3 s.h.

Principles and guidelines for design and evaluation of human-computer interactions (HCI); design methodologies (e.g., participatory design, low- and high-fidelity prototyping); user interface technologies (e.g., input and output devices, interaction styles); quantitative and qualitative evaluation of user interfaces (e.g., expert reviews, usability testing).