



To complete the online program in two years, students typically take two courses per semester, each lasting 14 weeks. There are seven required core classes, and students may choose two of the four technical electives.

The curriculum is organized as follows:

CORE CLASSES

EMAE 450: Advanced Engineering Analysis

This course aims to equip students with tools for solving mathematical problems commonly encountered in mechanical engineering. The goals are to enable the student to properly categorize the problem in a variety of ways, to identify appropriate approaches to solving the problem and to choose effective numerical solution methods. The course covers analytical and computational approaches to linear and nonlinear problems in both discrete and continuous systems. Computational approaches include direct methods, such as finite difference methods and approximation methods based on a variational approach, such as finite elements. The course is built around specific examples from solid mechanics, dynamics, vibrations, heat transfer and fluid mechanics, represented by initial value problems, eigenvalue problems and boundary value problems.

EMAE 456: Micro-Electro-Mechanical Systems and Biomanufacturing

Microscale technologies have enabled advanced capabilities for researchers in unexplored territories of cells in biology and medicine. Biological (or Biomedical) Micro-Electro-Mechanical Systems (BioMEMS) involve the fundamentals of mechanics, electronics and advanced microfabrication technologies with specific emphasis on biological applications. BioMEMS is an interdisciplinary research area which brings together multiple disciplines, including mechanical engineering, biomedical engineering, chemical engineering, materials science, electrical engineering, clinical sciences, medicine, and biology. BioMEMS-based technologies have found real-world applications in tissue engineering, implantable microdevices, proteomics, genomics, molecular biology, and point-of-care platforms. This course aims to: (1) introduce the need for miniaturized systems in biology and medicine and the fundamental design and microfabrication concepts, (2) introduce the basics of microscale manipulation of cells and biological agents employing the fundamentals of microscale behaviors of fluids and mechanical systems, and (3) expose the students to applications of BioMEMS and on-chip technologies in biology and medicine with clinical impact.

EMAE 460: Theory and Design of Fluid Power Machinery

This course focuses on fluid mechanic and thermodynamic aspects of the design of fluid power machinery. Examples and applications of theoretical and design analyses are drawn from axial and radial flow turbomachinery, positive displacement devices and their components.

EMAE 480: Fatigue of Materials

This course addresses the fundamental and applied aspects of fatigue in metals, polymers and ceramics. Topics include behavior of materials in stress and strain cycling, methods of computing cyclic stress and strain, and cumulative fatigue damage under complex loading. The application of linear elastic fracture mechanics to fatigue crack propagation is explored, as are mechanisms of fatigue crack initiation and propagation, and mechanistic and probabilistic approaches to fatigue life prediction. The course also uses case histories to illustrate fatigue failures and identify practical approaches to mitigate fatigue and prolong life.

EMAE 481: Advanced Dynamics

The purpose of this course is to broaden a student's expertise in dynamics beyond the level of a typical undergraduate course. In this course particle, and rigid body kinematics and dynamics will be developed for two- and three-dimensional motion. In addition to reviewing Newtonian mechanics, Lagrange's equations will be introduced and applied to constrained and unconstrained systems. Concepts of virtual work, which are needed for the development of Lagrange's equations, will also be introduced in this course. Newton's and Lagrange's equations will be applied to a range of systems, including mechanisms, gyroscopes and vehicles.



CORE CLASSES (CONT.)

EMAE 487: Vibration Problems in Engineering

The primary goal of this course is to introduce the student to the fundamentals of vibration engineering with the theory, computational aspects and applications of vibrations for typical problems, including the emphasis of computer techniques of analysis. Topics include free and forced-vibration problems in single and multi-degree of freedom damped and undamped linear systems, vibration isolation and absorbers, modal analysis and approximate solutions, introduction to vibration of continuous media, and noise problems.

EMAE 494: Energy Systems

This is a cutting-edge, interdisciplinary, graduate-level course focused at the nexus of advanced energy and innovation. The energy market is dynamic, complex and is a system of sub-systems with multiple paths to market. Key technology developments are influencing progress towards a drastically different energy future. The high cost of capital associated with bringing a new technology to market increases perceived risks. To successfully embed advanced energy technology, you have to be able to effectively navigate the market and reduce the risks associated with adopting a new technology. This course helps close the gap between energy research and the industry by providing students a process for managing innovation, an understanding of the complex and dynamic energy market and hands-on experience building a business through the creation of E-teams who ultimately pitch their business ideas to investors.

TECHNICAL ELECTIVES

(Choose two of so juthe following:)

EPOM 405: Applied Engineering Statistics

This course provides an intensive introduction to fundamental concepts, applications and the practice of contemporary engineering statistics. Each topic is introduced through realistic sample problems to be solved first by using standard spreadsheet programs and then using more sophisticated software packages. Primary attention is given to teaching the fundamental concepts underlying standard analysis methods.

EPOM 407: Engineering Economics and Financial Analysis

In this course, money and profit as measures of "goodness" in engineering design are studied. Methods for economic analysis of capital investments are developed and the financial evaluation of machinery, manufacturing processes, buildings, R&D, personnel development, and other long-lived investments is emphasized. Optimization methods and decision analysis techniques are examined to identify economically attractive alternatives. Basic concepts of cost accounting are also covered.

ECIV 420: Finite Element Analysis

Development and application of finite element methods with emphasis on solid mechanics. Development of truss, beam, shell and solid elements will be considered. Formulation of isoparametric elements. Meshing and modeling techniques discussed using commercial finite element software.

EECS 401: Digital Signal Processing

Characterization of discrete-time signals and systems. Fourier analysis: the Discrete-time Fourier Transform, the Discrete-time Fourier series, the Discrete Fourier Transform and the Fast Fourier Transform. Continuous-time signal sampling and signal reconstruction. Digital filter design: infinite impulse response filters, finite impulse response filters, filter realization and quantization effects. Random signals: discrete correlation sequences and power density spectra, response of linear systems. Recommended preparation: undergraduate signals and systems course or EECS 313.