Department of Mechanical Engineering (MEE)

The Department of Mechanical Engineering offers an upper-division curriculum which leads to a B.S. in mechanical engineering. The curriculum is based on a strong foundation of fundamental courses in the pure sciences and engineering, and professional courses in mechanical engineering. The curriculum also provides a background in the design, development, and applications of both complete systems and a wide variety of individual system components in many different fields.

The program offered by the Department of Mechanical Engineering encompasses many areas, such as solid mechanics, dynamics and controls, fluid mechanics, thermodynamics, heat and mass transfer, energy conversion, manufacturing, and tribology. This background is strengthened and integrated through application in a sequence of broad engineering design and laboratory courses. Computers are used extensively throughout the curriculum, with emphasis on interactive computer design/computer aided manufacturing. The department also has a significant amount of equipment for experimental investigations and has access to the university computer systems, both digital and analog. The Cooperative Education/Internship Program is also available to qualified students.

Department Requirements

Candidates for the Bachelor of Science degree in mechanical engineering must select their general education courses in the humanities and the arts, social sciences, and interdisciplinary studies to satisfy both university and the accreditation agency (Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology) requirements. These requirements are described under "Special General Education Requirements for Electrical, Industrial, and Mechanical Engineering Majors" in the College of Engineering and Engineering Technology section of this catalog. Students must consult with their faculty advisers to determine appropriate courses.

All mechanical engineering students must have their schedule reviewed, approved, and signed by their faculty adviser each semester. Any deviation from an approved course schedule may delay graduation.

Writing Across the Curriculum Courses

The Department of Mechanical Engineering recognizes that competence in technical writing is essential for engineers. To build upon the foundation for writing acquired in ENGL 103, Rhetoric and Composition I, and ENGL 104, Rhetoric and Composition II, or ENGL 105, Rhetoric and Composition, the Department of Mechanical Engineering has selected 300- and 400-level courses which are identified as writing intensive courses in the course description. These courses are MEE 390, MEE 425, MEE 481, MEE 482, and MEE 490. Each of these courses requires a significant technical writing component which will be reviewed by both the course instructor and a technical writing tutor.

Major in Mechanical Engineering (B.S.)

Requirements in Department (64-65)

MEE 210, Engineering Mechanics I (3)
MEE 211, Engineering Mechanics II (3)
MEE 212, Strength of Materials (3)
MEE 220, Mechanism Design (3)
MEE 270, Engineering Graphics (3)
MEE 321, Mechanical Vibrations I (3)
MEE 322, Dynamic Systems and Control I (4),
  OR ELE 380, Control Systems I (4)
MEE 330, Materials Science (4)
MEE 331, Manufacturing Processes (3)
MEE 340, Fluid Mechanics (3)
MEE 350, Engineering Thermodynamics (3)
MEE 352, Heat Transfer (3)
MEE 380, Computational Methods in Engineering Design (3)
MEE 390, Experimental Methods in Mechanical Engineering I (3)
MEE 430, Computer Aided Design and Manufacturing (3)
MEE 470, Design of Machine Elements (3)
MEE 481, Engineering Design Seminar (1)
MEE 482, Senior Mechanical Engineering Design Project (3)
MEE 494, Mechanical Engineering Competency (1)
Two of the following (6-7)
  IENG 431, Reliability Engineering (3)
  IENG 450, Integrated Manufacturing Systems (3)
  IENG 451, Expert Systems in Manufacturing (3)
  MEE 410, Intermediate Strength of Materials (3)
  MEE 422, Design of Robot Manipulators (3)
  MEE 424, Machinery Vibration (3)
  MEE 425, Design of Mobile Robots (3)
  MEE 431, Composite Materials (3)
  MEE 451, Refrigeration and Air Conditioning (3)
  MEE 452, Design of Thermal Systems (3)
  MEE 453, Propulsion (3)
  MEE 490, Experimental Methods in Mechanical Engineering II (3)
  TECH 345, Plastic Molding Processes (4)
  TECH 441, Thermoforming, Fabricating, and Expanding Plastic Polymers (3)
One of the following (3)
  IENG 430T, Quality Control (3)
  MEE 351, Applied Thermodynamics (3)
  MEE 421, Dynamic Systems and Control II (3)
  MEE 423, Mechanical Reliability (3)
  MEE 480, Finite Element Methods (3)

Requirements outside Department (44)

*CHEM 210T, General Chemistry I (3)
*CHEM 212, General Chemistry Laboratory I (1)
CSCI 230, Computer Programming in FORTRAN (4),
  OR CSCI 240, Computer Programming in C (4)
ELE 210, Engineering Circuit Analysis (3)
ELE 215, Electronic Instrumentation (3)
IENG 220, Engineering Economy (3)
*MATH 229, Calculus I (4)
MATH 230, Calculus II (4)
MATH 232, Calculus III (4)
MATH 336, Ordinary Differential Equations (3)
STAT 350, Introduction to Probability and Statistics (3),
  OR IENG 335, Statistics for Engineering (3)
*PHYS 250A, Fundamentals of Physics I (4)

*Available for general education credit.

*PHYS 251A, Fundamentals of Physics II (4)
UEET 101, Introduction to Engineering (1)

Total Hours for a Major in Mechanical Engineering: 108-109

Course List

200. ENERGY AND THE ENVIRONMENT (3). Development and current status of energy sources, technologies, consumption patterns, conservation, and energy policies. Emphasis on environmental effects of various choices made at each step of the energy cycle, and examination of those choices from technological and socioeconomical points of view. PRQ: PHYS 150 or CHEM 110.

210. ENGINEERING MECHANICS I (3). Principles of engineering mechanics; vector algebra, force systems, free-body diagrams, resultants, equilibrium, centroids and centers of gravity; application to trusses, frames, machines, and beams; moments of inertia; friction. PRQ: MATH 229 with grade of C or better; PHYS 250A with grade of C or better. CRQ: MATH 230.

211. ENGINEERING MECHANICS II (3). Kinematics of particles and rigid bodies; kinetics of particles and rigid bodies: force-mass-acceleration, work and energy, impulse and momentum. PRQ: MEE 210 and MATH 230 with grade of C or better.

212. STRENGTH OF MATERIALS (3). Mechanics of deformable bodies with emphasis on principles of stress and strain; shear and bending moments; torsion, buckling; failure criteria and design concepts. PRQ: MEE 210.

220. MECHANISM DESIGN (3). Introduction to kinematics and mechanism; mechanism design philosophy; displacement, velocity, and acceleration analysis; CAM design; gears; introduction to kinematic synthesis. Concepts of design supplemented by computer techniques of analysis. CRQ: UEET 101. PRQ: CSCI 230 and MEE 211, or consent of department.

230. MATERIALS AND MANUFACTURING PROCESSES (3). Structures and properties of materials; testing and heat treatment of engineering materials; casting and forming processes; machining processes; welding and allied processes; processes and techniques related to manufacturing. Not counted for credit toward the major in mechanical engineering. PRQ: CHEM 210T, CHEM 212, MATH 229, and PHYS 250A, or consent of department.

270. ENGINEERING GRAPHICS (3). Graphics in engineering and geometric constructions; orthographic projection and descriptive geometry with auxiliary views and revolution; pictorial presentation; developments; introduction to computer-aided drawing. CRQ: MATH 155 or MATH 229.

321. MECHANICAL VIBRATIONS I (3). Oscillatory motion, free vibration of single degree freedom systems, harmonically excited vibration, vibration under general forcing conditions, two or more degrees of freedom systems, and generalized eigenvalue problems. PRQ: MEE 211 and MATH 336.

322. DYNAMIC SYSTEMS AND CONTROL I (4). Introduction to simple harmonic motion, damping, resonance, and multiple degree of freedom systems. Modeling of mechanical systems and their transfer functions, feedback control, and introduction to Root-locus and Bode design. Lecture, discussion three periods per week; laboratory, problem session two periods per week. PRQ: ELE 315 or MEE 321, or consent of department.

330. MATERIALS SCIENCE (4). Introduction to principles of the mechanical, electronic, magnetic, optical, and thermal behavior of metallic, ceramic, and polymeric materials. Relation between processing, structure, properties, and performance of engineering materials. Principles of corrosion. Introduction to failure analysis. PRQ: CHEM 210T and CHEM 212 with grade of C or better and PHYS 251A with grade of C or better. CRQ: MEE 212 or consent of department.

331. MANUFACTURING PROCESSES (3). Mechanical properties of materials; metallurgical control of mechanical properties; casting and forming processes; machining processes; welding and allied processes; processes and techniques related to manufacturing. PRQ: MEE 330.

340. FLUID MECHANICS (3). Introduction and fundamentals of fluid statics, integral form and control volume analysis, differential analysis and potential flow, incompressible viscous internal and external flow, and compressible flow. PRQ: MEE 211 and MATH 336.

350. ENGINEERING THERMODYNAMICS (3). Principles of thermal energy conversion; properties of pure substance; work and heat; first law of thermodynamics, control volume, steady state and steady flow process, uniform state and uniform flow process; second law of thermodynamics, entropy, availability; power and refrigeration cycles. PRQ: MEE 211 and MATH 336.

351. APPLIED THERMODYNAMICS (3). Thermodynamic cycles and processes; generalized thermodynamic relationships; mixtures and solutions; chemical reaction; phase and chemical equilibrium; nozzles, diffusers, and flowmeters. PRQ: MEE 350.

352. HEAT TRANSFER (3). Basic laws of heat transfer; steady state heat conduction, heat generation, and extended surfaces; unsteady and multidimensional conduction; analytical, graphical, and numerical solutions; external and internal forced convection; boundary layer theory; free convection, similarity and integral solutions; radiation properties and exchange between black and nonblack surfaces; numerical solutions techniques. PRQ: MEE 340 and MEE 350. CRQ: MEE 380.

380. COMPUTATIONAL METHODS IN ENGINEERING DESIGN (3). Number representation, root finding, differentiation and integration, a system of linear equations and matrices, eigenvalues and eigenvectors, interpolation and extrapolation, least-squares methods and splines, linear programming. PRQ: CSCI 230 and MATH 336.

390. EXPERIMENTAL METHODS IN MECHANICAL ENGINEERING I (3). Basic concepts of measurement methods and planning and documenting experiments. Typical sensors, transducers, and measurement system behavior. Data sampling and computerized data acquisition systems. Statistical methods and uncertainty analysis applied to data reduction. Laboratory experiments with measurement of selected material properties and solid-mechanical and fluid/thermal quantities. A writing-intensive course. CRQ: ELE 215, MEE 212, MEE 340, MEE 350, and STAT 350 or IENG 335.

410. INTERMEDIATE MECHANICS OF MATERIALS (3). Buckling, unsymmetric bending, transverse loading, curved beams, thick-walled cylinders and rotating disks, torsion of thin-walled tubes, contact stresses, plastic behavior, strain energy and Castigliano's theorem, strength theories and design equations, fatigue, and fracture. PRQ: MEE 212, MATH 336, and CSCI 230.

421. DYNAMIC SYSTEMS AND CONTROL II (3). Concepts of linear system theory; modal analysis, Lagrange's Equations, approximate numerical methods for solving vibration problems. Root-locus and frequency response design. State-space analysis. Case studies in control system design. PRQ: MEE 322 or ELE 380, or consent of department.

422. DESIGN OF ROBOT MANIPULATORS (3). Mathematics, programming, and control in the design of robot manipulators. Includes topics on kinematics, differential relationships and dynamics, motion trajectories, and control algorithms. PRQ: MEE 211 and MATH 336, or consent of department.

423. MECHANICAL RELIABILITY (3). Basic probability, statistics, and reliability concepts applicable to mechanical systems. Probabilistic treatment of loads, stress, strength, safety indices, and fatigue. Mechanical equipment reliability; wear-out; reliability-based design, testing, and maintenance. PRQ: MEE 212. CRQ: MEE 470 or consent of department.

424. MACHINERY VIBRATION (3). Machinery vibration analysis: signature analysis in time and frequency domains, fault detection, diagnosis, and correction; instrumentation; case studies; machine monitoring programs. PRQ: MEE 322. CRQ: MEE 470.

425. DESIGN OF MOBILE ROBOTS (3). Configuration and architecture design. Position estimation, planning, and control. Perception and learning. Group capstone project in the design and development of a mobile robot. Lecture, discussion, case studies of mobile robot design. A writing-intensive course. PRQ: MEE 211 or TECH 375, or consent of department.

426. MECHATRONICS SYSTEM DESIGN (3). Use of computers embedded in mechanical systems, microcontrollers, real-time software, analog and digital world, sensors and actuators interfacing, electronics for mechatronics, measures of system performance, state transition logic and multitasking, mechatronics system design problems, advanced concepts and case studies of mechanical systems with embedded electronics. PRQ: CSCI 230 or CSCI 240, ELE 215, and ELE 380 or MEE 322, or consent of department.

430. COMPUTER-AIDED DESIGN AND MANUFACTURING (3). Computers for CAD/CAM; computer-aided design; numerical control, origin of CAM; industrial robots; group technology and process planning; computer control; computer-integrated manufacturing. PRQ: MEE 230 or CRQ: MEE 331.

431. COMPOSITE MATERIALS (3). Macromechanical behavior of a lamina; micromechanical behavior of a lamina; macromechanical behavior of a laminate; bending, buckling, and vibration of laminated plates. PRQ: MEE 212, MEE 330, and MEE 380, or consent of department.

451. REFRIGERATION AND AIR CONDITIONING (3). Refrigerants; vapor compression and absorption refrigeration systems; cryogenics; psychrometrics and humidity measurements; extended surface coils and transfer processes between moist air and water; solar radiation and heating and cooling loads of buildings and structures. PRQ: MEE 350 and MEE 352.

452. DESIGN OF THERMAL SYSTEMS (3). Application of principles of fluid mechanics, heat transfer, and thermodynamics in the component design of thermal systems. Examples are drawn from power generations, environmental control, and industrial processes. Students work on group projects for integration of these components in the design of thermal systems. PRQ: MEE 350 and MEE 352.

453. PROPULSION (3). Aerodynamics and thermodynamics of gas turbine airbreathing and rocket engines; quasi-one-dimensional flow; ideal and real cycle analysis; component performance; engine operating off-design characteristics. PRQ: MEE 340 and MEE 350.

470. DESIGN OF MACHINE ELEMENTS (3). Fatigue analysis; design of screws, fasteners, and connections; design of welded, brazed, and bonded joints; mechanical springs; bearings; gears; shafts; design of clutches, brakes, couplings, and flywheels; flexible mechanical elements. PRQ: MEE 212 and MEE 220. CRQ: MEE 331 or consent of department.

480. FINITE ELEMENT METHODS (3). Concepts of finite element methods, variational formulation and approximation; linear and quadrilateral elements; finite element formulation; error analysis; isoparametric elements; computer implementation; applications from solid mechanics, dynamics, heat transfer, and fluid mechanics. PRQ: MEE 322, MEE 352, and MEE 380, or consent of department.

481. ENGINEERING DESIGN SEMINAR (1). Complete preparation of an engineering system design or project proposal covering problem identification, conceptual design, and the schedule of work required to carry out the project. (Projects are carried out in MEE 482). Concurrent seminar of methodology, standards and safety codes, professional ethics, decision making, and design evaluations. A writing-intensive course. CRQ: MEE 350 and MEE 470.

482. SENIOR MECHANICAL ENGINEERING DESIGN PROJECT (3). Special design project under individual supervision of the instructor. A writing-intensive course. PRQ: MEE 481.

490. EXPERIMENTAL METHODS IN MECHANICAL ENGINEERING II (3). Experimental design; statistical analysis of data; computerized data acquisition and reduction; experiments on signature analysis, fluid flow, heat transfer, material properties, and vibrations; individual experimental design projects. A writing-intensive course. PRQ: MEE 390 or consent of department.

494. MECHANICAL ENGINEERING COMPETENCY (1). Review of fundamental concepts and problem solving in mathematics, physics, chemistry, electrical circuits, statics, dynamics, strength of materials, material science, fluid mechanics, thermodynamics, heat transfer, control, and computer programming. Grades based on performance on a national standardized examination. PRQ: Senior status.

497. INDEPENDENT STUDY (1-3). Independent pursuit of problems in mechanical engineering under faculty supervision. Written report required. May be repeated to a maximum of 3 semester hours. PRQ: Consent of department.

498. SPECIAL TOPICS (1-3). Topics not included in regular courses. May be repeated to a maximum of 3 semester hours. PRQ: Consent of department.

Mechanical Engineering Faculty

Shin-Min Song, Ohio State University, professor, chair
Behrooz Fallahi, Ph.D., P.E., Purdue University, associate professor
Sengoda G. Ganesan, Ph.D., P.E., Oklahoma State University, associate professor
Abhijit Gupta, Ph.D., P.E., Pennsylvania State University, associate professor
Romualdas Kasuba, Ph.D., P.E., University of Illinois, professor
Meung Jung Kim, Ph.D., Virginia Polytechnic Institute and State University, associate professor
Milivoje Kostic, Ph.D., P.E., University of Illinois, Chicago, associate professor
Pradip Majumdar, Ph.D., Illinois Institute of Technology, associate professor
Parviz Payvar, Ph.D., P.E., University of California, Berkeley, professor
Mohamed A. Seif, Ph.D., P.E., University of Central Florida, associate professor
Scott R. Short, Ph.D., P.E., University of Dayton, assistant professor