MECHANICAL ENGINEERING

Department of Mechanical Engineering
College of Engineering

201 Thermodynamics
Fall, Spring, Summer. 3(3-0) P: (CEM 141 or CEM 151 or CEM 181H or LB 171) and ((MTH 234 or concurrently) or (MTH 254H or concurrently) or (LB 220 or concurrently)) and (PHY 183 or PHY 183B or PHY 183H or PHY 233B or LB 273) Not open to students with credit in BE 351 or CHE 321.


221 Statics
Fall, Spring. 3(3-0) Interdepartmental with Civil Engineering. Administered by Civil Engineering. P: (PHY 183 or PHY 183B or PHY 193H) or (PHY 231 and PHY 233B) and ((MTH 234 or concurrently) or (LB 220 or concurrently) or (MTH 254H or concurrently)) SA: MSM 205


222 Mechanics of Deformable Solids
Fall, Spring, Summer. 3(3-0) P: MTH 234 and CE 221 SA: MSM 211


280 Graphic Communications
Fall, Spring. 2(2-0) P: (EGR 100) and ((LB 118 or concurrently) or (MTH 132 or concurrently) or (MTH 152H or concurrently)) and ((EGR 102 or concurrently) or (CSE 231 or concurrently)) SA: ME 180


285 Computer Aided Design Tools
Fall, Spring. 3(0-6) P: ME 280 R: Open to students in the College of Engineering. SA: MSM 260

Advanced 3-D solid modeling

300 Professional Issues in Mechanical Engineering
Fall, Spring. 1(1-0) P: Completion of Tier I Writing Requirement R: Open to undergraduate students in the Mechanical Engineering Major.


332 Fluid Mechanics
Fall, Spring. 4(3-3) P: ME 361 and (CHE 321 or ME 201) and (ME 391 or concurrently) and completion of Tier I writing requirement R: Open to juniors or seniors in the Mechanical Engineering Major.

Statics, control volume equations, similitude, and exact fluid solutions. Turbulence, pipe flow, boundary layer flow, compressible flow, and Navier-Stokes equations.

361 Dynamics
Fall, Spring. 3(3-0) P: (CE 221) and (MTH 235 or MTH 340 or MTH 347H) R: Open to students in the College of Engineering. SA: MSM 306


371 Mechanical Design I
Fall, Spring. 3(3-0) P: ME 361 or concurrently R: Open to juniors or seniors in the Mechanical Engineering Major.

Analysis of displacement, velocity and acceleration in mechanical linkages. Kinematics and dynamics of machines.

372 Machine Tool Laboratory
Fall, Spring. 1(0-3) R: Open to juniors or seniors in the Mechanical Engineering Major.

Principles and practice of machine tools. Safety, terminology, measurement, and working procedures for hand and machine tools.

391 Mechanical Engineering Analysis
Fall, Spring. 3(3-0) P: (MTH 235 or MTH 340 or MTH 347H) and CSE 231 R: Open to juniors or seniors in the Biosystems Engineering Major or in the Mechanical Engineering Major.

Analytical and numerical methods for the modeling and analysis of mechanical systems. Applications to vibrating elements, heat transfer, linear springs, and coupled spring-mass systems.

399 Special Topics in Mechanical Engineering
Fall, Spring. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Approval of department.

Topics selected to supplement and enrich existing courses.

410 Heat Transfer
Fall, Spring. 3(3-0) P: (ME 332 or CE 321 or CHE 311) and ME 391 R: Open to juniors or seniors in the Mechanical Engineering Major.


412 Heat Transfer Laboratory
Fall, Spring. 2(1-2) P: (ME 410) and completion of Tier I writing requirement R: Open to juniors or seniors in the Mechanical Engineering Major.

Practices and measurement techniques for heat transfer and thermal systems. Experimental problem solving applied to heat transfer.

416 Computer Assisted Design of Thermal Systems
Fall. 3(4-0) P: (ME 410 or concurrently) R: Open to juniors or seniors in the Mechanical Engineering Major.

Classifying, cataloging and processing design information. Modeling of thermal equipment. Simulation and optimization of thermal systems. Computer based design projects.

417 Design of Alternative Energy Systems
Spring. 3(3-0) P: ME 410 or concurrently R: Open to juniors or seniors in the Mechanical Engineering Major.

Analysis of alternative energy systems, including ocean, wind, fuel cells, solar, and nuclear. Predictive models for the systems. Design studies.

422 Introduction to Combustion
Fall. 3(3-0) P: (ME 332 or concurrently) R: Open to juniors or seniors in the Mechanical Engineering Major.

Thermodynamics, chemistry, fluid mechanics, and heat transfer principles applied to combustion.

423 Intermediate Mechanics of Deformable Solids
Fall. 3(3-0) R: ME 222 R: Open to students in the College of Engineering. SA: MSM 401

Fall, Spring. 3(3-0) Interdepartmental with Materials Science and Engineering. Administered by Mechanical Engineering. P: ME 222 R: Open to juniors or seniors in the College of Engineering. SA: MSM 444


425 Experimental Mechanics
Fall of odd years. 3(2-3) P: (ME 222) R: Open to students in the College of Engineering. SA: MSM 405


426 Introduction to Composite Materials
Spring. 3(3-0) Interdepartmental with Materials Science and Engineering. Administered by Mechanical Engineering. P: ME 222 R: Open to juniors or seniors in the College of Engineering. SA: MSM 444


433 Introduction to Computational Fluid Dynamics
Spring. 3(3-0) P: ME 410 or concurrently R: Open to juniors or seniors in the Department of Mechanical Engineering.

Theory and application of finite difference and finite volume methods to selected fluid mechanics and heat transfer problems developed based on Euler and Navier-Stokes equations. Application of commercial software to computational fluid dynamics problems.

440 Aerospace Engineering Fundamentals
Fall. 3(3-0) P: (ME 332 or concurrently) R: Open to juniors or seniors in the Mechanical Engineering Major.

Aerodynamics, propulsion, and flight mechanics. Vehicle and propulsion engine performance and design characteristics.

ME—Mechanical Engineering
Mechanical Engineering—ME

442 Turbomachinery
Spring. 3(3-0) P: (ME 332) R: Open to juniors or seniors in the Mechanical Engineering Major.
Applying energy, momentum, and continuity equations of thermo-fluids to turbomachinery. Blade geometry and aerodynamics. Performance and design parameters. Turbomachine design.

444 Automotive Engines
Fall. 3(3-0) P: (ME 410 or concurrently) R: Open to juniors or seniors in the Mechanical Engineering Major.
Design and development of internal and external combustion engines for vehicular propulsion.

445 Automotive Powertrain Design
Spring. 3(3-0) P: (ME 444) R: Open to juniors or seniors in the Mechanical Engineering Major.
Design of powertrain systems including piston ring assembly, combustion and induction systems, and transmissions. Performance emission tradeoffs with emphasis on emission control. Detailed design study required.

451 Control Systems
Fall, Spring. 4(3-3) P: ME 461 and ECE 345 R: Open to juniors or seniors in the Mechanical Engineering Major.

456 Mechatronic System Design
Fall. 3(2-3) P: (ECE 345 or concurrently) and (ME 391 or concurrently) R: Open to juniors or seniors in the Department of Mechanical Engineering.
Application of embedded microcontrollers to the design of mechatronic systems. Introduction to feedback and feedforward control concepts. Design of software and hardware for systems with mechanical, electrical and fluid components plus embedded control systems. Laboratory exercises and design projects. Application to automotive, consumer, industrial and commercial systems.

461 Mechanical Vibrations
Fall. Spring. 3(3-0) P: ME 361 and ME 391 R: Open to juniors or seniors in the Mechanical Engineering major.
Modeling and analysis of oscillatory phenomena found in linear discrete and continuous mechanical systems.

464 Intermediate Dynamics
Fall of even years. 3(3-0) P: (ME 361) R: Open to students in the College of Engineering. SA: MSM 403

465 Computer Aided Optimal Design
Spring. 3(3-0) P: (ME 222 and ME 280) and (ME 371 or concurrently) R: Open to juniors or seniors in the Mechanical Engineering Major.

471 Mechanical Design II
Fall. Spring. 3(3-0) P: ME 222 and ME 371 and ME 391 R: Open to juniors or seniors in the Mechanical Engineering Major.
Engineering design of machine elements and mechanical systems. Computer-based analysis in support of design. Design for static and fatigue strength, deflection, and reliability.

475 Computer Aided Design of Structures
Fall. 3(3-0) P: ME 471 or concurrently R: Open to juniors or seniors in the Mechanical Engineering Major.
Computational methods for analysis, design, and optimization of structural components. Basic concepts in geometric modeling, finite element analysis, and structural optimization.

477 Manufacturing Processes
Fall, Spring. 3(3-0) Interdepartmental with Materials Science and Engineering, Administered by Mechanical Engineering. P: ME 222 and MEE 250 R: Open to students in the Applied Engineering Sciences Major or in the Materials Science and Engineering Major or in the Mechanical Engineering Major. SA: MSM 481
Fundamentals of manufacturing processes such as casting, heat treating, partitcule processing, forming, machining, joining, and surface processing. Selection of manufacturing processes based on design and materials.

478 Product Development
Spring. 3(3-0) P: ME 477 R: Open to juniors or seniors in the Materials Science and Engineering Major or in the Mechanical Engineering Major. SA: MSM 482
Simulation of industrial environment for product development. Product concept, design, and manufacturing.

480 Mechanical Engineering Design Projects
Fall, Spring. 3(1-6) P: (ME 410 and ME 471) and completion of Tier I Writing requirement R: Approval of department; application required.

489 Technical Communication for Engineers
Spring. 2(2-0) RB: Engineers R: Open to juniors or seniors or graduate students in the College of Engineering.
Investigation of technical communication in the engineering workplace. Drafting, revising, and editing communications directed at a variety of audiences. Includes team writing activities, presentations, style, and flow.

490 Independent Study in Mechanical Engineering
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open to seniors in the Department of Mechanical Engineering. Approval of department. Independent study in mechanical engineering.

491 Selected Topics in Mechanical Engineering
Fall, Spring. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Open to seniors in the Department of Mechanical Engineering. Approval of department. Topics selected to supplement and enrich existing courses.

494 Biofluid Mechanics and Heat Transfer
Fall. 3(3-0) Interdepartmental with Biomedical Engineering. Administered by Mechanical Engineering. P: (ME 410 or concurrently) or (CHE 311 or concurrently) or (BE 350 or concurrently) R: Open to juniors or seniors or graduate students in the College of Engineering.
Applications of fluid mechanics, heat transfer, and thermodynamics to biological processes, including blood flow in the circulatory system, heart function, effects of heating and cooling on cells, tissues, and proteins. Pharmacokinetics.

495 Tissue Mechanics
Spring. 3(3-0) Interdepartmental with Biomedical Engineering. Administered by Mechanical Engineering. P: (ME 222) R: Open to students in the College of Engineering. SA: MSM 441
Application of solid mechanics to understanding mechanical responses of biological tissues. Microstructure and biological function for soft and hard connective tissues and muscle.

497 Biomechanical Design in Product Development
Spring. 3(3-0) Interdepartmental with Biomedical Engineering. Administered by Mechanical Engineering. P: ME 371 or concurrently R: Open to juniors or seniors in the Department of Mechanical Engineering. SA: BME 491A, MSM 445
Biomechanical product design with application to people or animals. Synthesis, prototyping, and analysis of designs. Project management. Market research.

800 Engineering Analysis
Fall. 3(3-0)
Use of analytical methods of mathematics in engineering applications. Applications of partial differential equations to thermal-fluid and vibration problems, vector calculus and tensor analysis in fluid and solid mechanics, and analytical function theory in mechanics.

810 Advanced Classical Thermodynamics
Fall. 3(3-0) P: ME 391 RB: ME 391 R: Open to graduate students in the College of Engineering. SA: ME 802

811 Micro-Scale Fluid Mechanics and Heat Transfer
Spring of odd years. 3(3-0) RB: ME 332 SA: ME 804
812 Conductive Heat Transfer
Spring. 3(3-0) RB: ME 391 and ME 411

814 Convective Heat Transfer
Spring. 3(3-0)
Analysis of convective transfer of heat, mass and momentum in boundary layers and ducts. Thermal instability. Free convection.

819 Combustion

820 Continuum Mechanics
Fall. 3(3-0) SA: MSM 810
Mathematical tools of continuum mechanics, stress principles, kinematics of deformation and motion, fundamental laws and equations. Applications in linear elasticity and classical fluids.

821 Linear Elasticity
Spring. 3(3-0) RB: ME 820 SA: MSM 813

823 Fracture Mechanics and Fatigue
Spring of even years. 3(3-1) RB: ME 821 SA: MSM 816

824 Plasticity
Spring of odd years. 3(3-0) RB: ME 821 SA: MSM 817
Yield conditions, stress-strain relations, plastic potential, hardening theories, torsion, bending. Thick walled shells under internal pressure. Limit analysis. Slip line theory.

825 Experimental Mechanics
Spring. 3(2-3) R: Open to graduate students in the College of Engineering. SA: MSM 805

826 Laminated Composite Materials
Fall of even years. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course. P: (ME 820) SA: MSM 814
Fundamentals of anisotropic elasticity and their application to laminated composite plates. Unique states of deformation, stress, and failure not encountered in isotropic, homogeneous materials.

830 Fluid Mechanics I
Fall. 3(3-0)
Integral and differential conservation laws, Navier-Stokes equations, and exact solutions. Laminar boundary layer theory, similarity solutions, and approximate methods. Thermal effects and instability phenomena.

832 Fluid Mechanics II
Spring of even years. 3(3-0) RB: ME 830 and MTH 425

834 Fundamentals of Turbulence
Fall of odd years. 3(3-0)

835 Turbulence Modeling and Simulation
Fall of even years. 3(3-0) RB: (ME 830) and and familiarity with graduate-level fluid mechanics and mathematics.

836 Experimental Methods in Fluid Mechanics
Fall of even years. 3(1-4)
Modern techniques of fluid mechanics measurement and data analysis. Pressure, temperature and velocity measurement techniques. Optical diagnostics.

840 Computational Fluid Dynamics and Heat Transfer
Spring. 3(3-0) RB: ((ME 410) and programming experience.) and (ME 830 or ME 814)
Theory and application of finite difference and finite volume methods to selected fluid mechanics and heat transfer models including the full potential flow model, the systems of Euler and Navier-Stokes equations, and turbulence. Grid generation techniques.

842 Advanced Turbomachinery
Spring of even years. 3(3-0) RB: ME 442 R: Open only to seniors and graduate students in Mechanical Engineering and Chemical Engineering.
Application of energy, momentum, continuity and heat transfer equations to energy transfer and transformation in turbomachinery.

851 Linear Systems and Control
Fall. 3(3-0) Interdepartmental with Electrical and Computer Engineering. Administered by Electrical and Computer Engineering. RB: Undergraduate coverage of linear algebra, differential equations and control/systems State models and their stability, controllability, and observability properties. Finding minimal realizations of transfer functions. Design of state and output feedback controllers. Design of state observers. LQ regulator and the Kalman filter. Time-varying systems.

853 Optimal Control
Spring of odd years. 3(3-0) Interdepartmental with Electrical and Computer Engineering. Administered by Electrical and Computer Engineering.

854 Robust Control
Spring of even years. 3(3-0) Interdepartmental with Electrical and Computer Engineering. Administered by Mechanical Engineering. R: Open to graduate students in the College of Engineering.

856 Adaptive Control
Fall of even years. 3(3-0) Interdepartmental with Electrical and Computer Engineering. Administered by Electrical and Computer Engineering.

859 Nonlinear Systems and Control
Spring. 3(3-0) Interdepartmental with Electrical and Computer Engineering. Administered by Mechanical Engineering. RB: ECE 851 R: Open to students in the College of Engineering. SA: ECE 827

860 Theory of Vibrations
Fall. 3(3-0)

861 Advanced Dynamics
Fall. 3(3-0) SA: MSM 801
Dynamics of systems of particles and rigid bodies. Energy and momentum principles. Lagrangian and Hamiltonian methods. Euler angles. Applications in system dynamics and vibrations.

863 Nonlinear Vibrations
Spring of even years. 3(3-0) RB: ME 461 Perturbation methods. Weakly nonlinear partial and ordinary differential equations. Modal interactions, internal tuning, saturation, sub/super/combination resonances, jump phenomenon. Nonlinear normal modes.

872 Finite Element Method
Fall. Spring. 3(3-0) Interdepartmental with Civil Engineering. Administered by Mechanical Engineering. SA: AE 809, MSM 809
Theory and application of the finite element method to the solution of continuum type problems in heat transfer, fluid mechanics, and stress analysis.

874 Analysis of Metal Forming and Manufacturing Processes
Fall of odd years. 3(3-0) RB: ME 471 and MSM 809 and MSM 817 and MSM 810
Review of fundamental knowledge in mechanics, materials and numerical analysis. Modeling, simulation and analysis of metal forming and manufacturing processes.
875  Optimal Design of Mechanical Systems
Spring of odd years. 3(3-0) RB: ME 461

891  Selected Topics in Mechanical Engineering
Fall, Spring. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department.
Special topics in mechanical engineering of current importance.

892  Mechanical Engineering Seminar
Fall, Spring. 1 credit.
Attend and present seminars in order to develop research and presentation skills relevant to mechanical engineering.

898  Master’s Project Research
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 7 credits in all enrollments for this course. R: Open only to master’s students in the Mechanical Engineering major. Approval of department.
Master's degree Plan B individual student project: original research, research replication, or survey and reporting on a topic such as system design and development, or system conversion of installation.

899  Master’s Thesis Research
Fall, Spring, Summer. 1 to 8 credits. A student may earn a maximum of 24 credits in all enrollments for this course.
Master's thesis research.

921  Nonlinear Elasticity
Fall of odd years. 3(3-0) RB: ME 821 SA: MSM 915

922  Thermoelasticity and Viscoelasticity
Spring of even years. 3(3-0) RB: ME 820 and MTH 443 SA: MSM 918

940  Selected Topics in Thermal Science
Spring. 1 to 3 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: ME 812 and ME 814 and ME 816 R: Open only to Mechanical Engineering majors.

960  Selected Topics in Vibrations
Fall. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. RB: ME 860
Current topics of interest to the student and faculty.

961  Nonlinear Dynamics and Chaos
Fall of even years. 3(3-0) RB: ME 857 or ME 860 or ECE 826 or MTH 441
Qualitative theory of dynamical systems applied to physical system models. Bifurcation theory for continuous and discrete-time systems. Chaos, the Smale horseshoe, Melnikov’s method, and nonlinear data analysis.

990  Independent Study in Mechanical Engineering
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
Individualized study of a current problem in mechanical engineering.

999  Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 36 credits in all enrollments for this course.
Doctoral dissertation research.