MECHANICAL ENGINEERING ME

Department of Mechanical Engineering
College of Engineering

201. Thermodynamics
Fall, Spring. 3(3-0)
P: CEM 141, MTH 234 or concurrently. R: Not open to students with credit in CHE 311 or MSM 351.
Basic concepts of thermodynamics. Property evaluation of ideal gases and incompressible substances. Theory and application of the first and second laws of thermodynamics. Entropy and Carnot efficiency.
QP: MTH 215, CEM 141 QA: ME 311

332. Fluid Mechanics
Fall, Spring. 4(3-3)
P: MSM 306; CHE 311 or ME 201 or MSM 351; ME 391 or concurrently. R: Open only to Mechanical Engineering and Mechanics students.
Statics, control volume equations, similitude, exact fluid solutions. Turbulence, pipe flow, boundary layer flow, external flow.
QP: ME 311, MMM 306, ME 351 QA: ME 332

371. Mechanical Design I
Fall, Spring. 3(3-0)
P: MSM 306 or concurrently. R: Open only to Mechanical Engineering and Mechanics majors.
Analysis of displacement, velocity and acceleration in mechanical linkages. Kinematics and dynamics of machines.
QP: MMM 306 QA: ME 320

391. Mechanical Engineering Analysis
Fall, Spring. 3(3-0)
P: MTH 235. R: Open only to majors in Mechanical Engineering, Agricultural Engineering, and Mechanics.
Analytical and numerical methods for the modeling and analysis of mechanical engineering systems. Applications to vibrating elements, heat transfer, linear and nonlinear springs, and coupled spring-mass systems.
QP: MTH 310 QA: ME 351

410. Heat Transfer
Fall, Spring. 3(3-0)
P: ME 332 or CE 321 or CHE 311; ME 391. R: Open only to Mechanical Engineering, Food Engineering, and Mechanics majors.
Steady state and transient heat conduction. Natural and forced convection based on boundary layer theory. Application of Nusselt number correlations. Radiant heat transfer principles and applications including radiation networks.
QP: ME 332 QA: ME 411

411. Applied Thermal Science
Fall, Spring. 3(3-0)
P: ME 410. R: Open only to Mechanical Engineering majors.
Thermodynamic principles as applied to gas and vapor power and refrigeration cycles for reciprocating and turbo machinery. Combustion. Analysis and design of heat exchangers. Numerical analysis of heat conduction.
QP: ME 411 QA: ME 312

412. Heat Transfer Laboratory
Fall, Spring. 1(1-2)
P: ME 411 or concurrently. R: Open only to Mechanical Engineering majors.
Practices and measurement techniques for heat transfer and thermal systems. Experimental problem solving applied to heat transfer.
QP: ME 312, ME 411 QA: ME 413

415. Solar Energy Conversion
Spring. 3(3-0)
P: ME 410. R: Open only to Mechanical Engineering majors.
Solar radiation: terrestrial diffuse and direct-beam insolation. Flat-plate and focusing collectors. Energy storage systems. Solar-assisted heat pumps. Photovoltaic, biomass and wind energy conversions.
QP: ME 411 QA: ME 415

416. Computer Assisted Design of Thermal Systems
Fall. 3(4-0)
P: ME 411. R: Open only to Mechanical Engineering majors.
Classifying, cataloging and processing design information. Modeling of thermal equipment. Simulation and optimization of thermal systems. Computer based design projects.
QP: ME 312

422. Introduction to Combustion
Fall. 3(3-0)
P: ME 332. R: Open only to Mechanical Engineering majors.
Thermodynamics, chemistry, fluid mechanics, and heat transfer principles applied to combustion.
QP: ME 332

432. Intermediate Fluid Mechanics
Spring. 3(3-0)
P: ME 332. R: Open only to Mechanical Engineering majors.
Deformable control volumes, Navier-Stokes equations, vorticity and circulation. Exact solutions. Turbulence, boundary layer flows, compressible flows.
QP: ME 332 QA: ME 333

433. Intermediate Fluid Mechanics Laboratory
Spring. 1(0-3)
P: ME 432 or concurrently. R: Open only to Mechanical Engineering majors.
Visualization and measurement of flow, jets and wakes. Flow separation and boundary layers.
QP: ME 333

440. Aerospace Engineering I
Fall. 3(3-0)
P: ME 332. R: Open only to Mechanical Engineering and Mechanics majors.
Aerodynamics, propulsion and flight mechanics. Vehicle and propulsion engine performance and design characteristics.
QP: ME 332 QA: ME 432

441. Aerospace Engineering II
Spring. 3(3-0)
P: ME 440. R: Open only to Mechanical Engineering and Mechanics majors.
Computer analysis experiments associated with aerospace vehicle design. Application of aerospace engineering principles in design such as propulsion, aerodynamics, stability and control.
QP: ME 432 QA: ME 434

442. Turbomachinery
Spring. 3(2-3)
P: ME 201, ME 332. R: Open only to majors in Mechanical Engineering.
Applying energy, momentum, and continuity equations of thermo-fluids to turbomachinery. Blade geometry and aerodynamics. Performance and design parameters. Turbomachine design.
QP: ME 312, ME 332 QA: ME 490

444. Automotive Engines
Spring. 3(3-0)
P: ME 391; ME 410 or concurrently. R: Open only to majors in College of Engineering.
Design and development of internal and external combustion engines for vehicular propulsion.
QP: ME 312 QA: ME 406

451. Control Systems
Fall, Spring. 4(3-3)
P: ME 391, MSM 306, EE 345. R: Open only to Mechanical Engineering and Mechanics majors.
Mathematical modeling of dynamic systems. Standard feedback control formulation. Transient and sinusoidal steady state analysis. Time and frequency domain controller synthesis.
QP: MMM 306, ME 351, EE 345 QA: ME 458

461. Mechanical Vibrations
Fall, Spring. 4(3-3)
P: ME 451. R: Open only to Mechanical Engineering and Mechanics majors.
Modeling and analysis of oscillatory phenomena found in linear discrete and continuous mechanical systems.
QP: ME 458 QA: ME 455

463. Computer Aided Design of Dynamic Systems
Spring. 3(3-0)
P: ME 451. R: Open only to Mechanical Engineering, and Mechanics majors.
Modeling and design of mechanical and mixed-energy dynamic systems. State-space equation representation. Simulation methods.
QP: ME 458 QA: ME 352

465. Computer Aided Optimal Design
Fall. 3(3-0)
P: ME 471 or concurrently. R: Open only to Mechanical Engineering majors.
Modeling for mechanical design optimization. Algorithms for constrained and unconstrained optimization. Optimality criteria. Optimization using finite element models. Design projects.
QP: ME 421 QA: ME 465

471. Mechanical Design II
Fall, Spring. 3(3-0)
P: ME 371, ME 391. R: Open only to Mechanical Engineering and Mechanics majors.
Engineering design of machine elements and mechanical systems. Computer based analysis in support of design. Design for static and fatigue strength, deflection and reliability.
QP: ME 351, ME 320 QA: ME 421

481. Mechanical Engineering Design Projects
Fall, Spring. 3(1-6)
P: ME 411 or concurrently; ME 471. R: Open only to Mechanical Engineering majors.
Application of design concepts in mechanical engineering. Problem definition, design specifications. Modeling and analysis methods. Design optimization, economics, reliability. Manufacturing considerations in design. Capstone design projects.
QP: ME 411, ME 421, ME 312 QA: ME 422

490. 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.
R: Open only to Mechanical Engineering majors. Approval of department.
Independent study in mechanical engineering.
QA: ME 499

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 only to Mechanical Engineering majors. Approval of department.
Topics selected to supplement and enrich existing courses.
QA: ME 490

802. Advanced Classical Thermodynamics
Fall. 3(3-0)
P: ME 391, ME 411.
Postulational treatment of the laws of thermodynamics. Equilibrium and maximum entropy postulates. Principles for general systems.
QP: ME 312, MTH 422 or MTH 424 QA: ME 815

812. Conductive Heat Transfer
Fall. 3(3-0)
P: ME 391, ME 411.
Theory of steady and unsteady heat conduction. Derivation of describing equations and boundary conditions. Numerical methods. Nonlinear problems. Duhamel's integral. Green's functions.
QP: ME 411, ME 351 QA: ME 817

814. Convective Heat Transfer
Spring. 3(3-0)
P: ME 391.
Analysis of convective transfer of heat, mass and momentum in boundary layers and ducts. Thermal instability. Free convection.
QP: ME 412, MTH 421 QA: ME 813

816. Radiative Heat Transfer
Fall. 3(3-0)
P: ME 410.
Electromagnetic theory of radiation. Spectral properties of diffuse and nondiffuse surfaces. Radiation exchange. Radiative transfer in media. Gaseous radiation exchange. Combined modes.
QP: ME 411 QA: ME 814

822. Combustion
Spring. 3(3-1)
P: ME 490, ME 802.
Thermodynamics and chemical kinetics. Multicomponent systems. Premixed and diffusion flames, flame radiation.
QP: ME 815, ME 490 QA: ME 863

830. Fluid Mechanics I
Fall. 3(3-0)
P: ME 432.
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.
QP: ME 333 QA: ME 844

832. Fluid Mechanics II
Spring. 3(3-0)
P: ME 830, MTH 425.
Inviscid flow, vortex motion, flow past bodies. Complex variables and conformal mapping. One-dimensional steady and unsteady compressible flow, shock waves and Prandtl-Meyer expansion. Small perturbations theory and method of characteristics.
QP: ME 844, MTH 423, ME 830, ME 333 QA: ME 841, ME 842

834. Fundamentals of Turbulence
Spring. 3(3-0)
P: ME 432.
Statistical descriptions of turbulent flows: isotropic, free shear and wall bounded. Correlation and spectral descriptions. Conditional probabilities and coherent motions. Experimental methods. Scaling relationships.
QP: MMM 810 QA: ME 843

836. Experimental Methods in Fluid Mechanics
Fall. 3(1-4)
P: ME 432.
Modern techniques of fluid mechanics measurement and data analysis. Pressure, temperature and velocity measurement techniques. Optical diagnostics.
QP: ME 333

852. Intermediate Control Systems
Spring. 3(3-0)
P: ME 451.
Design of controllers for dynamic systems in mechanical engineering. Modeling, analysis and simulation.
QP: ME 458 QA: ME 852

855. Digital Data Acquisition and Control
Spring of even-numbered years. 3(2-3)
P: ME 451.
Real-time digital measurement and control programming for mechanical engineering systems. Analog-to digital and digital-to-analog converters, timer/counters, and instrument interfaces. Open-loop and closed-loop control. Laboratory projects.
QP: ME 458 QA: ME 855

857. Modeling and Simulation of Dynamic Systems
Fall. 3(3-0)
P: ME 451.
Energy-based methods for modeling dynamic engineering components and systems. Systematic formulation of nonlinear state-space equations. Qualitative aspects of response: equilibrium points, linearization. Simulation techniques and design projects.
QP: ME 458 QA: ME 851

860. Theory of Vibrations
Fall. 3(3-0) Interdepartmental with Materials Science and Mechanics.
P: ME 452.
Discrete systems and continua. Analytical mechanics. Variational principles. Modal analysis. Function spaces. Eigenfunction expansions. Integral transforms. Stability. Approximations. Perturbations.
QP: ME 455 QA: ME 823

863. Nonlinear Vibrations
Spring of odd-numbered years. 3(3-0)
P: 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.
QP: ME 455 QA: ME 825

871. Elastodynamics of Machinery and Robotic Systems
Fall of even-numbered years. 3(3-0)
Rigid-body kinematic analysis. Linkage synthesis. Variational formulations, nonlinear phenomena, composites and smart materials.

873. Design-for-Manufacture Strategies for Composite Materials
Spring of even-numbered years. 3(3-0)
Modeling of fiberous composite materials. Processing techniques for thermoplastics and thermosets. Design-for-Manufacture (DFM) strategies.

875. Optimal Design of Mechanical Systems
Spring of odd-numbered years. 3(3-0)
P: ME 461.
Optimal design for static and dynamic response of mechanical and structural systems. Necessary and sufficient conditions for optimality. Discrete and continuous parameter problems. Sensitivity of response to design variations. Algorithms.
QP: MTH 334, ME 455, MMM 809 QA: ME 856

892. Parameter Estimation
Spring. 3(3-0)
P: STT 421 or STT 441.
Nonlinear estimation of parameters in ordinary and partial differential equations. Related concepts in probability and statistics. Least squares and other estimators. Sequential methods. Optimum experiment design.
QP: STT 421, STT 441 QA: ME 860

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.

QA: ME 899

913. Advanced Heat Conduction
Fall of even-numbered years. 3(3-0)
P: ME 812 or MTH 849.
Inverse and ill-posed problems in heat transfer: function estimation, regularization, adjoint methods, numerical methods in conduction. Moving boundaries, ablation, phase change, Green's functions and integral transforms.
QP: ME 817, CHE 826, MTH 841 QA: ME 917

930. Selected Topics in Fluid Mechanics
Fall. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
P: ME 830.
Current topics in fluid mechanics will be presented.
QP: ME 841

934. Application of Turbulence Fundamentals
Spring. 3(3-0)
P: ME 834.
Fundamental physics of turbulence from dimensional analysis approach. Classical and coherent structure analysis.
QP: ME 333 QA: ME 843

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.
P: ME 812, ME 814, ME 816. R: Open only to Mechanical Engineering majors.
Conduction, convection, radiation, phase change and interactive combined modes of heat transfer. Mass transfer. Irreversible thermodynamics.
QP: ME 813, ME 814, ME 817 QA: ME 980

952. Advanced Control Systems
Fall. 3(3-0)
P: ME 852.
Current topics in control theory with potential for improving mechanical systems design.
QP: ME 852

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.
P: ME 860.
Current topics of interest to the student and faculty.
QP: ME 823

963. Wave Phenomena
Spring of odd-numbered years. 3(3-0)
R: Approval of department.
Linear and non-linear waves in bounded and unbounded media. Reflection, refraction, diffraction. Dispersion. Shock and acceleration waves. Waveguides. Acoustical and optical analogies. Fluid and solid continua.
QA: ME 870

971. Intelligent Materials and Smart Structures: Applications
Fall of odd-numbered years. 3(3-0)
P: ME 873.
Design-for-manufacture issues in smart materials: biomimetics, nanotechnology, electro-rheological fluids, shape memory alloys, piezoelectric materials, fiberoptics, neural networks.

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.
QA: ME 925

999. Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 72 credits in all enrollments for this course.

QA: ME 999

MEDICAL TECHNOLOGY MT

Medical Technology Program
College of Natural Science

212. Fundamentals of Laboratory Analysis
Fall. 3(3-0)
P: MTH 103 or MTH 116; CEM 141 and CEM 161. C: MT 213
Chemical, biological and instrumental laboratory analyses: method evaluation, quality assurance, and predictive value theories.
QP: MTH 109 or MTH 111, CEM 142 QA: MT 210, MT 110

213. Application of Clinical Laboratory Principles
Fall. 1(0-3)
C: MT 212
Microscopy, pipetting. Specimen collection, handling and processing. Laboratory safety, quality control, and method evaluation.
QA: MT 211

414. Clinical Chemistry and Body Fluid Analysis
Spring. 4(4-0)
P: BCH 401, MT 212, PSL 250; STT 200 or STT 201.
Analytical methods in clinical chemistry and urinalysis. Correlation of laboratory test results with physiology and diseases of renal, hepatic and cardiac systems.
QP: PSL 241, MT 210, BCH 401 QA: MT 300, MT 440