MECHANICAL ENGINEERING

College of Engineering

201. The Science of Sound I: Rock, Bach and Oscillators (N)
Winter. 4(4-0) Interdepartmental with and administered by Physics.

303. Thermal-Fluid Phenomena
Winter. 3(3-0) MME 201, MTH 113.
Concepts and principles used to describe, predict, or explain thermal and fluid-flow phenomena. Constraints, approximations, engineering problem solving. Application to socio-technical questions.

304. Technology and Utilization of Energy
(300.) Spring. 3(3-0) M E 393.
Problems of energy technology and its impact: energy sources, conversions, waste and environmental effects, future outlook.

311. Thermodynamics I
Fall, Winter, Spring. 3(3-0) MTH 215 or concurrently.
Zeroth, first and second laws of thermodynamics. General energy equation. Process relations. Concepts of equilibrium, reversibility, and entropy. Applications of these to systems describable by two independent properties.

312. Thermodynamics II
Winter, Spring. 3(3-0) M E 311.
Continuation of M E 311. Gas and vapor relations, reactive and non-reactive mixtures. Thermodynamic principle as applied to gas and liquid power and refrigeration cycles for reciprocating and turbo machinery.

320. Kinematics of Machines I
Fall, Spring, Summer. 4(3-3) MMM 300 or concurrently.
Analysis of displacement, velocity, and acceleration in mechanical linkages; cam analysis and design; analysis of spur, bevel, and worm gears, including planetary systems.

332. Fluid Mechanics I
Winter, Spring. 4(3-3) M E 311; M E 351 or concurrently; MMM 306.
Fluid statics; Bernoulli equation; nondimensional control volume applied to conservation of mass, momentum and energy; derivation of differential equations of continuity and momentum; similitude.

333. Fluid Mechanics II
Fall, Spring. 4(3-3) M E 332.
Fluid flow phenomena; laminar flow; turbulent flow, pipe flow, inviscid flows; boundary layers; external flow; an introduction to compressible flow.

347. Thermosciences and Energy Systems Laboratory
Winter, Spring. 1(0-3) M E 312 or concurrently.
Properties of pure substances; first law energy balances and second law analyses applied to a pump, turbine, refrigerator and combustion process.

351. Mechanical Engineering Analysis
Fall, Winter, Spring. 4(4-0) CPS 120 or concurrently, MTH 310.
Application of analytical and numerical methods to the solution of problems encountered in mechanical engineering.

352. Introduction to Systems and Control
Winter. 4(4-0) MMM 306, E E 345.
Modeling of a variety of physical systems, using state-variable concepts. Time and frequency response of low-order linear systems. Primary applications to mechanisms and hydraulics.

406. Automotive Engines
Spring. 3(3-0) M E 312.
Analysis of internal combustion engines for vehicular propulsion.

407. Automotive Vehicles
Fall. 3(3-0) MME 306.
Analysis of the propulsion, braking, steering, and suspension requirements.

410. Thermomechanical Continua
Fall. 3(3-0) MME 211.
Reexamination of the continuum concept in the modeling of the deformation of solids and the flow of fluids. Cartesian tensor formulation of the basic physical laws involving stress and strain.

411. Heat Transfer I
Fall. 3(3-0) M E 311.

412. Heat Transfer II
Winter. Spring. 3(3-0) M E 333.
Natural and forced convection based on boundary layer theory. Heat transfer in fluids with phase change. Heat exchangers, mass transfer.

414. Energy Conversion
Fall. 3(3-0) M E 312.
Fundamental principles of energy conversion systems. Direct energy conversion: Thermoelectric, thermonic, nuclear, fuel cells, magnetohydrodynamic, and other methods of power generation.

415. Solar Energy Conversion
Fall. 4(4-0) M E 311 or approval of department.

416. Statistical Thermodynamics
(313.) Spring. 3(3-0) M E 311.

421. Mechanical Design
Fall. Winter. 3(3-0) MME 211.
Introduction to design, the design process, design considerations and design procedures. Application of design principles to machine elements.

422. Mechanical Design Projects
Winter. Spring. 3(3-0) M E 421.
Application of design concepts, such as optimization, economics and reliability, through several projects drawn from the basic areas of mechanical engineering (thermodynamics, heat transfer, fluid and solid mechanics).

424. Dynamics of Machines
Winter. 3(3-0) M E 320.
Analysis of static and dynamic forces in mechanical linkages; balancing of rotating and reciprocating machinery; flywheel requirements, gyroscopic forces, critical speeds.

432. Aerospace Engineering I
Fall. 3(3-0) M E 332.
Fundamentals of fluid mechanics, potential flows about bodies and airfoils, compressible flow, perturbation methods, viscous flow, boundary layers, transition, turbulence, separation, aerodynamics of wings and bodies.

433. Aerospace Engineering II
(417.) Winter. 3(3-0) M E 333.
Thermodynamics and fluid mechanics will be used to study rockets, turbojets, reciprocating engines, propellers, turboprops, and turbolasts; a specific propulsion system will be designed.

434. Aerospace Engineering III
(417.) Spring. 3(3-0) MME 306.
Particle and rigid body dynamics; orbit theory; aerodynamic forces; propulsion; longitudinal, directional and lateral stability and control; range; payload; a specific vehicle will be designed.
436. Cooling Processes
Winter. 3(3-0) M E 312.
Thermodynamic principles applied to the design of cooling systems in range of normal temperature to ultra-low cryogenic temperature conditions. Psychrometric principles as applied to air conditioning and evaporating systems.

446. Mechanical Engineering Measurements Laboratory
(346) Fall, Winter. 2(1-3) E E 345, M E 312, M E 333, M E 352, M E 411 or concurrent. Mechanical engineering experiments including accuracy, data reduction, and the measurement of pressure, velocity, temperature, heat flow and vibration.

455. Mechanical Vibrations
Fall, Winter. 4(4-0) M M 306.
Oscillatory phenomena for linear systems with one and two degrees of freedom, nonlinear systems, time varying systems with deterministic excitation, and time invariant systems with non-deterministic excitations.

458. Control Theory
Winter, Spring. 4(4-0) M E 352.
Closed-loop control systems; application of transfer function analysis; design for a definite degree of stability; on-off and on controllers.

463. Computer-Aided Design I
Winter. 3(2-2) CFS 120, MTH 334.
Three-dimensional transformations, perspectives, contour surface layout for design and manufacturing, an introduction to finite element applications.

464. Computer-Aided Design II
Spring. 3(2-2) M E 453, M E 463 and approval of department.
Modal analysis of dynamic systems; identification of modal characteristics from input-output data; computer techniques: including graphics, eigenvalue and Fourier transform computations.

490. Special Topics
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 8 credits. Approval of department.
Special topics in mechanical engineering of current interest and importance.

499. Independent Study
Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 8 credits. Approval of department.

510. Intermediate Heat/Mass Transfer
Fall. 4(4-0) Approval of department.

513. Convective Heat Transfer
Winter. 3(3-0) M E 412, M E 421.
Analysis of convective transfer of heat, mass and momentum in boundary layers and induced flows. Heat transfer with phase change of fluids.

514. Radiative Heat Transfer
Spring. 3(3-0) Approval of department.

515. Advanced Classical Thermodynamics
Fall. 3(3-0) M E 312; MTH 422 or MTH 452.

517. Conductive Heat Transfer
Fall. 3(3-0) M E 411, M E 351.

523. Theory of Vibrations I
Fall. 4(4-0) M E 455. Interdepartmental with the Department of Metallurgy. Mechanics, and Materials Science.
Closed and continuous parameter systems with linear and nonlinear characteristics. Variational principles; equations of motion. Matrices, quadratic forms; self-adjoint operators; eigenvalues. Transient and random excitations. Theory developed through physical problems.

524. Theory of Vibrations II
Winter of odd-numbered years. 4(4-0) MTH 422; M E 423 or approval of department.
Interdepartmental with and administered by the Department of Metallurgy, Mechanics, and Materials Science.

526. Kinematics of Machines II
Fall. 3(3-0) M E 320.

527. Machine Design III
Spring. Summer. 3(3-0) M E 421.

528. Machine Design IV
Winter. 3(3-0) M E 421.
Application of design theory to the synthesis of complete mechanical and hydraulic systems. Stress waves due to impact loading. Critical speed.

529. Fluid Transients
Fall. 3(3-0) M E 333 or approval of department, Interdepartmental with and administered by Civil Engineering.
Application of unsteady flow concepts and wave mechanics to hydraulic engineering; method of characteristics; surges and waterhammer in piping systems; resonance phenomena.

530. Intermediate Fluid Mechanics
Fall. 3(3-0) M E 333 or C E 331. Interdepartmental with Civil Engineering.
Definite and indefinite linear-Stokes equations, dimensionless variables, vorticity and circulation, turbulent flow, inviscid flow, and boundary layer theory.

532. Refrigeration
Spring. 3(3-0) M E 436.
Characteristics of refrigerants; application details pertaining to comfort cooling, food refrigeration, and ultra-low temperature units; refrigeration controls, and control systems.

541. Advanced Gas Dynamics
Spring. 3(3-0) M E 432; MTH 229 or MTH 422 or MTH 424 or approval of department.

542. Inviscid Flows
Spring. 3(3-0) M M 510; M E 322 or M E 323.
Kinematics; dynamical equations; potential flows, transformations, Helmholtz flows; added masses, forces and moments; vortex motion; wave motion.

543. Turbulence
Winter, Summer. 4(4-0) M M 510 or approval of department.
Basic equations of turbulent motions including momentum, kinetic energy, scalar transport, turbulence, correlation and spectrum functions. Basic elements of statistical descriptions, isotropic and shear flows, phenomenological theories and hot-wire anemometry.

551. Modeling of Engineering Systems I
Fall, 3(3-0) M E 458 or E E 415. Interdepartmental with Systems Science.
Modeling of engineering components and dynamic systems; mechanical, electrical, fluid, thermal, and transducer effects. Linear state-space descriptions, transfer functions. Simulation of linear models. Design project.

552. Modeling of Engineering Systems II
Winter. 3(3-0) M E 521. Interdepartmental with Systems Science.

553. Finite Dimensional Dynamical Systems
Spring. 3(3-0) M E 551 or SYS 526 or approval of department.
Transition matrices and matrix exponentials, periodicity and reducibility; controllability and observability, weighting patterns, realizations and minimal realizations, least squares theory, free and fixed endpoint problems, canonical equations, conjugacy and focal points.

555. Digital Data Acquisition and Control
Winter. 3(3-0) M E 458, M E 463.
Real-time digital measurement and control programming. Analog-to-digital and digital-to-analog converters. Computer structure, binary arithmetic, boolean operations, open-loop and closed-loop control, laboratory projects.

560. Topics in Parameter Estimation
Spring. 4(4-0) May reenroll for a maximum of 4 credits when different topics are taken. STT 421 or STT 441 recommended.
870. Wave Motion in Continuous Media I
Fall, Winter, Spring. 3 credits. MTH 422, MATH 410, or approval of department.

890. Special Topics
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 9 credits. Approval of department. Special topics in mechanical engineering of current interest and importance.

899. Doctoral Dissertation Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

917. Advanced Heat Conduction
Winter of even-numbered years. 3 credits. MATH 417 or CHE 382 or MTH 481. Exact analytical techniques including use of Green's function and integral transforms; approximate numerical methods; phase change problems; ablation; inverse heat conduction problems.

925. Mechanical Engineering Problems
Fall, Winter, Spring. 1 to 5 credits. May reenroll for a maximum of 9 credits. Approval of department. Analysis of advanced engineering problems involving design, thermodynamics, fluid dynamics, gas dynamics, space.

MEDICAL TECHNOLOGY M T

College of Natural Science

110. Clinical Laboratory Science and Health Care Delivery
Winter. 2(2-0)
The history and definition of medical technology, its diagnostic and therapeutic role in health care delivery, and its relationship to other allied health professions.

210. Exploration of the Disciplines of the Clinical Laboratory Sciences
Fall. 2(2-0) Sophomore in medical technology.
Clinical laboratory disciplines including hematology, immunohematology, chemistry, microbiology, cytology, and histology through an orientation of laboratory testing and its role in the assessment, prevention, monitoring of health status.

211. Introduction to the Clinical Laboratory
Fall. 1(0-2) M T 210 or concurrently.
Basic laboratory techniques in clinical microbiology, immunohematology, hematology, hemostasis, clinical chemistry and clinical microscopy.

300. Foundations of Laboratory Practices
Fall. 3(3-0) Clinical Laboratory Sciences majors.
Quality assurance of clinical laboratory analysis.

400. Clinical Laboratory Sciences Educational Practices
Fall. 2(2-0) Clinical Laboratory Sciences majors, approval of Medical Technology Program.
Development and implementation of educational programs for clinical laboratory personnel. Includes scope of CLS education, administration of programs and accreditation standards.

410. General Pathology
Fall. 3(3-0) M T 404, Spring. 3(3-0) ANT 416, PSL 422 or concurrently. Interdepartmental with the Department of Pathology.
Features of lethal and sublethal cell injury and inflammation and repair process. Definition of the major causes of pathologic change with a consideration of specific associated diseases.

411. Basic Histopathology
Spring. 2(1-2) ANT 420, PSL 432, M T 410 or concurrently. Interdepartmental with the Department of Pathology.
Microscopic examination of cell injury and death, inflammation and tissue repair. Pathologic tissue changes in diseases resulting from degenerative changes, abnormal metabolism, neoplasia, immunologic processes, infection, mechanical trauma and malnutrition.

412. Clinical Biochemistry
Spring. 2(2-0) BCH 412, BCH 401, CEM 162.
A comprehensive survey of clinical biochemistry, assessment of normal and pathologic physiology.

420. Hematology
Spring, Summer. 3(3-0) BCH 401, PSL 432.
Physiology, pathophysiology and laboratory assessment of hematological states.

421. Hematology Laboratory
Spring. 1(0-2) or 2(0-4) M T 420 or concurrently.
Laboratory techniques in hematology. Normal and abnormal blood cell morphology.

430. Immunohematology
Fall, Spring. 3(3-0) MPH 461.
Genetics and immunology pertinent to blood group systems, antibody identification, and compatibility testing. Common practices of transfusion centers. Clinical correlations related to transfusion reactions and to hemolytic disease of the newborn.

431. Immunohematology Laboratory
Fall. 1(0-3) or 2(0-4) M T 430 or concurrently.
Techniques relevant to practice of immunohematology. Special emphasis on blood typing, antibody screening and identification, compatibility testing, prenatal and postnatal testing, quality assurance and problem solving.

440. Clinical Microscopy and Hemostasis
Winter, Summer. 2(2-0) PSL 432, BCH 401.
Renal physiology pertinent to the physical, chemical, and microscopic analyses of urine. The coagulation and fibrinolytic mechanisms including inherited and acquired diseases, laboratory testing and anticoagulant therapy.

441. Clinical Microscopy and Hemostasis Laboratory
Winter. 1(0-2) or 2(0-4) M T 440 concurrently.
Routine urinalysis including the physical, chemical and microscopic examination. Semi-automated procedures for routine coagulation testing including prothrombin times, partial thromboplastin times, and factor assays.

451. Senior Seminar I
Fall. 3(3-0) Clinical Laboratory Sciences majors, approval of Medical Technology Program.
Problem oriented learning approach to develop managerial, scientific and educational leadership for the clinical laboratory. Topics to include clinical chemistry, hematology, immunology, microbiology, hemostasis, quality control, instrumentation.

452. Senior Seminar II
Fall. 3(0-6) M T 451.
Continuation of M T 451. Problems of increasing difficulty and based on additional topics in immunohematology and medical mycology.

453. Senior Seminar III
Spring. 3(3-0) M T 452.
Continuation of M T 452. Problems of increasing difficulty and based on additional topics from medical parasitology.

461. Medical Immunology and Microbiology
Winter. 5(5-0) MPH 401, MPH 427.
Students may not receive credit in both MPH 461 and MPH 427. Interdepartmental with and administered by the Department of Microbiology and Public Health.

480. Hematology
Fall, Winter, Spring. 6 credits.
Clinical Laboratory Sciences majors, approval of Medical Technology Program.
Application of the theory and technical skills of chemistry in a clinical laboratory.

481. Hematology Laboratory
Fall, Winter, Spring. 5 credits.
Clinical Laboratory Sciences majors, approval of Medical Technology Program.
Application of the theory and technical skills of hematology in a clinical laboratory.

483. Clinical Immunohematology
Fall, Winter, Spring. 4 credits.
Clinical Laboratory Sciences majors, approval of Medical Technology Program.
Application of the theory and technical skills of immunohematology in a clinical laboratory.

484. Clinical Microbiology
Fall, Winter, Spring. 6 credits.
Clinical Laboratory Sciences majors, approval of Medical Technology Program.
Application of theoretical and technical aspects of clinical microbiology in a clinical laboratory.