999   Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 120 credits in all enrollments for this course. R: Approval of department.
Doctoral dissertation research.

MECHANICAL ENGINEERING   ME

Department of Mechanical Engineering
College of Engineering

180   Engineering Graphic Communications
Fall, Spring. 3(1-4) P:M: (MTH 116 or concurrently or LBS 117 or concurrently or MTH 132 or concurrently or MTH 152H or concurrently) or (MTH 103 and MTH 114 or concurrently) SA: MSM 160
Computer-aided design and drafting. Freehand sketching. Two and three dimensional visualization. Blueprint reading. Geometric dimensioning and tolerancing. Introduction to engineering design.

201   Thermodynamics
Fall, Spring. 3(3-0) P:M: (CEM 141 or CEM 151 or CEM 181H or LBS 165) and (MTH 234 or concurrently or MTH 254H or concurrently or LBS 220 or concurrently) Not open to students with credit in CHE 321 or MSM 351 or BE 351.
Basic concepts of thermodynamics. Property evaluation of ideal gases and compressible substances. Theory and application of the first and second laws of thermodynamics. Entropy and Carnot efficiency.

220   Introduction to Solid Mechanics
Spring. 4(4-0) P:M: (MTH 133 or MTH 153H or LBS 119) R: Not open to students in the Civil Engineering or Engineering Arts or Engineering Mechanics or Manufacturing Engineering or Materials Science and Engineering or Mechanical Engineering major. SA: MSM 206 Not open to students with credit in ME 221 or ME 222.
Statics: moment and force resultants, equilibrium. Mechanics of deformable bodies: stress and strain, classification of material behavior, generalized Hooke's law. Engineering applications: axial loads, torsion of circular rods and tubes, bending and shear stresses in beams, deflection of beams, combined stresses, stress and strain transformation.

221   Statics
Fall, Spring. 3(3-0) P:M: (MTH 132 or MTH 152H or LBS 118) SA: MSM 205
Vector description of forces and moments. Two and three dimensional equilibrium of particles and rigid bodies. Analysis of trusses, frames and machines. Coulomb friction.

222   Mechanics of Deformable Solids
Fall, Spring. 3(3-2) P:M: (ME 221) and (MTH 133 or concurrently or MTH 152H or concurrently or LBS 119 or concurrently) SA: MSM 211
Tension compression and shear stresses. Axially loaded bars. Torsion of circular shafts. Beam theory. Combined stresses. Mohr's circles. Columns.

285   Computer Aided Design Tools
Spring. 3(1-4) P:M: (ME 180) R: Open only to students in Manufacturing Engineering and Engineering Arts-Product Design cognate. SA: MSM 260
Advanced 3-D solid modeling, CNC programming, and rapid prototyping.

332   Fluid Mechanics
Fall, Spring. 4(3-3) P:M: (MSM 306) and (CHE 311 and ME 201 and MSM 351) and (ME 391 or concurrently) and completion of Tier I writing requirement. R: Open only to juniors or seniors in the Mechanical Engineering or Engineering Mechanics major.
Statics, control volume equations, similitude, exact fluid solutions. Turbulence, pipe flow, boundary layer flow, compressible flow, and Navier-Stokes equations.

361   Dynamics
Fall, Spring. 3(3-0) P:M: (ME 221) and (MTH 235 or MTH 255H or LBS 220) R: Open only to students in the College of Engineering. SA: MSM 306
Kinematics of particles, rigid bodies, and mass moments of inertia. Kinetics of particles and rigid bodies. Energy and momentum principles.

371   Mechanical Design I
Fall, Spring. 3(3-0) P:M: (MSM 306 or concurrently) R: Open only to juniors or seniors in the Mechanical Engineering or Manufacturing Engineering major.
Analysis of displacement, velocity and acceleration in mechanical linkages. Kinematics and dynamics of machines.

385   Introduction to Product Design
Fall. 3(1-4) P:M: (STA 110) R: Open only to students in Manufacturing Engineering and Engineering Arts-Product Design cognate. SA: MSM 360
Ideation methods, design methodology, 3-D model building, small-scale group and individual projects. Project presentations.

386   Computer Aided Product Design
Spring. 3(1-4) P:M: (ME 285 or concurrently and ME 385) R: Open only to students in Manufacturing Engineering and Engineering Arts-Product Design cognate. SA: MSM 361
Freeform modeling techniques. Top down product design. Use of computer tools to assist in the development of products.

391   Mechanical Engineering Analysis
Fall, Spring. 3(3-0) P:M: (MTH 235 or MTH 255H or LBS 220) R: Open only to juniors or seniors in the Mechanical Engineering or Biosystems Engineering or Engineering Mechanics major.
Analytical and numerical methods for the modeling and analysis of mechanical engineering systems. Applications to vibrating elements, heat transfer, linear springs, and coupled spring-mass systems.

410   Heat Transfer
Fall, Spring. 3(3-0) P:M: (ME 332 or CE 321 or CHE 311) and (ME 391) and completion of Tier I writing requirement. R: Open only to juniors or seniors in the Mechanical Engineering or Engineering Mechanics major.
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.

412   Heat Transfer Laboratory
Fall, Spring. 2(1-2) P:M: (ME 410) and completion of Tier I writing requirement. R: Open only to juniors or seniors in the Mechanical Engineering or Engineering Mechanics major.
Practices and measurement techniques for heat transfer and thermal systems. Experimental problem solving applied to heat transfer.

414   Vehicle Thermal System Design
Spring. 3(2-2) P:M: (ME 410) R: Open only to seniors in the Mechanical Engineering major.
Analysis and design of general heat exchange systems applied to automotive vehicle systems including heaters, air conditioning, electronic, and cabin systems. Students will work in teams to design, build, and test heat exchanger systems. A global engineering experience via the internet may be included.

416   Computer Assisted Design of Thermal Systems
Fall. 3(4-0) P:M: (ME 410 or concurrently) R: Open only 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.

422   Introduction to Combustion
Fall. 3(3-0) P:M: (ME 332 or concurrently) R: Open only 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) P:M: (ME 222) R: Open only to students in the College of Engineering. SA: MSM 401
Stress, strain and linearly elastic behavior. Plane stress and plane strain. Torsion. Yield criteria. Elastoplastic behavior of beams, shafts and cylinders. Unsymmetrical bending. Curved beams.

424   Computational Mechanics
Spring. 3(3-0) P:M: (ME 423 or ME 471) R: Open only to students in the College of Engineering. SA: MSM 402
Energy methods with applications. Finite element methods. Buckling and stability. Green's functions.

425   Experimental Mechanics
Fall of odd years. 3(2-3) P:M: (ME 222) R: Open only to students in the College of Engineering. SA: MSM 405
Measurement of stress, strain, vibration, and motion using strain gauges, accelerometers, photoelasticity, holography, Moire patterns, laser speckle and electronic imaging. Transducer design.

426   Introduction to Composite Materials
Spring. 3(3-0) Interdepartmental with Materials Science and Engineering. Administered by Department of Chemical Engineering and Materials Science. P:M: (ME 222) R: Open only to students in the Department of Chemical Engineering and Materials Science. SA: MSM 444
Constituents and interfacial bonding. Manufacturing techniques. Microstructure and micromechanics. Theory of anisotropy. Classical laminate theory. Material characterization. Failure and damage. Composite structure design.

432   Intermediate Fluid Mechanics
Spring. 3(3-0) P:M: (ME 332) R: Open only to juniors or seniors in the Mechanical Engineering or Engineering Mechanics major.

Deformable control volumes, Navier-Stokes equations, vorticity and circulation. Exact solutions. Turbulence, boundary layer flows, compressible flows.

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

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

442   Turbomachinery
Spring. 3(3-0) P:M: (ME 332) R: Open only 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:M: (ME 410 or concurrently) R: Open only 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:M: (ME 444) R: Open only 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:M: (MSM 306 and ECE 345) and completion of Tier I writing requirement. R: Open only to juniors or seniors in the Mechanical Engineering or Engineering Mechanics major.

Mathematical modeling of dynamic systems. Standard feedback control formulation. Transient and sinusoidal steady state analysis. Time and frequency domain controller synthesis.

456   Mechatronic System Design
Fall. 3(2-3) P:M: (ECE 345 and ME 451 or concurrently) R: Open only to juniors or seniors in the Mechanical Engineering major.

Application of imbedded microcontrollers to the design of mechatronic systems. Design of software and hardware for systems with mechanical, electrical and fluid components plus imbedded control systems. Laboratory exercises and design projects. Application to automotive, consumer and commercial systems.

457   Mechatronic System Modeling and Simulation
Spring. 3(3-0) P:M: (ECE 345 and MSM 306) R: Open only to juniors or seniors in the Mechanical Engineering major and to students in the Master of Science degree in Industrial Mathematics.

Modeling and simulation of mechatronic systems, including mechanical, electrical, fluid, power, and other effects. Transducer modeling, including pumps, motors, and valves. Application to automotive systems.

461   Mechanical Vibrations
Fall, Spring. 4(3-3) P:M: (ME 451) and completion of Tier I writing requirement. R: Open only to juniors or seniors in the Mechanical Engineering or Engineering Mechanics 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:M: (ME 361) R: Open only to students in the College of Engineering. SA: MSM 403

Kinematics and kinetics of particle and rigid body systems. Virtual work, Lagrangian method, and Euler equations. Basic vibrations of discrete and continuous systems. Elementary wave propagation.

465   Computer Aided Optimal Design
Fall. 3(3-0) P:M: (ME 471 or concurrently) R: Open only to juniors or seniors in the Mechanical Engineering major.

Modeling for mechanical design optimization. Algorithms for constrained and unconstrained optimization. Optimality criteria. Optimization using finite element models. Design projects.

471   Mechanical Design II
Fall, Spring. 3(3-0) P:M: (ME 371) and (ME 391) and (MSM 211) R: Open only 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 Automotive Structures
Spring. 3(2-2) P:M: (ME 471 or concurrently) R: Open only to seniors in the Mechanical Engineering major.

Computational methods for analysis, design, and optimization of automotive structural components. Basic concepts in geometric modeling, finite element analysis, and structural optimization.

477   Manufacturing Processes
Fall. 3(3-0) Interdepartmental with Materials Science and Engineering. P:M: (ME 222 and MSE 250) and completion of Tier I writing requirement. R: Open only to students in the Engineering Arts, Engineering Mechanics, Manufacturing Engineering and Materials Science and Engineering majors. SA: MSM 481

Fundamentals of manufacturing processes such as casting, heat treating, particulate processing, forming, machining, joining and surface processing. Selection of manufacturing processes based on design and materials.

478   Product Development
Spring. 3(3-0) P:M: (ME 361 and ME 477) and completion of Tier I writing requirement. SA: MSM 482

Simulation of industrial environment for product development. Product concept, design and manufacturing.

481   Mechanical Engineering Design Projects
Fall, Spring. 3(1-6) P:M: (ME 410) and (ME 471) and completion of Tier I writing requirement. R: Open only to juniors or seniors in the Mechanical Engineering major.

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.

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 only to juniors or 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 only to juniors or seniors in the Department of Mechanical Engineering. Approval of department.

Topics selected to supplement and enrich existing courses.

492   Senior Research and Design Project (W)
Fall, Spring, Summer. 2 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. P:M: Completion of Tier I writing requirement. R: Open only to seniors in the Engineering Mechanics or Engineering Arts major. Approval of department.

Design and analysis to solve mechanics related problem. Preparation of written report, oral presentation, and defense of the project.

495   Tissue Mechanics
Spring. 3(3-0) Interdepartmental with Biomedical Engineering. P:M: (ME 222) 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.

496   Biodynamics
Fall. 3(2-2) Interdepartmental with Biomedical Engineering. P:M: (ME 361) R: Open only to students in the Engineering Mechanics major.

Fundamentals of motion analysis of human movement and its application to the study of function and dysfunction of the musculoskeletal system. Solution methods of the inverse dynamics problem.

Mechanical Engineering—ME

497   Biomechanical Design
Spring. 3(3-0) Interdepartmental with Biomedical Engineering. R: Open only to juniors or seniors in the College of 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.

802   Advanced Classical Thermodynamics
Fall. 3(3-0) RB: (ME 391 and ME 411)
Postulational treatment of the laws of thermodynamics. Equilibrium and maximum entropy postulates. Principles for general systems.

804   Micro-Scale Fluid Mechanics and Heat Transfer
Spring of odd years. 3(3-0) RB: (ME361 and ME332 and ME410)
Basic concepts of micro-scale processes. Molecular derivation of the conservation equations of fluid dynamics, Boltzmann equation and Monte-Carlo methods of modern micro-applied science. Theory of micro-scale heat transfer. Applications to fluid mechanics, heat transfer, combustion.

812   Conductive Heat Transfer
Fall. 3(3-0) RB: (ME 391 and ME 411)
Theory of steady and unsteady heat conduction. Derivation of describing equations and boundary conditions. Numerical methods. Nonlinear problems.

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.

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
Fundamentals of isotropic linear elasticity. Solution of plane elasticity problems. St. Venant bending and torsion. Singular solutions. Basic three-dimensional solutions.

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

823   Fracture Mechanics and Fatigue
Spring of even years. 3(3-0) RB: (ME 821) SA: MSM 816
Brittle and ductile fracture. Elastic stress fields near cracks. Elastic-plastic analysis of crack extension. Plastic instability. Cyclic crack propagation. Models of cyclic deformation and fatigue failure. Environmental effects. Case studies.

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: Approval of department. SA: MSM 805
Measurement of strain, displacement, velocity, acceleration using resistance strain gages, accelerometers, and related methods. Detailed study of strain gages and accelerometers. Transducer design. Basic modal analysis.

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:M: (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.

827   Energy Methods in Mechanics
Spring of even years. 3(3-0) RB: (ME 821) SA: MSM 820
Calculus of variations. Variational principles in mechanics. Approximate methods. Energy criteria for stability. Applications to structural dynamics.

828   Advanced Strength of Materials
Spring of odd years. 3(3-0) SA: MSM 815
General theory of torsion, nonsymmetric bending, transverse shear, thin-walled beams, beams on elastic foundations, thick-walled cylinders. Basic contact mechanics. Failure criteria for solids.

829   Micromechanics of Materials
Fall of odd years. 3(3-0) P:M: (MSE 870) SA: MSM 818
Microscopic analysis of cellular solids, polycrystals and composite materials. Homogenization techniques for finding effective properties of inhomogeneous 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)
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.

834   Fundamentals of Turbulence
Fall of odd years. 3(3-0)
Statistical descriptions of turbulent flows: isotropic, free shear and wall bounded. Correlation and spectral descriptions. Conditional probabilities and coherent motions. Experimental methods. Scaling relationships.

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 (ME 830 or ME 814) and programming experience.
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.

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

855   Digital Data Acquisition and Control
Spring of odd years. 3(2-3) RB: (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.

857   Modeling and Simulation of Dynamic Systems
Fall. 3(3-0) RB: (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.

860   Theory of Vibrations
Fall. 3(3-0)
Discrete systems and continua. Analytical mechanics. Variational principles. Modal analysis. Function spaces. Eigenfunction expansions. Integral transforms. Stability. Approximations. Perturbations.

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. 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)
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.

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 Parameter Estimation
Fall of odd years. 3(3-0) RB: (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.

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
Spring of even years. 3(3-0) RB: (ME 821) SA: MSM 915
Kinematics and kinetics of large deformations. Incompressible and compressible finite elasticity. Solution of basic problems. Nonuniqueness, stability and buckling. Singular fields near cracks and flaws.

922 Thermoelasticity and Viscoelasticity
Spring of even years. 3(3-0) RB: (ME 820 and MTH 443) SA: MSM 918
Thermomechanics of solids. Theory of thermoelasticity. Boundary value problems in thermoelasticity. Linear and nonlinear viscoelasticity. Model representation. Boltzmann superposition. Correspondence principle.

925 Optical Methods of Measurement
Fall of even years. 3(2-3) R: Approval of department. SA: MSM 905
Measurement of dimension, position, motion, strain, using optical methods including holography, speckle interferometry, Moire, photoelasticity, laser Doppler, electronic imaging, model analysis. Relevant optics theory.

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.
Conduction, convection, radiation, phase change and interactive combined modes of heat transfer. Mass transfer. Irreversible thermodynamics.

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 EDE 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 72 credits in all enrollments for this course.
Doctoral dissertation research.

MEDICAL TECHNOLOGY MT

Medical Technology Program
College of Natural Science

212 Fundamentals of Laboratory Analysis
Fall, Summer. 3(3-0) P:M: (MTH 103 or MTH 116 or LBS 117) RB: (BS 111L)
Chemical, biological and instrumental concepts in laboratory analyses: quality assurance, laboratory mathematics, safety, health care systems and regulatory issues.

213 Application of Clinical Laboratory Principles
Fall, Summer. 1(0-3) P:M: (MT 212 or concurrently) RB: (BS 111L) R: Open only to students in Clinical Laboratory Sciences or Medical Technology or Human Biology major or LBS Medical Technology coordinate major.
Lab safety and standards of good laboratory practice including specimen handling and processing. Application of technologies and techniques to the performance of clinical diagnostic testing.

414 Clinical Chemistry I: Laboratory Analysis and Practice
Spring. 3(3-0) P:M: (STT 200 or STT 201 or STT 231 or STT 351 or STT 421) RB: (MT 212 and MT 213 and PHY 231 and PHY 232)
Concepts and principles of analytic methods commonly used in the clinical laboratory are presented. Emphasis on qualitative and quantitative features of instrumental analysis. Issues of QC, QA, method evaluation and standards of laboratory practice.

415 Clinical Chemistry and Body Fluid Analysis Laboratory
Spring. 1(0-3) P:M: (MT 213) R: Open only to students in the Clinical Laboratory Sciences major. C: MT 414 concurrently.
Quantitative analysis of blood and body fluids. Spectophotometry, electrophoresis, chromatography, enzymatic assays, and immunoassays.

416 Clinical Chemistry II: Pathophysiology and Body Fluid Analysis
Fall. 5(5-0) P:M: (MT 212) and (BMB 401 or BMB 462) and (PSL 250) or (PSL 431 and PSL 432) RB: (MT 414)
Correlation of laboratory test results with normal physiology and biochemistry and with disease states. Emphasis on metobolic and endocrine systems, and acquired and inherited diseases. Therapeutic drug monitoring, toxicology and urinalysis.

422 Hematology and Hemostasis
Fall. 4(4-0) P:M: (MT 212 or concurrently) RB: (BS 111 and BS 111L and BMB 401 and PSL 250)
Structure and function of normal blood cells with changes seen in benign and malignant diseases and acquired and hereditary disorders. Mechanisms of hemostasis, fibrinolysis and hemostatic control.

423 Hematology and Hemostasis Laboratory
Fall. 1(0-3) P:M: (MT 213 or concurrently) R: Open only to students in the Clinical Laboratory Sciences major. C: MT 422 concurrently.
Diagnostic assessment of blood cells and hemostatic function.

432 Clinical Immunology and Immunohematology
Spring. 5(5-0) P:M: (MT 212 and BS 111 and BS 111L) RB: (MT 422 and PSL 250)
Cellular and humoral immunity and diseases of immunity. Clinical serology and immunology, blood group serology, and transfusion practices.

433 Clinical Immunology and Immunohematology Laboratory
Spring. 1(0-3) P:M: (MT 213 and MT 432 or concurrently) R: Open only to students in the Clinical Laboratory Sciences major.
Immunologic methods for disease detection. Methods of blood typing and pre-transfusion testing.