ME 2050 Introduction to Computer-Aided Mechanical Drafting Cr. 2
Introduction to CAD system using available software system at the college computer center, including AutoCAD. Offered Fall, Winter.

ME 2200 Thermodynamics Cr. 3
Transformation of heat energy to other energy forms. Basic concepts and laws of thermodynamics. Thermodynamic properties and processes for simple substances. Applications to power and refrigeration cycles. No credit after ME 2210. Offered Fall, Winter.
Prerequisites: (MAT 2020 with a minimum grade of C-) OR (PHY 2175 with a minimum grade of C-) OR (BE 1200 with a minimum grade of C-) OR (BE 1500 with a minimum grade of C-)

ME 2410 Statics Cr. 3
Basic concepts and principles of statics with applications to Newton's Laws of Motion to engineering problems. Forces, moments, equilibrium, couples, free body diagrams, trusses, frames, fluid statics, friction, area and mass moment of inertia. Offered Yearly.
Prerequisites: (MAT 2020 with a minimum grade of D-) OR (PHY 2175 with a minimum grade of D-)
Equivalent: CE 2410

ME 2420 Elementary Mechanics of Materials Cr. 3
Elastic relationships between external forces acting on deformable bodies and the associated stresses and deformations; structural members subjected to axial load, torsion, and bending; column buckling; combined stresses; repeated loads; unsymmetrical bending. Offered Yearly.
Prerequisites: (ME 2410 with a minimum grade of C-) OR (CE 2410 with a minimum grade of C-) OR (BE 1300 with a minimum grade of C-) OR (BE 1310 with a minimum grade of C-)
Equivalent: CE 2420

ME 2500 Numerical Methods Using MATLAB Cr. 2
Developing numerical solutions for engineering problems using MATLAB. Evaluation of alternative approaches to the numerical solutions in terms of accuracy and efficiency. Offered Fall, Spring/Summer.
Prerequisites: BE 1500

ME 3300 Fluid Mechanics: Theory and Laboratory Cr. 4
Introduction to the nature and physical properties of fluids, statics, equation of motion, incompressible inviscid flow, dimensional analysis, incompressible one-dimensional compressible channel flow. Experiments to supplement lectures. Offered Fall, Winter.
Prerequisites: (ME 2200 with a minimum grade of C-) OR (BE 1500 with a minimum grade of C-) OR (BE 2550 with a minimum grade of C-) OR (ME 2210 with a minimum grade of C-) OR (ME 2500 with a minimum grade of C-)

ME 3400 Dynamics Cr. 3
Basic concepts and principles of dynamics with application of Newton's Laws of Motion to engineering problems. Kinematics and kinetics of particles and rigid and variable-mass bodies. Equations of motion, impulse-momentum, impact and work-energy principles. Offered Fall, Winter.

ME 3450 Manufacturing Processes I Cr. 3
A study of the field of manufacturing processes from a mechanical engineering design standpoint. Topics include: processing of metals, polymers and ceramics, and computer-aided manufacturing. Offered Fall, Winter.
Prerequisites: ME 2420 with a minimum grade of C-
Course Material Fees: $10
Equivalent: IE 3450

ME 4150 Design of Machine Elements Cr. 4
Static body stresses, strain and deflection, failure theories, introduction to impact loading and fatigue. Design of common mechanical elements: threaded fasteners, rivets, welding and bonding, springs, lubrication and sliding bearings, rolling element bearings. Offered Every Term.
Prerequisites: (ME 3450 with a minimum grade of C-) OR (BE 2100 with a minimum grade of C-)

ME 4210 Heat Transfer: Theory and Laboratory Cr. 4
Fundamental concepts and basic modes of heat transfer. General equation of heat conduction, steady state heat conduction on one and more dimensions. Transient heat conduction. Heat transfer by radiation, Kirchoff's law and the black body. Radiation between diffuse surfaces. Radiation from gases, vapors and flames. Introduction to heat convection; concept of heat transfer coefficient and Nusselt number. Lab experiments to supplement lectures. Offered Fall, Winter.
Prerequisites: ME 3300, with a minimum grade of C+; ENG 3050, with a minimum grade of C+
Course Material Fees: $25

ME 4300 Thermal Fluid Systems Design Cr. 4
Design of thermal-fluid systems to meet system performance requirements, computer-aided design, system simulation, design optimization including investment economics. Offered Fall, Winter.
Prerequisites: ME 4210, with a minimum grade of C-; ENG 3060, with a minimum grade of C-
Course Material Fees: $25

ME 4410 Vibrations: Theory and Laboratory Cr. 4
Prerequisite: ME 3400, with a minimum grade of C+; ENG 3050, with a minimum grade of C+
Course Material Fees: $25

ME 4420 Dynamic Modeling and Control of Engineering System Cr. 4
Mathematical modeling of linear, lumped, time-invariant systems, open and closed loop systems, single-input-single-output system design using root locus method. Offered Fall, Winter.
Prerequisite: ME 3400, with a minimum grade of C+
ME 4500 (WI) Mechanical Engineering Design II Cr. 4
Involves teamwork on semester-long open-ended design project. Develop design concepts based on various design theories, analyze alternative solutions and identify "best design solution" within given constraints. Students perform patent literature search, design, fabricate, develop and test prototypes. Perform product verification and validation. Require submission of formal progress reports, a final written report and a public presentation. Course satisfies Writing Intensive course requirement. Offered Fall, Winter.
Prerequisites: (ME 4150 with a minimum grade of C-) OR (ENG 3600 with a minimum grade of C-) OR (BE 2250 with a minimum grade of C-) OR (ME 2500 with a minimum grade of C-) OR (ME 4410 with a minimum grade of C-) OR (ME 4250 with a minimum grade of C-)
Course Material Fees: $25

ME 5000 Engineering Analysis I Cr. 4
Course Material Fees: $5

ME 5040 Finite Element Methods I Cr. 4
Introduce finite element methods and review solid mechanics concepts and formalisms, variational methods and potential energy principles. Emphasize the basic understanding of the finite element method including its physical and mathematical principles, numerical procedures and their implementation. Define displacement-based formulations of spring, bar, beam, plane strain and plane stress elements along with isoparametric element formulation, assembly of elements and solution of global stiffness equations. Offered Fall, Winter.

ME 5100 Quantitative Physiology Cr. 4
The basic principles of human physiology presented from the engineering viewpoint. Bodily functions, their regulation and control discussed in quantitative terms and illustrated by simple mathematical models when feasible. Offered Winter.
Prerequisites: (BME 5005 with a minimum grade of C) OR (BME 2010 with a minimum grade of C)
Equivalent: BME 5010, CHE 5100, ECE 5100, IE 5100

ME 5110 Fundamental Fuel Cell Systems Cr. 4
Introduce various types of fuel cells, materials properties of electrodes and polymeric membranes, and electrochemical mechanisms. Reforming of various types of hydrocarbon fuel to hydrogen, and reforming technology. Offered Fall.
Equivalent: AET 5110, CHE 5110, EVE 5130

ME 5115 Fundamentals of Electric-drive Vehicle Engineering Cr. 4
Cover engineering fundamentals and basic design of electric-drive vehicle powertrains by understanding and analyzing the relevant multi-physics and applying the associated equations and simple models. Offered Fall.
Equivalent: EVE 5110

ME 5120 Fundamentals of Alternative Energy Technology Cr. 4
Provide an overview/review of thermodynamics. Cover advanced thermodynamics topics of energy and chemical reacting systems. Introduce general areas of alternative energy technology, engineering analysis and design of solar angle/time/radiation, solar heating, solar photovoltaic, and wind power. Offered Winter.
Equivalent: AET 5120

ME 5160 Musculoskeletal Biomechanics Cr. 4
Structure and properties of the major tissue components of the musculoskeletal system and evaluation of how tissues combine to provide support and motion to the body. Offered Winter.
Prerequisites: (BME 5010) OR (BME 6550) OR (BMS 5550)
Equivalent: BME 5210

ME 5170 Design of Human Rehabilitation Systems Cr. 4
Design, fabrication and testing of customized hardware to aid handicapped patients. Offered Fall.

ME 5180 Introduction to Biomaterials Cr. 4
Introduction to study of both biological materials (bone, muscle, etc.) and materials for medical applications. Topics include tissue properties and effects of pathology, biocompatibility, and design considerations. Offered Yearly.
Prerequisites: (BE 1300 and BME 5010) OR (BMS 6550) OR (BMS 5550)
Equivalent: BME 5300

ME 5210 Convective and Radiative Heat Transfer Cr. 4

ME 5215 Fundamentals of Battery Systems for Electric and Hybrid Vehicles Cr. 4
Cover fundamental electrochemistry and engineering aspects for electric propulsion batteries including lead acid, nickel metal hydride, lithium ion and capacitor technologies. Offered Winter.
Equivalent: AET 5310, CHE 5120, EVE 5120

ME 5300 Intermediate Fluid Mechanics Cr. 4
Introduce fluid kinematics entailing vector field, potential flows, vorticity along with the computation of particle trajectory in a given velocity field and near stagnation points. Define basics of fluid dynamics including stress tensor in fluids, Navier-Stokes equations, Euler's equations, properties of solutions of Euler's equations, Bernoulli’s integral and role of viscosity. Extend the analysis to two-dimensional potential flows and vortex flows. Offered Winter.

ME 5330 Advanced Thermal Fluid System Design Cr. 4
Involves teamwork on semester-long open-ended design project of thermal fluid systems to meet performance requirements using sound design process and system engineering approach. Apply engineering principles and computational design software to analyze and optimize system or subsystem processes. Offered Fall, Winter.
Prerequisites: ME 4210 and ENG 3060

ME 5400 Dynamics II Cr. 4
Cover three-dimensional kinematics and kinetics of rigid bodies, Euler angles, angular momentum, D'Alembert Principle, equations of motion in general rotating coordinate frames. Derive Lagrange's equation of motion for particles and rigid bodies. Introduce Lagrange multipliers, holonomic and non-holonomic constraints, virtual work principle, and Hamilton's Principle. Offered Fall.
Course Material Fees: $10
ME 5410 Vibrations II Cr. 4
Review the vibration response of two-degree-of-freedom systems including frequency response function. Extend the analysis to multi-degree-of-freedom systems including eigenvalues (natural frequencies) and orthogonality of eigenvectors (normal modes). Introduce numerical and experimental modal analysis techniques. Formulate the boundary-value problem for the vibration of continuous structural elements such as rods, strings, and beams. Offered Winter.

ME 5425 Analysis of Vibration Movements and Instrumentation Cr. 4
Introduce metal design. Introduce computer-aided simulation and manufacturing. Intelligent solid models with application to data management and sheet metal design. Offered Winter.

ME 5440 Industrial Noise Control Cr. 4
Introduce principles and methodologies of automotive assembly systems and processes. Cover operation management, quality management, principle of system development, planning and analysis of assembly systems and supportive functions, assembly processes, automatic and manual operations, management of tooling development and honing systems and supportive functions, assembly processes, automatic and manual operations, management of tooling development and honing processes of sheet metal parts. Offered Spring/Summer. *Prerequisite: ME 3450, with a minimum grade of D-; ME 4250, with a minimum grade of D-

ME 5453 Automotive Manufacturing Systems and Processes Cr. 4
Introduce principles and methodologies of automotive assembly systems and processes. Cover operation management, quality management, principle of system development, planning and analysis of assembly systems and supportive functions, assembly processes, automatic and manual operations, management of tooling development and honing processes of sheet metal parts. Offered Spring/Summer. *Prerequisite: ME 3450, with a minimum grade of D-

ME 5460 Fundamentals in Acoustics and Noise Control Cr. 4
Introduce principles of sound generation, propagation and interaction with solid boundary surfaces, as well as engineering noise control applications. Gain hands-on experience on simulating sound radiation and interactions with solid boundaries, and estimating sound transmission through partitions. Offered Biannually (Fall).

ME 5470 Fundamentals of Mechanics Cr. 4
Introduce principles and methodologies of automotive assembly systems and processes. Cover operation management, quality management, principle of system development, planning and analysis of assembly systems and supportive functions, assembly processes, automatic and manual operations, management of tooling development and honing processes of sheet metal parts. Offered Spring/Summer. *Prerequisite: ME 3450, with a minimum grade of D-

ME 5480 Combustion Engines Cr. 4
Introduce combustion processes in actual systems, engine performance characteristics and engine modeling. Offered Winter.

ME 5490 (WI) Advanced Engineering Design Cr. 4
Involve team work on semester-long open-ended design project. Develop design concepts based on various design theories, analyze alternative solutions and identify "best design solution" within given constraints. Students perform patent literature search, design, fabricate, develop and test prototypes. Perform product verification and validation. Require submission of formal progress reports, a final written report and a public presentation. Course satisfies Writing intensive course requirement. Offered Fall, Winter. *Prerequisites: BE 2550, ME 4250, and ENG 3060* 

ME 5500 (WI) Advanced Engineering Design Cr. 4
Involve team work on semester-long open-ended design project. Develop design concepts based on various design theories, analyze alternative solutions and identify "best design solution" within given constraints. Students perform patent literature search, design, fabricate, develop and test prototypes. Perform product verification and validation. Require submission of formal progress reports, a final written report and a public presentation. Course satisfies Writing intensive course requirement. Offered Fall, Winter. *Prerequisites: BE 2550, ME 4250, and ENG 3060* 

ME 5520 Fracture Mechanics in Engineering Design Cr. 4
Introduce linear and nonlinear fracture mechanics principles and their applications to structural design. Formulate fracture parameters based on energy methods and stress-intensity factors for linear elastic fracture mechanics (LEFM), J-Integral and crack tip opening displacement (CTOD) for elastic plastic fracture mechanics (EPFM). Introduce design concepts based on failure assessment diagram and damage tolerance. Cover crack growth mechanisms, crack closure and crack retardation concepts. Offered Fall, Winter.

ME 5530 Tribology and Lubrication Technology Cr. 4
Introduce Lagrangian and Hamiltonian classical mechanics. Derive thermodynamics laws from mechanics. Cover continuum kinematics and basics of tensor analysis, continuum mechanics (basic laws; thermodynamics of continuum media; classical continuum models). Offered Winter.

Course Material Fees: $5

ME 5560 Computer-Aided Mechanical Design Cr. 4
Introduce aspects of constraint-based solid modeling and parametric modeling using Unigraphics, Solid Edge, I-DEAS and Pro-E. Develop intelligent solid models with application to data management and sheet metal design. Introduce computer-aided simulation and manufacturing. Offered Spring/Summer.

ME 5610 Combustion and Emissions Cr. 4
Define air quality and emissions standards. Cover fundamentals of emission formation in combustion systems, wall quenching and imperfect combustion, unburned hydrocarbons, carbon monoxide, aldehydes, nitrogen oxides, species stratification in the combustion chamber, and particulates. Discuss the effects of design parameters and engine operating variables on emission formation. Introduce chemical kinetics simulation. Offered Winter. *Prerequisite: ME 5800, with a minimum grade of C-

ME 5620 Fracture Mechanics in Engineering Design Cr. 4
Introduce linear and nonlinear fracture mechanics principles and their applications to structural design. Formulate fracture parameters based on energy methods and stress-intensity factors for linear elastic fracture mechanics (LEFM), J-Integral and crack tip opening displacement (CTOD) for elastic plastic fracture mechanics (EPFM). Introduce design concepts based on failure assessment diagram and damage tolerance. Cover crack growth mechanisms, crack closure and crack retardation concepts. Offered Fall, Winter.

ME 5700 Fundamentals of Mechanics Cr. 4
Introduce Lagrangian and Hamiltonian classical mechanics. Derive thermodynamics laws from mechanics. Cover continuum kinematics and basics of tensor analysis, continuum mechanics (basic laws; thermodynamics of continuum media; classical continuum models). Offered Winter.

Course Material Fees: $5

ME 5720 Mechanics of Composite Materials Cr. 4
Develop a comprehensive understanding of analytical models of micro-mechanical and macro-mechanical behavior of composite materials. Conduct stiffness, strength, hydrothermal, laminate, viscoelastic, dynamic behavior and fracture analyses. Introduce experimental characterization procedures for mechanical behavior evaluation. Offered Fall.

ME 5730 Tribology and Lubrication Technology Cr. 4
Introduce friction, wear, and lubrication fundamentals including wear mechanisms, application of coatings, surface engineering fundamentals, measurement of surface topological features and surface wear. Offered Yearly.

ME 5740 Advanced Engineering Design Cr. 4
Involve team work on semester-long open-ended design project. Develop design concepts based on various design theories, analyze alternative solutions and identify "best design solution" within given constraints. Students perform patent literature search, design, fabricate, develop and test prototypes. Perform product verification and validation. Require submission of formal progress reports, a final written report and a public presentation. Course satisfies Writing intensive course requirement. Offered Fall, Winter. *Prerequisites: BE 2550, ME 4250, and ENG 3060* 

ME 5750 (WI) Advanced Engineering Design Cr. 4
Involve team work on semester-long open-ended design project. Develop design concepts based on various design theories, analyze alternative solutions and identify "best design solution" within given constraints. Students perform patent literature search, design, fabricate, develop and test prototypes. Perform product verification and validation. Require submission of formal progress reports, a final written report and a public presentation. Course satisfies Writing intensive course requirement. Offered Fall, Winter. *Prerequisites: BE 2550, ME 4250, and ENG 3060* 

ME 5760 Computer-Aided Mechanical Design Cr. 4
Introduce aspects of constraint-based solid modeling and parametric modeling using Unigraphics, Solid Edge, I-DEAS and Pro-E. Develop intelligent solid models with application to data management and sheet metal design. Introduce computer-aided simulation and manufacturing. Offered Spring/Summer.

ME 5780 Products Liability Introduction for Engineers Cr. 1
Application of engineering practice to minimize products liability exposure. Stages of a products liability lawsuit; how engineers may be involved at different stages of the process. Offered Yearly. *Equivalent: IE 5780* 

ME 5800 Combustion Engines Cr. 4
Cover thermodynamics and cycle analysis of spark and compression ignition engines. Introduce combustion processes in actual systems, engine performance characteristics and engine modeling. Offered Fall, Winter.

ME 5810 Combustion and Emissions Cr. 4
Define air quality and emissions standards. Cover fundamentals of emission formation in combustion systems, wall quenching and imperfect combustion, unburned hydrocarbons, carbon monoxide, aldehydes, nitrogen oxides, species stratification in the combustion chamber, and particulates. Discuss the effects of design parameters and engine operating variables on emission formation. Introduce chemical kinetics simulation. Offered Winter. *Prerequisite: ME 5800, with a minimum grade of C-

ME 5820 Thermal Environmental Engineering Cr. 4
Design and analyze heating, ventilating and air-conditioning systems. Introduce moist air properties calculations, heat transfer and transmission coefficients, heating load, cooling load, heating and cooling equipment, duct design, fans, air distribution, and refrigeration principles. Offered Spring/Summer.

ME 5900 National Design Competition Projects Cr. 1-4
Offered Every Term. Repeatable for 998.99 Credits
ME 5990 Directed Study Cr. 1-4
Offered Every Term. Repeatable for 6 Credits

ME 5992 Research Experiences for Undergraduates Cr. 1-4
Offered for undergraduate credit only. Offered Irregularly. Repeatable for 6 Credits

ME 5995 Special Topics in Mechanical Engineering I Cr. 1-4
Topics to be announced in Schedule of Classes. Offered Irregularly. Repeatable for 8 Credits

ME 6180 Biomedical Instrumentation Cr. 4
Engineering principles of physiological measurements. Signal conditioning equipment, amplifiers, recorders and transducers. Recent advances. Offered Winter. Prerequisites: (ECE 3300, BME 5020, and BME 5010) OR (BMS 6550) OR (BMS 5550) Equivalent: BME 6480, ECE 6180, IE 6180

ME 6550 Modeling and Control of Dynamic Systems Cr. 4
Introduce state-space representation of dynamical systems, apply Lyapunov stability criteria, and examine controllability and observability of systems. Design linear state feedback controllers using pole-placement technique and formulate full- and reduced-order linear state observers such as Luenberger observer. Design linear model following controller and linear quadratic optimal controllers. Offered Fall. Course Material Fees: $5

ME 6991 Internship in Industry Cr. 1-4
Written report describing internship experience. Offered Every Term. Repeatable for 4 Credits

ME 7020 Finite Element Methods II Cr. 4
Introduce isoparametric elements, plate and shell elements. Perform dynamic analysis of structures (explicit versus implicit methods). Formulate problems with geometric, materials, and/or contact nonlinearities. Introduce hybrid variational techniques, Cover examples dealing with solids, fluids and heat transfer by utilizing commercially available software such as HyperMesh, OptiStruct, LS/DYNA and ANSYS. Offered Winter. Prerequisites: ME 3400 and BME 5010 OR (BMS 6550) OR (BMS 5550) Equivalent: BME 7100, ECE 7100, IE 7100

ME 7100 Mathematical Modeling in Impact Biomechanics Cr. 3-4
Review of models created for impact simulations. Regional impact simulation models. Human and dummy models subject to various restraint systems. Offered Winter. Prerequisites: (ME 3400 and BME 5010) OR (BMS 6550) OR (BMS 5550) Equivalent: BME 7100, ECE 7100, IE 7100

ME 7160 Impact Biomechanics Cr. 4
Biomechanical response of the body regions and the whole body to impact. Mechanisms of injury in blunt impact. Effects of restraints on injury reduction. Development of test surrogates such as dummies. Offered Fall. Prerequisites: (BME 5010) OR (BMS 6550) OR (BMS 5550) Course Material Fees: $10 Equivalent: BME 7160, ECE 7160

ME 7180 Advanced Topics in Biomaterials and Tissue Mechanics Cr. 4
Seminar format: advanced topics presented to the class; lectures by the instructor and by the participants based on literature reviews. Topics determined by student interest. Offered Biannually. Prerequisites: (BME 5210) OR (BME 5370) Equivalent: BME 7300, MSE 7180

ME 7195 Tissue Biomechanics Cr. 4
Tissue-level mechanical properties. Analytical models of hard and soft tissue mechanics. Soft tissue viscoelasticity, quasilinear viscoelasticity, and biphasic theory. Wolff's law and bone remodeling, bone fatigue and microfracture. Form and function relationships from microstructure to macrostructure. Offered Biannually (Fall). Prerequisites: (BME 5020, BME 5210, and BME 5010) OR (BMS 6550) OR (BMS 5550) Equivalent: BME 7210

ME 7260 Heat and Mass Transfer Cr. 4
Introduce transport phenomena and rate equations. Formulate heat and mass transfer problems using lumped, differential and integral formulations. Solve these problems using the method of separation of variables, partial solutions, variation of parameters, superposition, Laplace transformation and Duhamel integral for problems with time-dependent boundary conditions. Apply these concepts to various thermal and combustion systems. Offered Fall. Prerequisites: ME 5300, with a minimum grade of C-

ME 7300 Advanced Fluid Mechanics Cr. 4
Understand the physics of governing equations of conservation of mass, momentum, energy, and other scalar properties in transport processes. Express the numerical aspects of the transport processes in finite volume approach and pressure-based solution algorithm. Introduce physical models of turbulence, multi-phase and reacting flows. Acquire hands-on experience of formulation, meshing, simulation, post-processing and presentation to solve engineering problems. Stress the importance of CFD encountered in real-life engineering applications. Offered Winter. Prerequisites: ME 5300, with a minimum grade of C-

ME 7310 Computational Fluid Mechanics and Heat Transfer Cr. 4
Understand the physics of governing equations of conservation of mass, momentum, energy, and other scalar properties in transport processes. Express the numerical aspects of the transport processes in finite volume approach and pressure-based solution algorithm. Introduce physical models of turbulence, multi-phase and reacting flows. Acquire hands-on experience of formulation, meshing, simulation, post-processing and presentation to solve engineering problems. Stress the importance of CFD encountered in real-life engineering applications. Offered Fall. Prerequisites: ME 5300, with a minimum grade of C-

ME 7315 Electric-drive Vehicle Modeling and Simulation Cr. 4
Cover modeling, simulation and control of electric-drive vehicle powertrain including plant modeling, controls model development, and in-the-loop controls testing. Proficiency in MATLAB/Simulink is required. Offered Winter. Equivalent: EVE 7310

ME 7400 Advanced Dynamics Cr. 4
Introduce physical concepts and formalisms of Newtonian, Lagrangian, and Hamiltonian mechanics. Formulate calculus of variations including Hamiltonian least action principle and Euler-Lagrange equation. Develop the boundary-value problem of continuous elastic structures using Hamilton’s principle. Model strongly nonlinear dynamical systems involving impact, non-smooth and discontinuous loads. Offered Winter. Prerequisite: ME 5400, with a minimum grade of C-

Course Material Fees: $5
ME 7410 Vibrations of Continuous Systems Cr. 4
Model and solve boundary-value problems of vibration for continuous elastic structures using approximate algorithms and computational schemes. Assess the effects of boundary conditions on the eigenvalue problem of geometrically nonlinear elastic structures. Offered Winter.
Prerequisite: ME 5400, with a minimum grade of C-; ME 5410, with a minimum grade of C-

ME 7420 Random Vibrations Cr. 4
Introduce statistical parameters of random vibration such as mean, mean square, correlation function, power spectral density, cumulant and moment generating function. Define Brownian motion process, white noise, Markov processes, and Fokker-Planck-Kolmogorov equation. Develop stochastic calculus rules (Itô and Stratonovich integrals) and stochastic averaging. Generate random response statistics of single- and two-degree-of-freedom systems. Offered Winter.

ME 7440 Signal Processing Technologies and Their Applications Cr. 4
Develop advanced signal processing techniques for analyzing transient signals containing discontinuities and sharp spikes with applications to such fields as blind sources separation, de-noising time-domain signals, etc. Acquire hands-on experience with software such as LabVIEW to set up experiments and analyze data. Offered Winter.

ME 7451 Advanced Manufacturing II: Material Forming Cr. 4
Cover classical theory of plasticity and basic equations, deformation behavior and constitutive equations of materials, deformation mechanisms related to microstructures, mechanical analyses of various forming processes, experimental study on material properties, microstructure evolution and forming mechanics. Offered Biannually (Fall).

ME 7460 Advanced Acoustics and Noise Control Cr. 4
Introduce advanced techniques in near-field acoustical holography for visualizing acoustic fields, analyzing vibro-acoustic correlations and identifying the critical vibration components responsible for acoustic radiation from a vibrating structure. Offered Biannually (Winter).
Prerequisite: ME 5460, with a minimum grade of C-

ME 7480 Nonlinear Vibration Cr. 4
Categorize nonlinearities in mechanical systems and qualitatively describe their effects on the dynamic response. Introduce the concepts of phase portrait, limit cycles, dynamic characteristics of Duffing and Van der Pol oscillators, parametric vibration and parametric resonance. Outline nonlinear techniques such as harmonic balance, averaging method, and multiple scales methods to analyze nonlinear modal interaction (internal resonance), vibro-impact dynamics and chaotic motion. Offered Fall.
Prerequisite: ME 5410, with a minimum grade of C-; ME 7400, with a minimum grade of C-

ME 7550 Control of Dynamic Systems Cr. 4
Formulate static optimization problems with equality constraints, system identification, parameter optimization using Lyapunov's method. Introduce calculus of variations including dynamic optimization with equality constraints and apply them to formulate linear regulator and tracking problems. Introduce Pontryagin's minimum principle and state inequality constraints. Solve minimum-time problems and minimum control-effort problems. Offered Winter.
Prerequisite: ME 6550, with a minimum grade of C-; ECE 5470, with a minimum grade of C-
Course Material Fees: $5

ME 7590 Nonlinear Control Systems Cr. 4
Provide examples of nonlinear dynamical control systems, perform system analysis using phase-portrait, and examine stability using Lyapunov's direct method and invariant set theorems (local and global stability). Introduce describing function method, feedback linearization technique, internal dynamics, and zero-dynamics. Design nonlinear robust controllers. Offered Fall.
Prerequisite: ME 6550, with a minimum grade of C-; ECE 5470, with a minimum grade of C-
Equivalent: ECE 7420

ME 7610 Theory of Elasticity Cr. 4
Define boundary value problems of linear elasticity. Cover variational principles in linear elasticity along with theory of beams, plates and shells. Introduce homogenized description of composite materials. Offered Fall.
Prerequisite: ME 5700, with a minimum grade of C-

ME 7680 Manufacturing Processing Mechanics Cr. 4
Perform finite element analysis (FEA) of non-linear large strain deformation problems using the software ABAQUS. Cover thermal-mechanical coupled deformation problems involving micro-manufacturing of micro-electronic mechanical systems (MEMS), electronic packaging, composite curing, creep-fatigue of micro-system and large plastic deformation in metal forming. Offered Yearly.
Prerequisite: ME 5040, with a minimum grade of C-

ME 7720 Advanced Mechanics of Composite Materials Cr. 4
Conduct a review on tensor notation with application to stress strain and constitutive equations. Develop damage tolerance analysis and approaches including durability of composite materials and structures. Conduct extensive literature review and independent focused research on the above topics that encompass advanced models and their applications. Offered Winter.
Prerequisite: ME 5720, with a minimum grade of C-

ME 7820 Engineering Non-Destructive Evaluation (NDE) Methods and Industrial Applications Cr. 4
Cover basic and advanced non-destructive evaluation methods used in industry. Treat in-depth the physics and engineering NDE applications of ultrasonics, vibration, acoustic emission and thermal wave sciences. Cover methodologies of penetrant and eddy current diagnostics. Illustrate NDE concepts through laboratory experiments. Offered Fall.

ME 7850 Dynamics and Vibration of Automotive Engines Cr. 4
Covers kinematics, dynamics and balance of reciprocating engines, engine mounts and torsional vibrations of powertrains. Offered Yearly.
Prerequisite: ME 5800, with a minimum grade of C-

ME 7990 Directed Study Cr. 1-4
Advanced study and instruction in mechanical engineering. Offered Every Term.
Repeatable for 4 Credits

ME 7995 Special Topics in Mechanical Engineering II Cr. 1-8
Special subject matter in mechanical engineering. Topics to be announced in Schedule of Classes. Offered Irregularly.
Repeatable for 8 Credits

ME 7996 Research Cr. 1-4
Perform experimental and analytic study on a selected topic in mechanical engineering. Offered Every Term.
Repeatable for 4 Credits
ME 8020 Crashworthiness and Occupant Protection in Transportation Systems I Cr. 4
Introduce crashworthiness and occupant safety facts along with computational environment influences. Review of federal motor vehicle safety regulations. Design strategies for crash load sustainment and disbursement. Review the plasticity theory and its application to modeling and design. Define strategic material selection for crash affected and related regions. Cover modeling, analysis and simulation techniques in restraint systems, energy management, and various barrier crash tests. Offered Fall, Winter.
**Prerequisite:** ME 5040, with a minimum grade of C-

ME 8030 Crashworthiness and Occupant Protection in Transportation Systems II Cr. 4
Develop mathematical models of vehicle crashes in front, side, rear, and rollover modes. Cover roles of vehicle structures and restraint systems in reducing risk of injury. Offered Winter.
**Prerequisite:** ME 8020, with a minimum grade of C

ME 8290 Advanced Combustion and Emissions II Cr. 4
Introduce single-component and multi-component droplet evaporation and combustion processes, liquid fuel sprays formation, evaporation and combustible mixture formation, comparison between autoignition of homogeneous and heterogeneous mixtures, diffusion flames, combustion of liquid sprays in compression ignition engines and emission control strategies along with advances in gasoline compression ignition engines. Offered Winter.
**Prerequisite:** ME 7260, with a minimum grade of C

ME 8999 Master's Thesis Research and Direction Cr. 1-8
Offered Every Term.

ME 9990 Pre-Doctoral Candidacy Research Cr. 1-8
Research in preparation for doctoral dissertation. Offered Every Term.
**Repeatable for 12 Credits**

ME 9991 Doctoral Candidate Status I: Dissertation Research and Direction Cr. 7.5
Offered Every Term.

ME 9992 Doctoral Candidate Status II: Dissertation Research and Direction Cr. 7.5
Offered Every Term.
**Prerequisite:** ME 9991, with a minimum grade of S

ME 9993 Doctoral Candidate Status III: Dissertation Research and Direction Cr. 7.5
Offered Every Term.
**Prerequisite:** ME 9992, with a minimum grade of S

ME 9994 Doctoral Candidate Status IV: Dissertation Research and Direction Cr. 7.5
Offered Every Term.
**Prerequisite:** ME 9993, with a minimum grade of S

ME 9995 Candidate Maintenance Status: Doctoral Dissertation Research and Direction Cr. 0
Offered Every Term.
**Repeatable for 0 Credits**