ME 510  Finite Element Methods  3 Credit Hours
Overview and applications of FE theory in linear static and dynamic systems. Review of matrices, strain and stress tensors. Variational and energy principles in FEA. Applications in linear stress analysis; 1D, 2D and 3D. Transient solutions; modal analysis. Modeling concepts. Use of general purpose codes like ANSYS, NISA, ARIES. Project work. Graduate standing or special permission. (YR).
Restriction(s):
Cannot enroll if Class is
Cannot enroll if Major is Mechanical Engineering-NCFD, Bioengineering, Mechanical Engineering

ME 512  Structural Dynamics  3 Credit Hours
Advanced treatment of dynamic structural theories. Topics covered include: Rayleigh and Timoshenko beams and plates; free and forced vibration response of structural components; static and dynamic stability; and impact.
Restriction(s):
Cannot enroll if Level is
Cannot enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

ME 514  Advanced Mechanics of Materials  3 Credit Hours
Stresses and deformations in mechanical and structural elements and systems; theory, analysis and applications. Topics selected from among the following in applied elasticity and advanced mechanics of materials: stress and strain transformation; plane theory of elasticity and stress functions; energy methods; thick-walled cylinders and spinning disks; torsion of non-circular and hollow sections; unsymmetric bending and shear center; curved beams; beams on elastic foundations; plates and shells; elastic stability. Graduate standing or permission of instructor. (YR).
Restriction(s):
Cannot enroll if Level is
Cannot enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

ME 515  Advanced Mechanics of Solids  3 Credit Hours
Restriction(s):
Cannot enroll if Level is
Cannot enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

ME 516  Special Topics in Mech Eng  1 to 3 Credit Hours
Selected topics pertinent to mechanical engineering. Graduate standing or special permission. (YR).
Restriction(s):
Cannot enroll if Class is
Cannot enroll if Level is
Cannot enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

ME 518  Advanced Engineering Analysis  3 Credit Hours
The course emphasizes the exact methods used in the solution of the partial differential equations that arise in advanced engineering problems. Examples are taken from heat transfer, fluid dynamics, solid mechanics, electromagnetic theory, vibrations, etc. Linear integral equations, time dependent boundary conditions, nonlinear boundary conditions, and other topics. Graduate standing or special permission. (YR).
Restriction(s):
Cannot enroll if Class is
Cannot enroll if Level is
Cannot enroll if Major is Mechanical Engineering-NCFD, Bioengineering, Mechanical Engineering

ME 520  Dyn and Therm of Comp Flow  3 Credit Hours
Review of basic equations of fluid mechanics and thermodynamics in control volume form. One-dimensional, compressible flow involving area change, normal shocks, friction, heat transfer, and combined effects. Two-dimensional supersonic flow including linearization, method of characteristics, and oblique shocks. One-dimensional, constant area, unsteady flow. Graduate standing or special permission. (YR).
Restriction(s):
Cannot enroll if Level is
Cannot enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

ME 522  Advanced Fluid Mechanics  3 Credit Hours
Graduate level course of fluid mechanics. Review of fluid flow phenomena based on common principles of transfer of mass, momentum, and energy. Introduction of the fundamental concepts and methods of analysis of fluid flows in industrial and environmental settings. Navier Stokes equations; viscous and inviscid flows; laminar and turbulent flows; boundary layers; drag; thermal convection. Prerequisite: Full course of undergraduate thermodynamics, fluid dynamics, and heat transfer. Course is the equivalent of ME 520. Students who have already taken ME 520 with a grade of B or better will not receive additional credit for ME 522. (WYR)
Restriction(s):
Cannot enroll if Class is
Cannot enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

ME 525  Computational Thermo-Fluids  3 Credit Hours
Prerequisite(s): ME 518
Restriction(s):
Cannot enroll if Level is
Cannot enroll if Major is Mechanical Engineering-NCFD, Bioengineering, Mechanical Engineering
ME 532  Combustion Processes  3 Credit Hours
Prerequisite(s): ME 371*
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is , Mechanical Engineering-NCFD, Mechanical Engineering

ME 535  Advanced Thermodynamics  3 Credit Hours
Advanced treatment of engineering thermodynamics as applied to producing mechanical power and refrigeration. Involves rigorous application of the first and second laws. Topics to be discussed are energy/entropy generation, thermodynamics relations, nonreacting mixtures, and reacting mixtures. Graduate standing or special permission. (YR).
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is , Mechanical Engineering-NCFD, Mechanical Engineering

ME 537  Automotive Air Conditioning  3 Credit Hours
Applications of HVAC fundamentals to analysis and design of automotive air conditioning systems. Topics include psychrometrics, thermal comfort, refrigeration cycles and system design, heating system design, air flow circuits, air space diffusion, compact heat exchanger design, and instrumentation/controls.
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is , Mechanical Engineering-NCFD, Mechanical Engineering

ME 538  Vehicle Thermal Management  3 Credit Hours
This course covers fundamental thermo-fluid principles and advanced topics in thermal management of conventional and electric drive vehicles (EDVs). The topics include: principles of energy conservation, heat transfer, and fluid mechanics; vehicle thermal management system and components; electrification of vehicle thermal management system; EDV thermal management; battery thermal management in EDVs; and waste energy recovery.
Restriction(s):
Cannot enroll if Class is
Can enroll if Major is , Mechanical Engineering-NCFD, Mechanical Engineering

ME 540  Mechanical Vibrations  3 Credit Hours
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is Mechanical Engineering-NCFD, , Bioengineering, Mechanical Engineering

ME 542  Advanced Dynamics  3 Credit Hours
An advanced treatment of analytical mechanics for particles, systems of particles and rigid body motions with special emphasis on three-dimensional motion. Lagrange's equation of motion will be introduced and utilized in the analysis of multiple-mass systems. Computer methods will be covered. Graduate standing or special permission. (YR).
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is Mechanical Engineering-NCFD, , Bioengineering, Mechanical Engineering

ME 543  Vehicle Dynamics  3 Credit Hours
A treatment of the response, ride, and maneuvering of motor vehicles. Road loads, suspension systems, mechanics of pneumatic tires.
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is , Mechanical Engineering-NCFD, Mechanical Engineering

ME 544  Acoustics and Noise Control  3 Credit Hours
Fundamentals of acoustical waves, sound propagation and intensity, instruments for vibration and noise, HVAC system noise, automobile and aircraft noise, noise control techniques. Graduate standing or special permission. (YR).
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is , Mechanical Engineering-NCFD, Mechanical Engineering

ME 547  Powertrains I  3 Credit Hours
Topics in vehicle powertrain kinematics and dynamics, engine output characteristics, vehicle road load analysis, engine-transmission matching, design and analysis of gears and gear systems, planetary gear trains, design of powertrain components, clutch design and analysis, transmission design and analysis, torque and ratio analysis of automatic transmissions. (YR).
Restriction(s):
Cannot enroll if Class is
Can enroll if Major is , Mechanical Engineering-NCFD, Mechanical Engineering

ME 548  Automotive Powertrains II  3 Credit Hours
Simulation of vehicle performance; dynamics in gear shifting; engine balance, fuel economy, and performance related to powertrains; powertrain arrangements, manual and automatic transmissions, automotive axles, four-wheel-drive systems; design and manufacturing of gearing systems.
Prerequisite(s): AENG 547 or ME 547
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is , Mechanical Engineering-NCFD, Mechanical Engineering

ME 552  Sustainable Energy Systems  3 Credit Hours
The course provides an overview of energy technology from a broad perspective that encompasses technical and environmental aspects. It covers a wide range of traditional and alternative energy sources and presents assessments of their availability, sustainability, and environmental impacts as well as evaluation of their potential role in solving the global energy problem. Course work includes project.
Restriction(s):
Cannot enroll if Class is
Can enroll if Major is , Mechanical Engineering-NCFD, Mechanical Engineering

Can enroll if Major is Mechanical Engineering-NCFD, , Bioengineering, Mechanical Engineering
**ME 554  Theory of Gearing and Application  3 Credit Hours**
The course emphasizes the theory and methodology for the design, manufacturing and analysis of gears and other engineering surfaces. Topics include differential geometry, kinematics of conjugate motions, surface enveloping, curvatures, cutter design, machine tool settings, simulation of machining process, tooth contact analysis, geometry modeling and design of power transmissions. Graduate standing or special permission. (YR).

**Restriction(s):**
- Cannot enroll if Class is
- Cannot enroll if Level is
- Can enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

**ME 555  Stress and Strength Cons in Design  3 Credit Hours**
Treatement of stress and strength aspects of machine design. Analytic and experimental determination of stresses in machine members. Evaluation of strength under steady and fatigue loadings. Post-yield behavior, residual stress, temperature and corrosion effects. Graduate standing or special permission. (YR).

**Restriction(s):**
- Can enroll if Level is Rackham or Graduate
- Can enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

**ME 556  Fracture and Fatigue Cons in Dsgn  3 Credit Hours**
A comprehensive review of fracture and fatigue processes in engineering material with emphasis on mechanics instead of mechanisms of failure. Design methodology based on fracture toughness and fatigue crack propagation is presented. Laboratory test methods and data interpretations are also presented. Graduate standing or permission of instructor. (YR).

**Restriction(s):**
- Cannot enroll if Level is
- Can enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

**ME 558  Advanced Instrum and Control  3 Credit Hours**
Analysis of design techniques in modern control theory are presented. State space concepts, digital control, and adaptive control methods are covered, along with information on practical implementation problems experienced with these control techniques. Graduate standing or special permission. (YR).

**Restriction(s):**
- Can enroll if Level is Rackham or Graduate
- Can enroll if Major is Mechanical Engineering-NCFD, Bioengineering, Mechanical Engineering

**ME 563  Mechatronics  3 Credit Hours**
Mechatronics, as an engineering discipline, is the synergistic combination of mechanical engineering, electrical engineering, control engineering, and computer science, all integrated through the design process. The course is to establish a working familiarity with the key engineering elements in the design and control of electro-mechanical systems in general and automotive systems in particular. The key engineering elements include microprocessor technology, electronics, sensors and actuators, data communication and interface, control algorithms, and mechanisms of machine elements. The course is to introduce a design methodology in an integrated system environment through case studies and design projects. (AY).

**Restriction(s):**
- Cannot enroll if Class is
- Can enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

**ME 567  Reliability Consid in Design  3 Credit Hours**
Theory and application of common statistical distributions to the analysis of both life and strength data for components. Introduction to system reliability. Emphasis on use of digital computer in reliability simulation and analysis. Graduate standing or special permission. (YR).

**Restriction(s):**
- Cannot enroll if Level is
- Can enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

**ME 570  Powertrain NVH of Elect Veh  3 Credit Hours**
This course focuses on the Noise, Vibration and Harshness (NVH) characteristics of Electric Vehicles (EV), Hybrid Electrical Vehicles (HEV), and Plug-In Electric Vehicles (PHEV). Topics include principles of mechanical vibration and acoustics, driveline induced noise/vibration from both conventional internal combustion engine and electrical motor/generator, cooling fan noise, regenerative braking system and electrical accessory noise. The potential countermeasures for typical noise/vibration sources will be presented. The course consists of classroom lectures and experimental laboratory sessions. The laboratory sessions will provide the student with hands-on experience on noise/vibration measurements and analyses. The student will be required to carry out a course project on NVH related subject of electrified vehicles.

**Restriction(s):**
- Cannot enroll if Class is
- Can enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

**ME 571  Conduction Heat Transfer  3 Credit Hours**
Conduction heat transfer in steady and transient state, including heat sources. Analytical, numerical, graphical, and analog methods of solution for steady and fluctuating boundary conditions. Thermal stresses. Dynamics of thermal instrumentation and heat exchangers. Graduate standing or special permission. (YR).

**Restriction(s):**
- Cannot enroll if Level is
- Can enroll if Major is Mechanical Engineering-NCFD, Bioengineering, Mechanical Engineering
ME 572 Convection Heat Transfer 3 Credit Hours
The course is primarily concerned with the determination of the rate of heat transfer due to the transport of energy to or from surfaces by both molecular conduction processes and gross fluid movement inside channels and over external surfaces. Emphasis will be placed on basic understanding of the convection heat transfer phenomena and the necessary mathematical techniques for the solution of such problems along with engineering applications. Graduate standing or special permission. (YR).
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is Mechanical Engineering-NCFD, Bioengineering, Mechanical Engineering

ME 573 Radiative Transport of Heat 3 Credit Hours
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

ME 576 Battery Sys Modeling & Ctrl 3 Credit Hours
Full Course Title: Battery Systems, Modeling, and Control This course will cover modeling, control, and estimation techniques for battery systems. Students will learn how electrochemical systems work and how they can be mathematically described. A simple phenomenological electrical circuit model and a detailed physics-based model that can capture diffusion dynamics will be covered. The thermal behavior of a battery system and its modeling will be covered as well. Students will learn the basic functions of battery management systems for monitoring state-of-charge, state-of-power, and state-of-health in applications to automotive and consumer electronics. (OC).
Restriction(s):
Can enroll if Level is Doctorate or Rackham or Graduate
Can enroll if Major is Automotive Systems Engineering

ME 577 Energy Conversion 3 Credit Hours
This course covers fundamental engineering principles for converting available energy sources, renewable and nonrenewable, into other energy forms of direct utility. It may include such topics as steam and gas based power plants as well as devices for solar, wind, and hydraulic energy conversion.
Restriction(s):
Cannot enroll if Class is
Cannot enroll if Level is
Can enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

ME 580 Advanced Engineering Materials 3 Credit Hours
A second course in materials which expands the philosophy that all materials possess common traits which allow: (1) interchange of classes of materials to perform the same function, e.g., metals, polymers, ceramics, composites, etc.; and (2) understanding of the mechanisms of property controls in new materials. There is an attempt to provide equal representation of the science and the phenomena of engineering materials. Greater emphasis is placed on thermodynamics, stress-strain relations, multicomponent phase equilibria, and such other areas as received minimal exposure in the first course in materials. As a result of present technology trends, more time is spent on composites and achievement of design specifications through synthesis. Graduate standing or special permission. (YR).
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

ME 582 Injection Molding 3 Credit Hours
This is an in-depth course on injection molding processes, which include the conventional injection molding process, low pressure injection molding, structural sandwich molding, gas assisted injection molding etc. Material, process and tool design parameters are emphasized. The roles of rheology and flow modeling are discussed. Design issues for injection molded products are also discussed. Injection molding applied to other materials, such as ceramics, is also described. (YR).
Restriction(s):
Can enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

ME 583 Mechanical Behav of Materials 3 Credit Hours
Mechanical behavior of materials are covered in relation to their structures, deformation characteristics and failure mechanisms. Means of improving strength, fracture toughness and other mechanical properties are discussed. Environmental effects on mechanical behavior are also included. The emphasis is on metals; however, polymers and ceramics are also covered. Graduate standing or special permission. (YR).
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering

ME 584 Mechanical Behavior of Polymer 3 Credit Hours
Mechanical behavior of polymers and ceramics are considered in relation to their structures, processing and applications. Emphasis is given on their deformation, fatigue and fracture characteristics. Strengthening mechanisms for both materials are discussed. Graduate standing or special permission. (YR).
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is Mechanical Engineering-NCFD, Mechanical Engineering
ME 585 Cast Metals in Eng Design 3 Credit Hours
An understanding of the properties of the most important cast metals is obtained by melting, casting, and testing. In addition to measurement of mechanical properties, resistance to heat, wear, and corrosion is discussed. The application of these properties in the design of critical parts in the aircraft, automotive, chemical, mining, and railroad industries is presented by case histories and examination of castings. Graduate standing or special permission. (YR).
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is , Mechanical Engineering-NCFD, Mechanical Engineering

ME 586 Materials Consid in Manufactur 3 Credit Hours
Manufacturability of materials and influence of processing variables on the properties of manufactured products are important considerations in materials selection and product design. These issues are addressed on the basis of mechanical deformation and thermal characteristics of materials during processing. Test methods to measure formability, castability, machinability, etc., are critically discussed. Defects in manufactured products including their origin and detection are also discussed. Graduate standing or special permission. (YR).
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is , Mechanical Engineering-NCFD, Mechanical Engineering

ME 587 Automotive Composites 3 Credit Hours
The emphasis in this course is on automotive composites, such as SMC, SRIM and RTM. In addition to properties and applications of these materials, this course covers manufacturing processes, design considerations, test methods and quality control techniques used for automotive composites. The use of continuous fiber composites in automotive applications, such as leaf springs, drive shafts and energy absorbing structures, are also discussed. (YR).
Restriction(s):
Can enroll if Major is , Mechanical Engineering-NCFD, Mechanical Engineering

ME 589 Composite Materials 3 Credit Hours
This course will consider four different aspects of composite materials; namely, materials, mechanics, manufacturing and design. Recent developments on fiber reinforced plastics and metals will be covered. Fundamental analytical concepts on micro and macro mechanics will be emphasized to create a better understanding of the design principles of composite materials. Graduate standing or special permission. (YR).
Restriction(s):
Cannot enroll if Class is
Cannot enroll if Level is
Can enroll if Major is , Mechanical Engineering-NCFD, Mechanical Engineering

ME 591 Degradation of Materials 3 Credit Hours
The course will introduce students to the fundamentals of corrosion and degradation behavior of materials. The degradation of metals, polymers and composites will be discussed. Monitoring and life prediction techniques will be covered. Preventive measures such as a materials selection and design, protective coating, surface treatments, inhibitors, and electrochemical techniques are applied, when they should be used, and how various techniques can be integrated to solve complex problems. (AY).
Restriction(s):
Cannot enroll if Class is
Can enroll if Major is , Mechanical Engineering-NCFD, Mechanical Engineering

ME 592 Fuel Cells 3 Credit Hours
This course covers fundamentals of fuel cell systems for both automotive and distributed power applications. Detailed descriptions of the principles and component designs of various types of fuel cells including proton exchange membrane fuel cell (PEMFC), phosphoric acid fuel cell (PAFC), solid oxide fuel cell (SOFC), and molten carbonate fuel cell (MCFC). Discussions on water and thermal management, and balance of power plant. Review of hydrogen storage and safety consideration. Challenges and future opportunities.
Restriction(s):
Cannot enroll if Class is
Can enroll if Major is , Mechanical Engineering-NCFD, Mechanical Engineering

ME 593 Powder Materials & Processing 3 Credit Hours
A lecture course that provides a comprehensive understanding of the theory and principles, the associated synthesis, processing, and characterization techniques; and the applications of powder and particulate materials. The students will gain knowledge of the following: fundamentals of powder and particulate materials (metals and ceramics), various metallic and non-metallic powder synthesis/production techniques, diverse techniques of powder characterization, and the principles and methods of homogenization, compaction, and sintering. Students will be exposed to the relevant criteria for designing parts/components based on powder and particulate materials and, will familiarize themselves with a wide range of applications as structural, functional, and biomedical components made of metallic, ceramic, and composite powders in various industries. (OC)
Restriction(s):
Can enroll if Major is , Mechanical Engineering-NCFD, Mechanical Engineering
ME 595  Digital Manufacturing  3 Credit Hours
This combined lecture and hands on project course aims to train
students to optimize the interplay of materials, people, machines and
profitability. The course introduces methods to identify product concepts
with commercial potential. Student teams will perform market analysis
and explore the intellectual property space around their ideas and
rapidly iterate them into a final prototype via direct digital manufacturing
(e.g., 3D CAD/CAM files manifested via digital printing or machining).
Advanced instruction on direct digital manufacturing tools will be given,
and customer response will be used as feedback. Early stage prototypes
will progress into more sophisticated designs, scaling up (cost, pricing,
tooling, process flow and automation) scenario planning for mass
manufacturing as well as Failure Mode Effect Analysis (FMEA) will be
discussed. (W, YR).
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is Mechanical Engineering-NCFD, Mechanical
Engineering

ME 596  Internal Combustion Engines I  3 Credit Hours
Comparison of several forms of internal combustion engines including
Otto and Diesel type piston engines; performance parameters and
testing; thermodynamic cycles and fuel-air cycles; combustion in SI and
Diesel engines; charge formation and handling; ignition; elements of
exhaust emissions. (Not available to students with ME 496 or equivalent
background.)
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is Mechanical Engineering-NCFD, Mechanical
Engineering

ME 597  Internal Combustion Engines II  3 Credit Hours
Fuel flow and air flow measurements and techniques; engine maps; fuel
and ignition control and control strategies; combustion and burn rate
considerations in engine design; intake and exhaust systems; emissions
and control strategies; emission test procedures.
Prerequisite(s): AENG 596 or ME 596
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is Mechanical Engineering-NCFD, Mechanical
Engineering

ME 598  Engine Emissions  3 Credit Hours
This course introduces students to the fundamentals of engine exhaust
emissions, including their formation mechanisms and abatement
techniques. The students will be familiarized with the present emission
control technologies and future challenges. The topics covered include:
engine emissions and air pollution; review of emission regulations;
catalyst fundamentals; catalyst aftertreatment techniques for gasoline,
diesel, and lead-burn engines; discussion of cold start emission control
and breakthrough catalytic technologies. (AY).
Restriction(s):
Cannot enroll if Level is
Can enroll if Major is Mechanical Engineering-NCFD, Mechanical
Engineering

ME 600  Study or Res in Sel Mech Eng  1 to 3 Credit Hours
Individual or group study or design in an area of Mechanical Engineering
under the supervision of a member of the graduate faculty. The student
will submit a report on the project and give an oral presentation to a panel
of faculty members at the close of the term. Graduate standing or special
permission. (YR).
Restriction(s):
Can enroll if Class is Graduate
Can enroll if Level is Rackham or Graduate

ME 601  Exper Research in Mech Eng  1 to 3 Credit Hours
Laboratory investigation in an area of Mechanical Engineering under
the supervision of a member of the graduate faculty. The student will
submit a report on the project and give an oral presentation to a panel of
faculty members at the close of the term.
Restriction(s):
Can enroll if Class is Graduate

ME 602  Guided Study in Mech Eng  1 to 6 Credit Hours
Independent Study of specified material in an area of Mechanical
Engineering under the guidance of a member of the graduate faculty. The
student will submit a report on the project and give an oral presentation
a panel of faculty members at the close of the term.
Restriction(s):
Can enroll if Class is Graduate

ME 607  Adv Mechanical Engin Problems  3 Credit Hours
A graduate-level analytical study of selected topics in mechanical
engineering. The subjects of study in each term usually depend
on student and instructor interest. Typical areas of study include
vibrations of continuous or lumped systems, fluid mechanics, devices,
thermodynamics, heat transfer, mechanics of solids, materials, or
processing, etc. The course can be organized to meet the subject needs
of a group of students with mutual interests.
Restriction(s):
Can enroll if Class is Graduate

ME 610  Finite Elem Methods--Nonlinear  3 Credit Hours
Review of FE theory in linear static. FEA in dynamics. FEA in heat
transfer. FEA in fluid mechanics. FEA in nonlinear problems; material and
gerometrical nonlinearities, total and updated Lagrangian formulations,
solution techniques. Use of FE codes. Graduate standing or special
permission. (YR).
Prerequisite(s): ME 510
Restriction(s):
Can enroll if Class is Graduate

ME 611  Modeling of Engr Mats  3 Credit Hours
Full Course Title: Modeling of Engineering Materials
This course will present the mathematical models and constitutive behavior of
engineering materials subjected to mechanical and non-mechanical
loads. It will consider both linear and non-linear models to describe
elastic, plastic, viscoelastic, viscoplastic, hypo- and hyper-elastic response
of materials to mechanical loads. Non-mechanical loads will include
thermal and electro-mechanical fields. Micro-scale and multi-scale
mechanical modeling will also be introduced. (OC)
Prerequisite(s): ME 518
Restriction(s):
Can enroll if Level is Doctorate or Rackham or Graduate
Can enroll if Program is
ME 622  Adv Topics in Fluid Mechanics  3 Credit Hours
The course presents selected topics of contemporary advanced fluid mechanics, such as the hydrodynamic stability theory, turbulence, multi-phase flows, magnetohydrodynamics, interfacial flows, flows of non-newtonian fluids, micro- and nano-fluid mechanics, biofluid mechanics, etc.
Prerequisite(s): ME 522
Restriction(s):
Can enroll if Class is Graduate
Can enroll if Level is Rackham or Graduate or or Doctorate
Can enroll if Program is PHD-Automotive Engineering, MSE-Mechanical Engineering, MSE-Automotive Engineering

ME 640  Advanced Vibration Theory  3 Credit Hours
The course will emphasize the similarities between various types of continuous systems as well as common features of continuous and discrete systems. Variational principle will be introduced as a notion of natural modes of vibration for discrete systems is reviewed. Natural modes of vibration for continuous systems will be discussed using the boundary value formulation, the general formulation of the eigenvalue problem and orthogonality. These concepts will be applied to bars, rods, membranes, and plates. Approximate methods will be introduced to determine the natural modes of vibration for complex continuous systems. A few methods to be considered include the Rayleigh-Ritz, Galerkin, Collocation, Myklestad, and Lumped-parameter methods. All the approximate methods presented will allow expedient numerical solution by means of high-speed computers. The damped and undamped response to deterministic excitations will be considered for various systems. Graduate standing or special permission. (YR).
Prerequisite(s): ME 540
Restriction(s):
Can enroll if Level is Rackham or Graduate

ME 642  Simulation of Mechanic Systems  3 Credit Hours
Analysis, synthesis, and optimization of linear, multilinear and nonlinear mechanical systems with the electronic analog computer. Graduate standing or special permission. (YR).
Prerequisite(s): ECE 365
Restriction(s):
Can enroll if Level is Rackham or Graduate

ME 675  Predictive Control of Dynamic Systems  3 Credit Hours
This course covers predictive control of dynamic systems to students working on controls. The topics will include unconstrained and constrained optimization, discrete-time optimal control problems, dynamic programming, stability, invariance, reachability, and linear predictive control problems with application examples in mechanical engineering. (OC).
Prerequisite(s): ME 564 or ECE 560

ME 699  Master's Thesis  1 to 6 Credit Hours
Graduate students electing the course, while working under the general supervision of a member of the department faculty, are expected to plan and carry out the work themselves and submit a thesis for review and approval, and also present an oral defense of the thesis. Students must satisfactorily complete 6 credit hours in ME 699, but these hours may be spread over more than one term. Graduate standing or special permission. (YR).
Restriction(s):
Can enroll if Class is Graduate

ME 791  Adv Guided Research  1 to 6 Credit Hours
Independent study and research work on the material related to the doctoral research project under the guidance of the faculty advisor. The course is for doctoral students who have not completed the PhD program's coursework requirements. A report and an oral presentation are required. (F,W,S)
Restriction(s):
Can enroll if Level is or Doctorate
Can enroll if College is Engineering and Computer Science
Can enroll if Major is Mechanical Engineering

ME 798  Doctoral Seminar  0 Credit Hours
After attaining candidacy, every Ph.D. student is required to attend and actively participate in research seminars given by CECS Dean's office or individual departments in CECS. A student gets a satisfactory grade if he/she attends at least two research seminars during the course period. (F,W,S)
Restriction(s):
Can enroll if Level is or Doctorate
Can enroll if Major is

ME 980  Pre-Cand Dissertation Research  1 to 9 Credit Hours
Full Title: Pre-Candidate Dissertation Research Dissertation work by a pre-candidate student in Mechanical Sciences and Engineering program conducted under guidance of the faculty advisor. (F,W,S)
Restriction(s):
Can enroll if Level is Doctorate or
Can enroll if Major is

ME 990  Doctoral Dissertation  1 to 9 Credit Hours
Dissertation work by a student of the Ph.D. in Mechanical Sciences and Engineering Program conducted under guidance of the faculty advisor. The student must be admitted to the Ph.D. candidacy status.
Restriction(s):
Can enroll if Level is Doctorate or
Can enroll if Major is

* An asterisk denotes that a course may be taken concurrently.

Frequency of Offering

The following abbreviations are used to denote the frequency of offering:
(F) fall term; (W) winter term; (S) summer term; (F, W) fall and winter terms; (YR) once a year; (AY) alternating years; (OC) offered occasionally