

# MECHANICAL ENGINEERING (ME)

## Mechanical Engineering (ME) Courses

### ME 5013. Topics in Mechanical Engineering. (3-0) 3 Credit Hours.

Prerequisite: Graduate standing in engineering or consent of instructor. Current topics in mechanical engineering, such as advanced fracture mechanics, lean manufacturing, advanced manufacturing engineering and advanced energy systems. May be repeated for credit with consent of Graduate Committee as topics vary. This course has Differential Tuition.

### ME 5023. Numerical Techniques in Engineering Analysis. (3-0) 3 Credit Hours.

Prerequisite: Graduate standing in engineering or consent of instructor. Advanced methods of applied mathematics, including numerical linear algebra, initial value problems, stability, convergence, partial differential equations, and optimization. (Same as EGR 5023. Credit cannot be earned for both ME 5023 and EGR 5023.) This course has Differential Tuition.

### ME 5033. Engineering Optics. (3-0) 3 Credit Hours.

Prerequisite: Graduate standing in engineering or consent of instructor. Overview of the principles of light, key definitions, and units. Key concepts of linear geometric optics and optical components (e.g., simple lenses, mirrors, diffraction gratings, prisms, coatings, and camera lenses), detectors (PMTs, photodiodes, CCDs, etc.), and lasers. Design of modern optical experiments with an introduction to the current state-of-the-art in optical diagnostics used in aerospace and mechanical engineering. This course has Differential Tuition.

### ME 5053. Propulsion. (3-0) 3 Credit Hours.

Prerequisite: Graduate standing in engineering or consent of instructor. Application of thermodynamics and fluid mechanics to the analysis of problems related to the propulsion of aerospace vehicles. Development of control volume analysis techniques for compressible flow problems, with applications in the design and analysis of rocket nozzles and state-of-the-art propulsion systems like ramjets, scramjets, and detonation cycle systems. This course has Differential Tuition.

### ME 5213. Topics in Systems Modeling. (3-0) 3 Credit Hours.

Prerequisite: Graduate standing in engineering. Systems analysis approach to formulating and solving engineering problems. Topics include operational research, mathematical modeling, optimization, linear and dynamic programming, decision analysis, and statistical quality control. Topic 1: Applied Operations Research. Application of operations research methods to practical engineering problems. Topic 2: Engineering Systems Modeling. Modeling of modern engineering systems for operational and management control. May be repeated for credit as topics vary. (Same as CE 5013 and EGR 5213. Credit can only be earned for one course: ME 5213, EGR 5213 or CE 5013.) This course has Differential Tuition. Course Fee: L001 \$25.

### ME 5233. Advanced Quality Control. (3-0) 3 Credit Hours.

Prerequisite: Graduate standing in engineering or consent of instructor. Methods and techniques for process control, process and gage capabilities, inspection plans, American National Standard, and recent advanced techniques. Tour of manufacturing industry. Case studies in process control, outgoing quality, and costs. A project, assigned by a manufacturing company, is required, along with a final presentation of the project. (Same as EGR 5233. Credit cannot be earned for both ME 5233 and EGR 5233.) This course has Differential Tuition.

### ME 5243. Advanced Thermodynamics. (3-0) 3 Credit Hours.

Prerequisite: ME 3293. Concepts and postulates of macroscopic thermodynamics; formulation of thermodynamic principles; exergy stability of thermodynamic systems, principles of irreversible thermodynamics, chemical equilibria. This course has Differential Tuition.

### ME 5263. Combustion. (3-0) 3 Credit Hours.

Prerequisite: ME 4293. Thermochemistry and transport theory applied to combustion; gas phase equilibrium; energy balances; reaction kinetics; flame temperatures, speed, ignition, and extinction; premixed and diffusion flames; combustion aerodynamics; mechanisms of air pollution. This course has Differential Tuition. Course Fee: LRE1 \$25; STSE \$30.

### ME 5273. Alternative Energy Sources. (3-0) 3 Credit Hours.

Prerequisite: ME 3293. Solar, nuclear, wind, hydrogen, and geothermal energy sources. Resources, production, utilization, economics, sustainability, and environmental considerations. (Same as CE 5643. Credit cannot be earned for both ME 5273 and CE 5643.) This course has Differential Tuition. Course Fee: LRE1 \$25; STSE \$30.

### ME 5303. Advanced Heat and Mass Transfer. (3-0) 3 Credit Hours.

Prerequisite: ME 4313. Derivation of energy and mass conservation equations with constitutive laws for conduction, convection, radiation, and mass diffusion. Dimensional analysis, heat exchangers, boiling and condensation, steady and transient solutions. This course has Differential Tuition.

### ME 5373. Corrosion Engineering. (3-0) 3 Credit Hours.

Prerequisite: Graduate standing in engineering or consent of instructor. Application of thermodynamics and kinetics to the analysis of problems related to Corrosion. Introduction of techniques for corrosion assessment and corrosion control methods. Inspection of corrosion cases and development of corrosion control strategies to mitigate corrosion problems. This course has Differential Tuition.

### ME 5453. Advanced Strength of Materials. (3-0) 3 Credit Hours.

Prerequisite: Graduate standing in engineering or consent of instructor. Failure theories, energy methods, advanced topics in bending, torsion, and stress concentration. (Formerly EGR 5553. Credit cannot be earned for both ME 5453 and EGR 5553.) This course has Differential Tuition.

### ME 5463. Fracture Mechanics. (3-0) 3 Credit Hours.

Prerequisite: Graduate standing in engineering or consent of instructor. Introduction to failure and fracture of engineering materials, Griffith's energy balance, stress intensity and strain energy release rate approaches to brittle fracture, Dugdale and Irwin approaches to ductile fracture. Application to modern engineering materials. (Formerly EGR 5313. Credit cannot be earned for both ME 5463 and EGR 5313.) This course has Differential Tuition.

### ME 5473. Viscoelasticity. (3-0) 3 Credit Hours.

Prerequisite: Graduate standing in engineering or consent of instructor. Principle of fading memory, integro-differential constitutive laws, mechanical models, time and temperature superposition, and linear and nonlinear methods. Applications to polymers, composites, and adhesives. (Formerly EGR 5323. Credit cannot be earned for both ME 5473 and EGR 5323.) This course has Differential Tuition. Course Fee: LRE1 \$25; STSE \$30.

### ME 5483. Finite Element Methods. (3-0) 3 Credit Hours.

Prerequisite: Graduate standing in engineering or consent of instructor. Derivation and computer implementation of the finite element method for the solution of boundary value problems. (Formerly CE 5023. Same as CE 5193. Credit cannot be earned for more than one of the following: ME 5483, CE 5023, and CE 5193.) This course has Differential Tuition.

**ME 5493. Fundamentals of Robotics. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Theoretical and analytic developments, Denavit-Hartenberg parameters, quaternions, state-space, linear and nonlinear analysis, classical and modern methods of mechanics, serial manipulators, parallel manipulators, and controls. This course has Differential Tuition.

**ME 5503. Lean Manufacturing and Lean Enterprises. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Methodologies for transforming an enterprise into a lean enterprise. Topics include Lean Manufacturing basics and tools; Lean Implementation Guidelines; Lean Metrics and Performance Measures; Lean Extended Enterprise; and Lean Supply Chain Design and Management. Hands-on Value Stream Mapping project is required. This course has Differential Tuition.

**ME 5513. Advanced Mechanism Design. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Advanced topics in kinematic synthesis of linkage, static and dynamic force analyses, and computer-aided design of mechanisms. This course has Differential Tuition. Course Fee: LRE1 \$25; STSE \$30.

**ME 5543. Probabilistic Engineering Design. (3-0) 3 Credit Hours.**

Prerequisite: STA 2303 or an equivalent. Development and application of probabilistic methods in engineering: random variable definitions, probability distributions, distribution selection, functions of random variables, numerical methods including Monte Carlo sampling, First Order Reliability Methods, and component and systems reliability. (Same as BME 6333. Credit cannot be earned for both BME 6333 and ME 5543.) This course has Differential Tuition.

**ME 5563. Computer Integrated Manufacturing. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Concepts and modern methods for computer-integrated manufacturing, planning and execution, shopfloor automation and controls, and emerging technologies. Includes hands-on practices on numerical controls and programmable controls. This course has Differential Tuition.

**ME 5573. Facilities Planning and Design. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Advanced concepts and fundamentals essential to understand, analyze, and solve problems related to manufacturing plant layout and material handling system selection. Topics include Product, Process, and Schedule Design; Flow, Space, and Activity Relationships; Material Handling; Layout Planning Models and Design Algorithms; and Warehouse Operations. The subjects included in this course are organized around integrated product, process, and manufacturing system design principles. This course has Differential Tuition. Course Fee: LRE1 \$25; STSE \$30.

**ME 5583. Process Improvement and Variability Reduction. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Concepts, methodologies, and tools for analyzing and improving manufacturing systems and enterprise operations. Topics include systems capability evaluation, Six Sigma and DMAIC, root-cause analysis, statistical process control, and other contemporary process engineering approaches. This course has Differential Tuition.

**ME 5603. Advanced Manufacturing Systems Engineering. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Design, planning, scheduling, and control of manufacturing systems with emphasis on information flow and decision-making. Analytical models and discrete-event simulation will be introduced to evaluate system performance under different production planning and control strategies. Contemporary manufacturing topics and research areas are emphasized. This course has Differential Tuition.

**ME 5633. Advanced Compressible Flow. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Integral and differential forms of the conservation equations, one-dimensional flow, oblique shock and expansion waves, and supersonic, transonic, and hypersonic flows. (Formerly titled "Gas Dynamics.") This course has Differential Tuition.

**ME 5643. Green and Sustainable Manufacturing and Enterprise Systems. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing, ME 5503, or consent of instructor. Advanced concepts, tools and topics in eliminating wastes from the processes and operations of manufacturing firms via the perspective of the environment. Topics include identifying, measuring, and minimizing environmental wastes related to energy, water, materials, garbage, transportation, emissions, and biodiversity, as well as ways to totally eliminate these environmental wastes from green value stream mapping techniques. Readings and survey of contemporary technologies and tools enabling green and sustainable manufacturing and enterprise systems are also required. (Formerly titled "Advanced Topics in Manufacturing and Enterprise Engineering.") This course has Differential Tuition.

**ME 5653. Computational Fluid Dynamics. (3-0) 3 Credit Hours.**

Prerequisite: ME 3663 or an equivalent. The mathematical models for fluid-flow simulations at various levels of approximation, basic description techniques, and the nature of flow equations and their boundary conditions. This course has Differential Tuition.

**ME 5673. Supply Chain Engineering. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. This course addresses critical issues faced in modern supply chains. Students will review essential information, constraints, and existing methodologies for problem-solving. Covered topics encompass production scheduling, inventory systems, package-courier systems, ground transportation, container shipping, railroad operations, and air cargo. Additionally, the course examines technologies supporting efficient supply chain operations. This course has Differential Tuition.

**ME 5693. Aircraft Performance. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Study of aircraft performance using the governing equations of fluid dynamics, atmospheric properties, and the concepts of lift and drag. Analysis of level flight performance, rates of climb, service and absolute ceilings, range, takeoff and landing, and turn performance. Study of longitudinal and lateral stability applied to aircraft. This course has Differential Tuition.

**ME 5703. Lean Product Development and Service Systems. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Theory and applications of lean manufacturing and six-sigma to enterprise functions beyond production shop floor, with focus on lean product and process development, lean costing, and integration of IT and ERP systems to sustain continuous improvement. (Credit cannot be earned for both ME 5703 and ME 5583 taken prior to Fall 2011.) (Formerly titled "Advanced Enterprise Systems Engineering.") This course has Differential Tuition.

**ME 5713. Mechanical Behavior of Materials. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Mechanical behavior of engineering materials (metals, alloys, ceramics, and polymers) elasticity, dislocation theory, strengthening mechanism, fracture, fatigue, creep, and oxidation. This course has Differential Tuition.

**ME 5733. Advanced Medical Device Design and Commercialization. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Topics include classification of medical devices, medical device design and design controls, IP protection, FDA approval processes, human factors in medical device design, and medical device employment by various clinical specialties. (Formerly titled "Advanced Medical Device Design.") This course has Differential Tuition.

**ME 5743. Composite Materials. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Introduction to mechanics of composites, micromechanics, macromechanics, lamination theory, design, and applications of fiber-reinforced composites and particulate composites. (Formerly EGR 5413. Credit cannot be earned for both ME 5743 and EGR 5413.) This course has Differential Tuition. Course Fee: LRE1 \$25; STSE \$30.

**ME 5753. Introduction to Turbulence. (3-0) 3 Credit Hours.**

Fundamental principles of turbulent fluid flows in natural systems with a focus on atmospheric flows, coastal flows, wind energy and physiological flows. Topics include classical and statistical theory of turbulence and energy cascading, spectral analysis of turbulence, atmospheric boundary layer, aerodynamics in diseased and normal coronary artery. This course has Differential Tuition.

**ME 5763. Advanced Scientific Visualization. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Topics include 3D image display and generation techniques, visual thinking process, interaction with visualization, efficiency of visualization on sparse grid, haptic rendering and control, and immersive 3D programming. (Same as EGR 5703. Credit cannot be earned for both ME 5763 and EGR 5703.) This course has Differential Tuition.

**ME 5773. High Performance Computing. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Topics include scientific computing in UNIX/LINUX environment, instruction on several import UNIX applications, various parallelization styles of computing, and application programming interfaces (APIs) in scientific applications. (Formerly EGR 5713. Credit cannot be earned for both EGR 5713 and ME 5773.) This course has Differential Tuition.

**ME 5963. Topics in Bioengineering. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Topics may include: biomechanics, biological systems, biosolid and biofluid, transport phenomena, biomaterials, medical devices, and medical imaging. May be repeated for credit as topics vary. This course has Differential Tuition. Course Fee: LRE1 \$25; STSE \$30.

**ME 5971. Special Project. (0-0) 1 Credit Hour.**

Prerequisite: Permission in writing (form available) from the instructor and the Graduate Advisor of Record. The directed research course is offered only for nonthesis option students and may involve either a laboratory or a theoretical problem. The course requires an oral presentation of the work done at the end of the semester. May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to the Master's degree. This course has Differential Tuition.

**ME 5973. Special Project. (0-0) 3 Credit Hours.**

Prerequisite: Permission in writing (form available) from the instructor and the Graduate Advisor of Record. The directed research course is offered only for nonthesis option students and may involve either a laboratory or a theoretical problem. The course requires an oral presentation of the work done at the end of the semester. May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to the Master's degree. This course has Differential Tuition.

**ME 6013. Advanced Engineering Mathematics I. (3-0) 3 Credit Hours.**

Prerequisite: EGR 2323 and EGR 3323, or equivalent courses. Advanced methods of applied mathematics, including vector differential calculus, linear algebra, functional space and their applications to engineering problems. (Same as BME 6033 and EGR 6013. Credit can only be earned for one course: ME 6013, EGR 6013 or BME 6033.) (Formerly titled "Analytical Techniques in Engineering Analysis.") This course has Differential Tuition. Course Fee: LRE1 \$25; STSE \$30.

**ME 6023. Advanced Engineering Mathematics II. (3-0) 3 Credit Hours.**

Prerequisite: EGR 2323 and EGR 3323, or equivalent courses. Advanced methods of applied mathematics. Topics may include solution methods of partial differential equations, complex analysis, optimization theory, other topics in engineering mathematics and their applications to engineering problems. May be repeated for credit as topics vary. (Same as EGR 6023. Credit cannot be earned for both ME 6023 and EGR 6023.) This course has Differential Tuition. Course Fee: LRE1 \$25; STSE \$30.

**ME 6033. Linear and Mixed Integer Optimization. (3-0) 3 Credit Hours.**

Prerequisite: ME 2173 or equivalent. Graduate standing in engineering or consent of instructor. Introduction to the theory of linear programming and duality, algorithms for solving linear programs, network simplex, integer and mixed integer programming (e.g., simplex, branch and bound and branch and cut). This course provides an overview of optimization theory and algorithms as well as emphasizes its applications in different areas of Engineering. (Same as EGR 6033. Credit cannot be earned for both ME 6033 and EGR 6033.) This course has Differential Tuition.

**ME 6043. Continuum Mechanics. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. The general purpose of the class is to introduce continuum mechanics, the equations of motion, various reference frames, and constitutive modeling. Topics covered in the class include the stress and strain tensors, equations of motion, finite elasticity, shock waves, plasticity theory, virtual displacements and nonlocal formulations. This course has Differential Tuition.

**ME 6053. Heuristic-based Optimization. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. This course provides an overview of modern heuristic-based optimization methods including single-solution and population-based algorithms. Students will gain hands-on experience in problem representation, algorithm implementation, parameter optimization, and performance analysis. This course has Differential Tuition.

**ME 6063. Convex Optimization. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. This course introduces the theory of convex optimization and provides practical tools to identify and solve related problems. Convex optimization has applications in diverse fields, including control systems, machine learning, supply networks, and robotics. This course covers foundational concepts, including convex sets and functions, modeling aspects, and practical results. Also, this course includes a review of convex analysis, least squares, linear and quadratic programs, optimality conditions, duality theory, interior-point methods, and convex relaxation. This course has Differential Tuition.

**ME 6113. Experimental Techniques in Engineering. (2-3) 3 Credit Hours.**

Prerequisite: Graduate standing and consent of instructor. Laboratory-based course focused on experimental testing, accounting for sources of errors, and analysis including uncertainty, graphing, and curve fitting. Modern transducers and measurement and data acquisition techniques will be discussed and utilized in the context of engineering laboratories and a course project. This course has Differential Tuition.

**ME 6123. Advanced Systems Dynamics and Control. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Dynamic modeling of mechanical and multi-energy domain systems; state-space and frequency-domain analysis of dynamic systems; feedback control systems; multivariable state-feedback control; principles of controllability, observability, stability; computer-based simulation system dynamics. (Formerly ME 5113. Credit cannot be earned for both ME 6123 and ME 5113.) This course has Differential Tuition.

**ME 6413. Elasticity. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Index notation and tensors, deformation and strain analysis, stress and equilibrium, material symmetry, constitutive relations for linear elastic solids, plane problems, boundary value problems in elasticity, strain energy, and related principles. This course has Differential Tuition.

**ME 6543. Machine Learning and Data Analytics. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Introduction to discovery and communication of meaningful patterns in data, including data description (descriptive/visualization techniques), prediction (predictive modeling using machine learning), improve performance (optimization/decision making). This course has Differential Tuition.

**ME 6553. Introduction to Deep Learning. (3-0) 3 Credit Hours.**

Introduction to the theory and application of deep learning, a branch of machine learning for the development and application of modern neural networks. This course covers a range of topics including basic neural networks, convolutional and recurrent network structures, generative adversarial networks, and deep reinforcement learning. This course has Differential Tuition.

**ME 6613. Advanced Fluid Mechanics. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Dynamics of incompressible fluid mechanics viscous flow, Navier-Stokes equations, boundary layer theory, and numerical operations for incompressible fluid flow. (Formerly ME 5613. Credit cannot be earned for both ME 6613 and ME 5613.) This course has Differential Tuition.

**ME 6663. Advanced Fatigue and Fracture. (3-0) 3 Credit Hours.**

Prerequisite: ME 5463 and graduate standing in engineering or consent of instructor. This course reviews concepts in fatigue, damage tolerance, and probabilistic fracture mechanics. It will also discuss fatigue life prediction and application for structural components, crack initiation and propagation, low and high cycle fatigue, notch strain analysis, and cumulative damage and apply these concepts to modern engineering problems. This course has Differential Tuition. Course Fee: LRE1 \$25; STSE \$30.

**ME 6673. Combustion. (3-0) 3 Credit Hours.**

Prerequisite: ME 4293. This course will cover thermochemistry and transport theory applied to combustion, gas phase equilibrium, energy balances, reaction kinetics, flame temperatures, speed, ignition, and extinction, premixed and diffusion flames, combustion aerodynamics, and mechanisms of air pollution. This course has Differential Tuition. Course Fee: LRE1 \$25; STSE \$30.

**ME 6683. Hypersonics. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. This is an introduction to hypersonics, including shock/expansion theory, Newtonian theory, 3D flows, entropy, viscous effects, high-temperature and real gas effects, and testing and modeling considerations. This course has Differential Tuition.

**ME 6833. Biomechanics. (3-0) 3 Credit Hours.**

Prerequisite: Graduate standing in engineering or consent of instructor. Fundamentals in applications of engineering mechanics to modeling structures and functions of tissues, organs, joints, and human body. (Formerly ME 5833 and ME 6033. Same as BME 6803. Credit can be earned for only one of the following: ME 6833, ME 6033, ME 5833 or BME 6803.) This course has Differential Tuition.

**ME 6853. Advanced CFD and Heat Transfer. (3-0) 3 Credit Hours.**

Prerequisite: ME 6613 or consent of instructor. Topics include large-scale simulation tools for turbulent flows including large-eddy-simulation (LES), direct numerical simulation (DNS) and turbulence modeling for range of incompressible, buoyancy driven and compressible flows. Generalized numerical framework for numerical solution of Navier-Stokes equations. This course has Differential Tuition. Course Fee: LRE1 \$25; STSE \$30.

**ME 6893. Topics in Biomechanics. (3-0) 3 Credit Hours.**

Prerequisite: ME 6833 or BME 6803 or an equivalent. The biomechanics of biological tissues and organs. Topics may include constitutive equations, stress, and adaptation of hard and soft tissues. (Formerly ME 6023. Same as BME 6893. Credit cannot be earned for both ME 6893 and ME 6023. Credit cannot be earned for both ME 6893 and BME 6893 when the topic is the same.) This course has Differential Tuition. Course fees: LRE1 \$25; STSE \$30.

**ME 6951. Independent Study. (0-0) 1 Credit Hour.**

Prerequisite: Graduate standing and permission in writing (form available) from the instructor, the student's advisor, and the Graduate Advisor of Record. Independent reading, research, discussion, and/or writing under the direction of a faculty member. For students needing specialized work not normally or not often available as part of the regular course offerings. May be repeated for credit, but not more than 3 hours, regardless of discipline, will apply to the Master's degree. This course has Differential Tuition.

**ME 6953. Independent Study. (0-0) 3 Credit Hours.**

Prerequisite: Graduate standing and permission in writing (form available) from the instructor, the student's advisor, and the Graduate Advisor of Record. Independent reading, research, discussion, and/or writing under the direction of a faculty member. For students needing specialized work not normally or not often available as part of the regular course offerings. May be repeated for credit, but not more than 3 hours, regardless of discipline, will apply to the Master's degree. This course has Differential Tuition.

**ME 6961. Comprehensive Examination. (0-0) 1 Credit Hour.**

Prerequisite: Approval of the Mechanical Engineering Graduate Program Committee to take the Comprehensive Examination. Independent study for the purpose of taking the Comprehensive Examination. May be repeated for credit as many times as approved by the Mechanical Engineering Graduate Program Committee. Enrollment is required each term in which the Comprehensive Examination is taken if no other courses are being taken that term. The grade report for the course is either "CR" (satisfactory performance on the Comprehensive Examination) or "NC" (unsatisfactory performance on the Comprehensive Examination). This course has Differential Tuition.

**ME 6973. Special Problems. (3-0) 3 Credit Hours.**

Prerequisite: Consent of instructor. An organized course offering the opportunity for specialized studies not normally available as part of the regular course offerings. Special Problems courses may be repeated for credit when topics vary, but not more than 6 hours, regardless of discipline, may be applied to the Master's degree. This course has Differential Tuition.

**ME 6981. Master's Thesis. (0-0) 1 Credit Hour.**

Prerequisite: Consent of the Graduate Advisor of Record and primary thesis advisor. Thesis research and preparation. May be repeated for credit, but not more than 6 hours will apply to the Master's degree. Credit will be awarded upon completion of the thesis. Enrollment is required each term in which the thesis is in progress. This course has Differential Tuition.

**ME 6982. Master's Thesis. (0-0) 2 Credit Hours.**

Prerequisite: Consent of the Graduate Advisor of Record and primary thesis advisor. Thesis research and preparation. May be repeated for credit, but not more than 6 hours will apply to the Master's degree. Credit will be awarded upon completion of the thesis. Enrollment is required each term in which the thesis is in progress. This course has Differential Tuition.

**ME 6983. Master's Thesis. (0-0) 3 Credit Hours.**

Prerequisite: Consent of the Graduate Advisor of Record and primary thesis advisor. Thesis research and preparation. May be repeated for credit, but not more than 6 hours will apply to the Master's degree. Credit will be awarded upon completion of the thesis. Enrollment is required each term in which the thesis is in progress. This course has Differential Tuition.

**ME 7941. Independent Doctoral Study. (0-0) 1 Credit Hour.**

Prerequisite: Graduate standing in Ph.D. in Mechanical Engineering program and permission in writing (form available) from the student's advisor. Independent reading, research, discussion, and/or writing under the direction of a faculty member. For Ph.D. students needing specialized work not normally or not often available as part of the regular course offerings. May be repeated for credit, but not more than 3 hours, regardless of discipline, will apply to the Doctoral degree. This course has Differential Tuition.

**ME 7943. Independent Doctoral Study. (0-0) 3 Credit Hours.**

Prerequisite: Graduate standing in Ph.D. in Mechanical Engineering program and permission in writing (form available) from the student's advisor. Independent reading, research, discussion, and/or writing under the direction of a faculty member. For Ph.D. students needing specialized work not normally or not often available as part of the regular course offerings. May be repeated for credit, but not more than 3 hours, regardless of discipline, will apply to the Doctoral degree. This course has Differential Tuition.

**ME 7951. Doctoral Research. (0-0) 1 Credit Hour.**

Prerequisite: Consent of the Graduate Advisor of Record and primary thesis advisor. May be repeated for credit. A minimum of 18 credit hours of Doctoral Research is required. This course has Differential Tuition.

**ME 7952. Doctoral Research. (0-0) 2 Credit Hours.**

Prerequisite: Consent of the Graduate Advisor of Record and primary thesis advisor. May be repeated for credit. A minimum of 18 credit hours of Doctoral Research is required. This course has Differential Tuition.

**ME 7953. Doctoral Research. (0-0) 3 Credit Hours.**

Prerequisite: Consent of the Graduate Advisor of Record and primary thesis advisor. May be repeated for credit. A minimum of 18 credit hours of Doctoral Research is required. This course has Differential Tuition.

**ME 7956. Doctoral Research. (0-0) 6 Credit Hours.**

Prerequisite: Consent of the Graduate Advisor of Record and primary thesis advisor. May be repeated for credit. A minimum of 18 credit hours of Doctoral Research is required. This course has Differential Tuition.

**ME 7981. Doctoral Dissertation. (0-0) 1 Credit Hour.**

Prerequisite: Consent of the Graduate Advisor of Record and primary thesis advisor, after being admitted to Ph.D. candidacy. May be repeated for credit. A minimum of 15 credit hours of Doctoral Dissertation is required. (Formerly ME 7993-8.) This course has Differential Tuition.

**ME 7982. Doctoral Dissertation. (0-0) 2 Credit Hours.**

Prerequisite: Consent of the Graduate Advisor of Record and primary thesis advisor, after being admitted for Ph.D. candidacy. May be repeated for credit. A minimum of 15 credit hours of Doctoral Dissertation is required. (Formerly ME 7993-8.) This course has Differential Tuition.

**ME 7983. Doctoral Dissertation. (0-0) 3 Credit Hours.**

Prerequisite: Consent of the Graduate Advisor of Record and primary thesis advisor, after being admitted for Ph.D. candidacy. May be repeated for credit. A minimum of 15 credit hours of Doctoral Dissertation is required. (Formerly ME 7993-8.) This course has Differential Tuition.

**ME 7993. Research Seminar. (3-0) 3 Credit Hours.**

Organized lectures and seminar presentations to facilitate the development of doctoral students' research skills and knowledge of current and emerging research. Required for all Ph.D. students in Mechanical Engineering and recommended to complete in the first year of the Ph.D. program. The grade report for the course is either "CR" (satisfactory performance) or "NC" (unsatisfactory performance). This course has Differential Tuition.