Mechanical Engineering

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Faculty

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Randall German, Ph.D., Professor of Mechanical Engineering and Associate Dean of the College of Engineering

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Eugene A. Olevsky, Ph.D., Professor of Mechanical Engineering and Director of Doctoral Programs in the College of Engineering

Asfaw Beyene, Ph.D., Associate Professor of Mechanical Engineering

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Khaled B. Morsi, Ph.D., Associate Professor of Mechanical Engineering (Graduate Adviser)

Samuel K. Kassegne, Ph.D., Assistant Professor of Mechanical Engineering

Fletcher J. Miller, Ph.D., Assistant Professor of Mechanical Engineering

Adjunct Faculty

Bryan Cornwall, Ph.D., Mechanical Engineering

Courses Acceptable on Master's Degree Programs in Mechanical Engineering (M E)

Refer to Courses and Curricula and Regulations of the Division of Graduate Affairs sections of this bulletin for explanation of the course numbering system, unit or credit hour, prerequisites, and related information.

UPPER DIVISION COURSES

NOTE: Proof of Completion of prerequisites required for all Mechanical Engineering 300-, 400-, and 500-level courses: Copy of transcript. In addition, Mechanical Engineering 390, 450, 490A, and 530 require evidence of concurrent registration in appropriate courses.

M E 502. Continuum Mechanics (3)

Prerequisites: Mechanical Engineering 304 (or Civil Engineering 301) and Engineering Mechanics 340.

Mechanics of continua, stress tensor, deformation and flow, constitutive relations. Applications to common solids and fluids

M E 514. Advanced Machine Design (3)

Prerequisites: Mechanical Engineering 314 and 340.

Application of advanced mechanics of materials to design and analysis of mechanical elements. Probabilistic design and finite element methods and applications. Design projects involve extensive use of finite element programs.

M E 520. Introduction to Mechanical Vibrations (3)

Prerequisites: Mechanical Engineering 304 (or Civil Engineering 301) and Mechanical Engineering 330.

Analysis of mechanical vibration; single- and multi-degree of freedom systems; free and forced vibrations; vibration isolation; vibration absorbers. Theory of vibration measuring instruments.

M E 530. Automatic Control Systems (3)

Prerequisite: Mechanical Engineering 330.

Dynamic characteristics of control components and systems. Stability and response of closed loop systems. Design of control systems.

M E 540. Nonmetallic Materials (3)

Prerequisites: Mechanical Engineering 314 and 340.

Fundamentals of ceramics, polymers, and composite materials. Materials design and selection. Statistical methods of brittle materials design, appropriate for ceramic materials, and rheological modeling of polymeric materials. Stress and strain analysis using classical lamination theory of multi-ply composite laminates.

M E 542. Manufacturing with Nonmetallic Materials (3)

Prerequisites: Mechanical Engineering 340 and Engineering 280 with a grade of C or better.

Engineering polymers and composites, processes, and manufacturing techniques. Polymer flow in extrusion, compression molding, RTM, and calendaring. Hands-on fabrication and test exercises included along with a capstone manufacturing project.

M E 543. Powder-Based Manufacturing (3)

Prerequisite: Mechanical Engineering 340.

Manufacturing of micro and nano-structured engineering components and composites starting with metal and/or ceramic powders. Powder production methods, characterization, powder shaping and compaction, sintering, hot consolidation, design considerations, and finishing operations.

M E 546. Computer Aided Manufacturing (3)

Prerequisites: Mechanical Engineering 102, 314, 340; and Engineering 280 with a grade of C or better.

Computer controlled manufacturing and assembly techniques and devices. Databases and special languages. Agile manufacturing soft ware programs and technologies.

M E 552. Heating, Ventilating, and Air-Conditioning (3)

Prerequisites: Mechanical Engineering 351 and 452.

Fundamentals of air conditioning processes, psychrometrics, and building cooling load calculations. Design and analysis of HVAC systems. Equipment selection. Design codes and standards. Computerized cooling load calculations.

M E 555. Thermal Systems Analysis and Design (3)

Prerequisites: Mechanical Engineering 351 and 452.

Analysis, design, and optimization of thermal systems using microcomputers. Modeling of thermal systems and components. Thermal system component characteristics and their effect on overall system performance. Relationship among thermal sciences in design process. Introduction to thermoeconomic optimization.

M E 556. Solar Energy Conversion (3)

Prerequisites: Engineering Mechanics 340, Mechanical Engineering 351 and 452.

Application of thermodynamics, fluid mechanics and heat transfer to the thermal design of solar energy conversion systems. Computer simulations utilized.

M E 580. Biomechanics (3)

Prerequisites: Mechanical Engineering 304 (or Civil Engineering 301) and Engineering Mechanics 340.

Application of engineering methodologies for quantitative understanding of biological/physiological phenomena. Continuum mechanics principles. Cardiovascular system and its components viewed from a mechanistic standpoint.

M E 585. Fundamentals of Micro-Electro-Mechanical Systems (MEMS) (3)

One lecture and four hours of laboratory.

Prerequisites: For aerospace engineering majors: E E 204, E M 220, and M E 240. For electrical engineering majors: E E 330 and M E 240. For mechanical engineering majors: E E 303, E M 220, and M E 240.

Microfabrication techniques, microsensors and microactuators, and scaling laws. A design project of a micro-device including schematic creation, test of performance, layout generation, and layout versus schematic comparison. (Formerly numbered Engineering Mechanics 585.)

M E 596. Advanced Mechanical Engineering Topics (1-3)

Prerequisite: Consent of instructor. **Proof of completion of prerequisite required**: Copy of transcript.

Modern developments in mechanical engineering. May be repeated with new content. See *Class Schedule* for specific content. Maximum credit of nine units for any combination of Mechanical Engineering 496, 499 and 596 applicable to a bachelor's degree. Credit for 596 and 696 applicable to a master's degree with approval of the graduate adviser.

GRADUATE COURSES

M E 610. Finite Element Methods in Mechanical Engineering (3)

Prerequisites: Engineering 280 with a grade of C or better and Mechanical Engineering 514.

Development of finite elements and an introduction to solution methods. Problems from various fields of study in mechanical engineering such as stress analysis, vibrations and heat transfer. Introduction to finite element programs such as NASTRAN.

M E 614. Engineering Design: Analytical Methods (3)

Prerequisites: Mechanical Engineering 330 and Engineering 510.

Classical optimization techniques, digital computer methods of optimization, design decision theory, reliability in design.

M E 621. Mechanical Vibrations (3)

Prerequisites: Mechanical Engineering 520 and Engineering 510.

Topics in vibration relating to mechanical design such as nonlinear vibrations, distributed mass systems, random vibrations, mobility analysis, isolator design.

M E 632. Advanced Topics in Automatic Controls (3)

Prerequisite: Mechanical Engineering 530.

Analysis and synthesis of sample data systems. State space analysis of multivariable systems, optimal control systems.

M E 645. Mechanical Behavior of Engineering Materials (3)

Prerequisites: Mechanical Engineering 314, 340, and 350.

Elastic and plastic deformation of monolithic engineering materials and composites. Dislocation theory and plasticity of crystalline solids. Linear elastic and elastic-plastic fracture mechanics. Failure analysis of engineering components. Design optimization based on materials and service environment variables.

M E 646. Mechanics of Sintering (3)

Prerequisites: Mechanical Engineering 340 and 514.

Practical aspects and conceptual models and mechanisms associated with sintering of ceramic and metal powders.

M E 651. Advanced Thermodynamics (3)

Prerequisites: Engineering 280 with a grade of C or better and Mechanical Engineering 351.

Advanced concepts of macroscopic thermodynamics are developed including entropy generation, irreversibility, effectiveness, exergy, and chemical exergy of fuels. Concepts applied to power and refrigeration cycles using computer software.

M E 653. Combustion (3)

Prerequisite: Mechanical Engineering 351.

Thermodynamics of combustion, chemical equilibrium, chemical kinetics, combustion of gaseous, liquid and solid fuels, and their application.

M E 656. Conduction Heat and Transfer (3)

Prerequisites: Mechanical Engineering 452 and Engineering 510.

Conduction heat transfer analysis of multi-dimensional and transient processes using both classical analysis and numerical methods.

M E 657. Convection Heat Transfer (3)

Prerequisites: Mechanical Engineering 452 and Engineering 510.

Convection heat transfer processes under laminar and turbulent conditions. Mass transfer. Scaling arguments, analytical and numerical modeling.

M E 658. Radiation Heat Transfer (3)

Prerequisites: Mechanical Engineering 452 and Engineering 510.

Radiation heat transfer processes. Radiative properties of surfaces and gases. Absorption, emission, and scattering phenomena. Numerical modeling.

M E 661. Gas Dynamics (3)

Prerequisites: Mechanical Engineering 351 and Engineering 510.

Thermodynamics of high velocity compressible fluid flow. Adiabatic and diabatic flow; shock phenomena; imperfect gases; multidimensional flow. Applications to the propulsive duct and turbomachinery.

M E 681. Biomaterials (3)

Prerequisites: Mechanical Engineering 240 and 580.

Structure and properties of metallic, ceramic, and polymer biomaterials. Chemical interaction with physiological environment. Thrombosis and hemostasis on synthetic surfaces. Sterilization and packaging. Ethics and regulatory approval process. Applications discussed in cardiovascular, pulmonary, renal, orthopedic and dental medicine.

M E 683. Design of Medical Devices (3)

Prerequisites: Mechanical Engineering 314 and 580.

Device design, including biomaterials, human factors engineering, reliability, and manufacturing. Topics relevant to industry reviewed include regulatory, documentation, quality, and legal.

M E 685. Micro-Electro-Mechanical Systems (MEMS) Design and Applications (3)
(Same course as Electrical Engineering 685)

Prerequisite: Mechanical Engineering 585.

Design and manufacturing technology for micro- and nano-scale devices. Topics include solid state transducers, microscale physics, biomedical microelectronics, microfluidics, biosensors, and hybrid integration of microfabrication technology. Emphasis on biomedical applications.

M E 696. Advanced Topics in Mechanical Engineering (2 or 3)

Intensive study in specific areas of mechanical engineering. May be repeated with new content. See *Class Schedule* for specific content. Credit for 596 and 696 applicable to a master's degree with approval of the graduate adviser.

M E 797. Research (1-3) Cr/NC/RP

Prerequisites: Consent of graduate adviser and advancement to candidacy.

Research in engineering. Maximum credit six units applicable to a master's degree.

M E 798. Special Study (1-3) Cr/NC/RP

Prerequisite: Consent of graduate adviser; to be arranged with department chair and instructor.

Individual study or internship. Maximum credit three units applicable to a master's degree.

M E 799A. Thesis or Project (3) Cr/NC/RP

Prerequisites: An officially appointed thesis committee and advancement to candidacy.

Preparation of a project or thesis for the master's degree.

M E 799B. Thesis or Project Extension (0) Cr/NC

Prerequisite: Prior registration in Thesis or Project 799A with an assigned grade symbol of RP.

Registration required in any semester or term following assignment of RP in Course 799A in which the student expects to use the facilities and resources of the university; also student must be registered in the course when the completed thesis or project is granted final approval.

M E 799C. Comprehensive Examination Extension (0) Cr/NC

Prerequisite: Completion or concurrent enrollment in degree program courses.

Registration required of students whose only requirement is completion of the comprehensive examination for the master's degree. Registration in 799C limited to two semesters.