

## DEPARTMENT OF MECHANICAL ENGINEERING

### Bachelor of Science Degree in Mechanical Engineering (BSME)

#### COURSE DESCRIPTIONS MECHANICAL ENGINEERING (ME)

**1301 Introduction to Engineering Design**

(1-1) 1 hour credit.

Principles and fundamentals of engineering design, especially in mechanical engineering design, and approaches to engineering problem formulation and solution; decision making process; design project.

**1402 Engineering Graphics**

(1-3) 2 hours credit. Prerequisite: ME 1301.

Introduction to engineering graphics: geometric constructions, multi-view drawing, dimensioning, sections, pictorials and auxiliary views. Computer-aided design, generation of mechanical drawings, and design projects.

**3113 Measurements and Instrumentation**

(3-1) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in EE 2213.

Fundamentals of measurement systems, descriptive statistics, probability, error, error propagation, confidence intervals, hypothesis testing, correlation, linear regression, data acquisition.

**3173 Numerical Methods**

(3-0) 3 hours credit. Prerequisite: EGR 2323.

Linear equations, non-linear equations, differentiation, integration, ordinary differential equations, initial value problems, boundary value problems, curve fitting, and optimization.

**3241 Materials Engineering Laboratory**

(1-2) 1 hour credit. Prerequisite: Completion of or concurrent enrollment in ME 3243.

Investigation of the properties of engineering materials, with emphasis on metals, sample preparation, metallography, and foundry processes.

**3243 Materials Engineering**

(3-0) 3 hours credit. Prerequisites: CHE 1103 and EGR 2103; completion of or concurrent enrollment in ME 3241.

Fundamentals in structures, properties, fabrication, and mechanical behavior of engineering materials.

**3263 Manufacturing Engineering**

(3-0) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in ME 3243.

An integrated coverage of mechanical properties of materials, tolerances, measurement and quality assurance, manufacturing processes, and manufacturing systems; fundamental definitions, design for manufacturing, and mathematical models; hands-on applications related to measurement and manufacturing processes.

**3293 Thermodynamics I**

(3-0) 3 hours credit. Prerequisite: EGR 2103.

Heat, work, kinetic theory of gases, equation of state, thermodynamics system, control volume, first and second law of thermodynamics, reversible and irreversible processes, and introduction to basic thermodynamic cycles.

**3323 Mechanical Vibration**

(3-0) 3 hours credit. Prerequisite: EGR 2513.

Free and forced vibrations; single and multiple degree of freedom systems; damping; matrix methods; time-domain and frequency-domain. Applications in the transmission and control of vibration.

**3513 Mechanism Design**

(3-0) 3 hours credit. Prerequisite: EGR 2513.

Introduction to mechanisms; graphical and linear analytical methods for kinematic synthesis of mechanisms; cam design; gears and gear trains; and computer-aided design projects.

**3593 Alternative Energy Sources**

(3-0) 3 hours credit. Prerequisite: ME 3293.

Solar, nuclear, wind, hydrogen, and geothermal energy sources. Resources, production, utilization, economics, sustainability, and environmental considerations.

**3663 Fluid Mechanics**

(3-0) 3 hours credit. Prerequisites: EGR 2513 and EGR 3323.

Fluid properties; fluid statics; integral and differential analysis of fluid flow; viscous laminar and turbulent flow in conduits; dimensional analysis; boundary layer concepts; drag and lift.

**3813 Mechanics of Solids**

(3-0) 3 hours credit. Prerequisite: EGR 2103.

Internal forces and deformations in solids; stress, strain and their relations; torsion, stresses and deflections in beams; elastic behavior of columns.

**3823 Machine Element Design**

(3-0) 3 hours credit. Prerequisites: ME 1402 and ME 3813.

Introduction to design of machine elements, pressurized cylinders, press and shrink fits, curved beams and contact stresses; static and fatigue theories of failure, shafts and shaft components; welded and bolted connections, mechanical springs, and computer-aided design projects. (Formerly ME 4423. Credit cannot be earned for both ME 3823 and ME 4423.)

**4133 CAD/CAE**

(3-0) 3 hours credit. Prerequisite: ME 1402.

Students are to study the basic theories and software structure of computer-aided design and engineering. It is anticipated that students will develop algorithms and software for practical engineering applications.

**4183 Compressible Flow and Propulsion Systems**

(3-0) 3 hours credit. Prerequisites: ME 3293 and ME 3663.

Application of mass, energy, and force balance to compressible fluids; analysis of one-dimensional steady flow, isentropic flow, adiabatic flow, flow with heat addition, supersonic flow, and shock waves.

Introduction to the analysis and design of air-breathing engines for aeronautical transportation. (Formerly EGR 4183. Credit cannot be earned for both ME 4183 and EGR 4183.)

**4243 Intermediate Materials Engineering**

(3-0) 3 hours credit. Prerequisites: ME 3241, ME 3243, and ME 3813.

Selected topics in macroscopic and microscopic aspects of the mechanical behavior of metals, ceramics, polymers and composites; introduction to dislocation theory, temperature dependent deformations, engineering failures, and fracture mechanics.

**4293 Thermodynamics II**

(3-0) 3 hours credit. Prerequisites: MAT 2213 and ME 3293.

Energy and availability analysis, reactive and nonreactive mixtures, moist air properties, psychometric systems and analysis, vapor and gas power cycles, refrigeration and heat-pump cycles, and thermodynamic relations.

**4313 Heat Transfer**

(3-0) 3 hours credit. Prerequisites: ME 3173, ME 3293, and ME 3663.

Generalized potential distribution and gradients; transient and steady heat transfer including conduction, forced and free convection, and radiation.

**4323 Thermal Systems Design**

(3-0) 3 hours credit. Prerequisites: ME 3663 and completion of or concurrent enrollment in ME 4313.

Application of basic thermodynamics, fluid mechanics, heat transfer, and computer methods to the design of heat exchangers, coils, fans, pumps, and thermal energy systems.

**4343 Heating, Air Conditioning, and Refrigeration Design**

(3-0) 3 hours credit. Prerequisites: ME 3293, ME 3663, and completion of or concurrent enrollment in ME 4313.

Moist air properties; human comfort; solar radiation; heating, ventilation, and air conditioning of buildings; design selection, construction, and operation of air conditioning equipment; and duct design.

**4523 Dynamic Systems and Control**

(3-0) 3 hours credit. Prerequisites: EGR 2513 and EGR 3323.

Introduction to modeling and control of dynamic physical systems, analysis and design of control systems for mechanical, electrical, manufacturing, fluid, and thermal systems. (Formerly ME 4522. Credit cannot be earned for both ME 4523 and ME 4522.)

**4553 Automotive Vehicle Dynamics**

(3-0) 3 hours credit. Prerequisite: ME 3513.

Dynamics and control of automotive systems; handling, tires, suspension, steering, and aerodynamic forces.

**4563 Computer Integrated Manufacturing**

(3-1) 3 hours credit. Prerequisite: ME 3263

Fundamental concepts and models related to computer aided design, computer aided process planning, computer aided manufacturing, production planning and scheduling, and manufacturing execution systems. Laboratory work includes computer-aided applications and programming of automated production equipment.

**4573 Facilities Planning and Design**

(3-0) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in ME 3563.

Product, process, and schedule design; flow, space, and activity relationships; material handling; layout planning models and design algorithms; and warehouse operations.

**4583 Enterprise Process Engineering**

(3-0) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in ME 3563.

Lean manufacturing fundamentals; value stream mapping (VSM) and lean initiatives; six-sigma for process design and improvement; performance evaluation; strategic planning and deployment; hands-on exercises including simulation games for process improvements and VSM practices.

**4603 Finite Element Analysis**

(3-0) 3 hours credit. Prerequisite: ME 3823.

Finite element method fundamentals, advanced geometric modeling of mechanical components and systems, review of static failure theories, finite element modeling of components, and mechanical design projects.

**4613 Power Plant System Design**

(3-0) 3 hours credit. Prerequisites: ME 3663 and ME 4293.

Application of thermodynamics and fluid mechanics to the design of vapor and gas-turbine power plant systems including boilers, condensers, turbines, pumps, compressors, and cooling towers.

**4623 Internal Combustion Engines**

(3-0) 3 hours credit. Prerequisites: ME 3293 and ME 3663.

Application of thermodynamics cycles in design, analysis, and modeling of internal combustion engines including spark-ignition and compression-ignition cycles; thermochemistry, fuels, combustion, emissions, and pollution.

**4663 Fluid Systems Design**

(3-0) 3 hours credit. Prerequisites: ME 3663 and ME 3173.

Review of fundamental laws in integral form; differential continuity, momentum, and energy equations; Navier-Stokes equations for laminar and turbulent flow; potential flow theory; and design of fluid systems.

**4673 Mechanical Systems Design**

(3-0) 3 hours credit. Prerequisites: ME 3513 and ME 3823.

Integration of machine elements, joints and links into comprehensive systems for practical applications to real-world problems.

**4702 Mechanical Systems and Control Laboratory**

(1-4) 2 hours credit. Prerequisites: ME 3113, ME 3813, and completion of or concurrent enrollment in ME 4523.

Fundamentals of measurement systems; transducers and signal conditioning; strain, force, acceleration, controls and vibration; rotating machinery; and design of experiments.

- 4723 Reliability and Quality Control in Engineering Design**  
(3-0) 3 hours credit. Prerequisites: EGR 2323 and ME 3113.  
Introduction to statistical methods in reliability and probabilistic engineering design methodology; statistical quality control and inspection; life prediction and testing; and design optimization.
- 4773 Fundamentals of Robotics**  
(3-0) 3 hours credit. Prerequisite: ME 3513.  
Fundamental analysis and control methods of robot manipulators will be taught in this course. Kinematics and dynamics of robotic systems will be studied. Project for the design and analysis of robotic system with practical application is expected.
- 4802 Thermal and Fluid Laboratory**  
(1-4) 2 hours credit. Prerequisites: ME 3113, ME 3663, and completion of or concurrent enrollment in ME 4313.  
An experimental laboratory concerned with fluid statics, fluid flow, heat transfer, internal combustion engines, and design of experiments.
- 4811 Senior Design I**  
(1-1) 1 hour credit. Prerequisites: ME 3663, ME 3823, and completion of or concurrent enrollment in ME 4313.  
Approval of design project proposals, computer-aided synthesis, analysis, and modeling of an open-ended problem. Development and presentation of conceptual designs. Industrial cooperation is encouraged.
- 4813 Senior Design II**  
(2-3) 3 hours credit. Prerequisites: ME 4313 and ME 4811.  
Development of a working design of an instructor-approved design project using computer-aided synthesis, analysis, modeling, and optimization methods. Industrial cooperation encouraged; considerations of safety, reliability, environmental, and economic constraints; and ethical and social impacts.
- 4911-3 Independent Study**  
1 to 3 hours credit. Prerequisite: Permission in writing (form available) from the instructor, the student's advisor, the Department Chair, and Dean of the College.  
Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours of independent study, regardless of discipline, will apply to a bachelor's degree.
- 4953 Special Studies in Mechanical Engineering**  
(3-0) 3 hours credit. Prerequisite: Will depend on the topics.  
An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies may be repeated for credit when topics vary, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree.
- 4963 Bioengineering**  
(3-0) 3 hours credit. Prerequisites: EGR 2513 and ME 3813.  
Biomechanics, biomaterials, biofluids, and bioimaging in biological systems and medical devices.