MECHANICAL ENGINEERING

Mechanical Engineering

The Department of Mechanical Engineering and Engineering Management offers a four-year Bachelor of Science degree program in Mechanical Engineering. The four-year Bachelor of Science degree program in Mechanical Engineering (ME) is dedicated to the principle of preparing its students for industry and graduate study with the expectation of eventual leadership responsibilities. To that end, its faculty and facilities focus on an emphasis of design and industrial experience, student-faculty-industry cooperative projects, teamwork, the adoption of new technologies and on the hands-on student utilization of laboratories and computing systems. The Mechanical Engineering program maintains professional accreditation by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; Telephone: (410) 347-7700).

The ME program is designed to achieve a balance among the major areas of Machine Design, Electro-Mechanical Systems, and Thermal Systems. Student may choose to specialize within the following areas: Thermal, Design and Micro-Electro-Mechanical Systems. Descriptions of program objectives and outcomes are publically posted in the Department and on the Department's webpages.

The Master of Science degree in Mechanical Engineering (MSME) is also available. This degree program is described in the Graduate Bulletin.

Mechanical Engineering B.S. Degree - Required Courses and Recommended Course Sequence

First Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MTH-111</td>
<td>Calculus I</td>
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<tr>
<td>CHM-117</td>
<td>Intro Chem Lab for Engineers</td>
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<td>CHM-118</td>
<td>Chemistry for Engineers</td>
<td>3</td>
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<tr>
<td>ME-180</td>
<td>CADD Lab</td>
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<tr>
<td>ENG-101</td>
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<td>FYF-101</td>
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<tr>
<td>PHY-201</td>
<td>General Physics I</td>
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<tr>
<td>EGR-140</td>
<td>Scientific Programming</td>
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<tr>
<td>EGR-200</td>
<td>Intro to Materials Science</td>
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Third Semester

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<tr>
<td>MTH-211</td>
<td>Intro. to Differential Equations</td>
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<tr>
<td>PHY-202</td>
<td>General Physics II</td>
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<tr>
<td>EE-211</td>
<td>Electrical Circuits and Devices</td>
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<td>EE-283</td>
<td>Electrical Measurements Lab</td>
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<tr>
<td>ME-231</td>
<td>Statics</td>
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Fourth Semester

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<tr>
<td>EGR-222</td>
<td>Mechatronics</td>
<td>3</td>
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<tr>
<td>ME-232</td>
<td>Strength of Materials</td>
<td>3</td>
</tr>
<tr>
<td>ME-234</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME-322</td>
<td>Engineering Thermodynamics</td>
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<tr>
<td>MTH-212</td>
<td>Multivariable Calculus</td>
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<tr>
<td>ME-175</td>
<td>Intro. to Manufacturing and Machining</td>
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Fifth Semester

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<tbody>
<tr>
<td>ME-321</td>
<td>Fluid Mechanics</td>
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<td>ME-323</td>
<td>Fluid Mechanics Lab</td>
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<tr>
<td>ME-215</td>
<td>Intro. to Manufacturing Processes</td>
<td>3</td>
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<tr>
<td>ME-335</td>
<td>Engineering Modeling &amp; Analysis</td>
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<tr>
<td>ME-333</td>
<td>Machine Design I</td>
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Sixth Semester

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<td>EGR-201</td>
<td>Professionalism and Ethics</td>
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<tr>
<td>PHY-203</td>
<td>Modern Physics or CHM-256 Polymer Chemistry</td>
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<td>PHY-206</td>
<td>Modern Physics Lab or CHM-258 Polymer Chemistry Lab</td>
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<td>EGM-320</td>
<td>Engineering Project Management &amp; Analysis</td>
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### Seventh Semester

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<tr>
<td>ME-324</td>
<td>Heat Transfer</td>
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<tr>
<td>ME-326</td>
<td>Heat Transfer Lab</td>
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<td>ME-384</td>
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<td>ME-391</td>
<td>Senior Project I</td>
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<tr>
<td>ME-317</td>
<td>Robotics</td>
<td>3</td>
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### Eighth Semester

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<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>ME-392</td>
<td>Senior Projects II</td>
<td>2</td>
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<tr>
<td>ME-332</td>
<td>Vibration of Dynamic Systems</td>
<td>3</td>
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<td>Free Elective</td>
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*Consult with the Cooperative Education Coordinator to determine availability and proper scheduling of the Cooperative Education experience.

**Technical electives may be chosen from any advisor approved math, science, or engineering course numbered 200 or above to satisfy a concentration requirement.

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**ME. MECHANICAL ENGINEERING**

### ME-395-396. INDEPENDENT RESEARCH

**Credits:** 1 - 3

Independent study and research for advanced students in the field of mechanical engineering under the direction of a staff member. A research paper at a level significantly beyond a term paper is required.

**Pre-Requisites**

Senior standing in mechanical engineering and approval of the department chairperson is required.

### ME-215. INTRODUCTION TO MANUFACTURING PROCESSES

**Credits:** 3

An introduction to manufacturing which examines traditional processes such as metal forming and casting and advanced manufacturing processes associated with thin film deposition, microfabrication and piezoelectric devices. Quality assurance and quality control issues in manufacturing.

**Pre-Requisites**

EGR-200, ME-180, ME-232

### ME-231. STATICS

**Credits:** 3

Statics of particles, including resolution of forces into components, vector sums, and concurrent force systems. Statics of rigid bodies and the study of moments. Equilibrium of bodies in two- and three-dimensions and determination of reactions. Analysis of trusses and frames. Determination of centroids and moments of inertia. Kinematics of particles, including displacement, velocity, and acceleration.

**Pre-Requisites**

PHY-201

### ME-232. STRENGTH OF MATERIALS

**Credits:** 3

Analysis of statically determinate and indeterminate structural systems; computation of reactions, shears, moments, and deflections of beams, trusses, and frames. Bending and torsion of slender bars; buckling and plastic behavior.

**Pre-Requisites**

ME-231

### ME-234. DYNAMICS

**Credits:** 3

This course continues the development of Newtonian mechanics with application to the motion of free bodies and mechanisms. Topics include rectilinear motion, vector calculus, particle motion, inertial and rotating reference frames, rigid body motion, rotational dynamics, linear and rotational momentum, work and kinetic energy, virtual work and collision.

**Pre-Requisites**

ME-231

### ME-298. TOPICS IN MECHANICAL ENGINEERING

**Credits:** 1-3

Selected topics in the field of mechanical engineering.

**Pre-Requisites**

Sophomore standing and permission of the instructor.

### ME-312. MANUFACTURING SYSTEM ENGINEERING

**Credits:** 3


**Pre-Requisites**

Junior standing in mechanical engineering.
ME-314. INVERSE PROBLEMS IN MECHANICS
Credits: 3
Inverse problems are very common in engineering where the outputs are known but the inputs are unknown. This course will show how to properly setup a well-posed inverse problem, how to solve matrix inverses, and conduct hands on experiments by creating strain gage based force transducers.

Pre-Requisites
ME-333

ME-317. ROBOTICS
Credits: 3
The analysis and design of robots. Class covers the mechanical principles governing the kinematics of robotics. Course topics include forward kinematics and the determination of the closed form kinematic inversion, as well as workspace and trajectory generation. Class also covers the formation and computation of the manipulator Jacobian matrix.

Pre-Requisites
EGR-222 and ME-234

ME-321. FLUID MECHANICS
Credits: 3
Thermodynamics and dynamic principles applied to fluid behavior and to ideal, viscous and compressible fluids under internal and external flow conditions.

Pre-Requisites
ME-231
Co-Requisites
Concurrent or after ME-322

ME-322. ENGINEERING THERMODYNAMICS
Credits: 3

Pre-Requisites
MTH-112

ME-323. FLUID MECHANICS LABORATORY
Credits: 1
Experiments with and analysis of basic fluid phenomena, hydrostatic pressure, Bernoulli theorem, laminar and turbulent flow, pipe friction, and drag coefficient. One three-hour lab per week.

Co-Requisites
ME-321

ME-324. HEAT TRANSFER
Credits: 3
Fundamental principles of heat transmission by conduction, convection, and radiation; application of the laws of thermodynamics; application of these principles to the solution of engineering problems.

Pre-Requisites
ME-321 and MTH-211

ME-325. ENERGY SYSTEMS
Credits: 3
Fundamental principles of energy transmission and energy conversion. Comprehension of the physical systems in which the conversion of energy is accomplished. Primary factors necessary in the design and performance analysis of energy systems.

Pre-Requisites
ME-322.

ME-326. HEAT TRANSFER LABORATORY
Credits: 1
Basic heat transfer modes are demonstrated experimentally. This includes conduction, convection, and radiation of heat as well as fin and heat exchanger. One two-hour lab per week.

Click here for course fees.

Pre-Requisites
ME-321
Co-Requisites
Concurrent or after ME-324

ME-328. COMBUSTION ENGINES
Credits: 3
Investigation and analysis of internal and external combustion engines with respect to automotive applications. Consideration of fuels, carburetion, combustion, detonation, design factors, exhaust emissions and alternative power plants.

Pre-Requisites
ME-322

ME-332. VIBRATION OF DYNAMIC SYSTEMS
Credits: 3
An introductory course in mechanical vibration dealing with free and forced vibration of single and multi-degrees of freedom for linear and nonlinear systems. Two hours of lecture and two hours of lab per week.

Click here for course fee.

Pre-Requisites
ME-234, MTH-211

ME-333. MACHINE DESIGN I
Credits: 3
The first of a two-course sequence in design of machine elements dealing with theories of deformation and failure, strength and endurance limit, fluctuating stresses, fatigue and design under axial, bending, torsional, and combined stresses. A study of fasteners, welds, gears, balled roller bearings, belts, chains, clutches, and brakes.

Pre-Requisites
ME-232
ME-335. ENGINEERING MODELING AND ANALYSIS  
Credits:  3  
Introduction to finite element method for static and dynamic modeling and analysis of engineering systems. Finite element formulation and computer modeling techniques for stress, plane strain, beams, axisymmetric solids, heat conduction, and fluid flow problems. Solution of finite element equation and post processing of results for further use in the design problem. Two hours of lecture and two hours of lab per week.  
Click here for course fee.

Pre-Requisites  
ME-232

ME-337. MICRO-ELECTRO-MECHANICAL SYSTEMS ENGINEERING  
Credits:  3  
This course explores the principles of MEMS by understanding materials properties, micro-machining, sensor and actuator principles. The student will learn that MEMS are integrated micro-devices combining mechanical and electrical systems, which convert physical properties to electrical signals and, consequently, detection. This course provides the theoretical and exercises the hands-on experience by fabricating a micro-pressure sensor. Two hours of lecture and three hours of lab per week.  
Click here for course fee.

Pre-Requisites  
Junior standing in engineering

ME-338. MACHINE DESIGN II  
Credits:  3  
An advanced course in machine design topics that expands upon the concepts of Machine Design I. This course goes into more detail of the basic machine fundamentals introduced previously such as levers, belts, pulleys, gears, cams and power screws. Emphasis is also placed on 3D printing and the future of additive manufacturing.

Pre-Requisites  
ME-333

ME-340. HEATING, VENTILATION AND AIR CONDITIONING  
Credits:  3  

Pre-Requisites  
ME-322

ME-384. MECHANICAL DESIGN LABORATORY  
Credits:  3  
A laboratory for the development of hands-on experience dealing with open-ended problems in mechanical systems. Emphasis on experimental performance, data collection, evaluations, analysis and design. Two hours of lecture and four hours of lab per week.  
Click here for course fee.

Pre-Requisites  
Senior standing in mechanical engineering or instructor permission

ME-391. SENIOR PROJECTS I  
Credits:  1  
Design and development of selected projects in the field of mechanical engineering under the direction of a staff member. Technical as well as economic factors will be considered in the design. A detailed progress report is required.  
Click here for course fees.

Pre-Requisites  
Senior standing in mechanical engineering, EGM-320

ME-392. SENIOR PROJECTS II  
Credits:  2  
Design and development of selected projects in the various fields of mechanical engineering under the direction of a staff member. Technical as well as economic factors will be considered in the design. A professional paper and detailed progress reports are required. This is a continuation of ME-391. An open-forum presentation and discussion of the professional paper are required.  
Click here for course fees.

Pre-Requisites  
ME-391

ME-397. SEMINAR  
Credits:  1-3  
Presentations and discussions of selected topics.

Pre-Requisites  
Junior or Senior standing in mechanical engineering

ME-398. TOPICS IN MECHANICAL ENGINEERING  
Credits:  1-3  
Click here for course fees.

Pre-Requisites  
Junior or senior standing in mechanical engineering.

ME-399. COOPERATIVE EDUCATION  
Credits:  1-6  
Professional cooperative education placement in a private or public organization related to the student's academic objectives and career goals. In addition to their work experiences, students are required to submit weekly reaction papers and an academic project to a Faculty Coordinator in the student's discipline. See the Cooperative Education section of this bulletin for placement procedures. Required: Junior standing; minimum 2.0 cumulative GPA; consent of the academic advisor; and approval of placement by the department chairperson.