MECHANICAL ENGINEERING

Mechanical engineering is a diverse field that encompasses a wide range of modern technologies, not limited to a specific type of technology or device/system. This broad focus makes the work of a mechanical engineer both challenging and varied, and provides ample job opportunities.

The perception of mechanical engineering as only related to mechanical devices like engines or machine parts is outdated. Modern mechanical engineers are designers who create physical systems of all types and ensure that technology solutions are effective, reliable, and safe. They play a crucial role in a variety of industries including automotive, aerospace, energy, microchip manufacturing, biomedical devices, and more.

To excel in this role, mechanical engineers receive a comprehensive education that includes a strong foundation in mathematics and natural sciences, as well as knowledge of concepts and applications of thermodynamics, statics, dynamics, fluid flows, heat transfer, stress and strength, materials science, manufacturing, machine design, instrumentation, control theory, and reliability. They also develop skills in data analysis, programming, and principles and methods of engineering design.

To prepare students for the modern engineering workplace, classes include hands-on lab work and project-based design exercises that are performed individually and in teams. Students learn effective communication and gain a comprehensive background in social, economic, and behavioral sciences. An extensive selection of engineering electives in diverse, cutting-edge areas enables students to choose between general mechanical engineering education and specialization in one of the recommended tracks: engineering mechanics, engineering design, energy and sustainability, materials and manufacturing, mechatronics and robotics, and vehicles and mobility. Undergraduate certificate credentials can be declared for each track. The program culminates in a final design project.

Accelerated Master's 4+1 Options for Mechanical Engineering Students

The accelerated master's (4+1) option allows the most qualified UM-Dearborn undergraduate students to complete both a bachelor and a master's degree in a 5-year accelerated format. This is accomplished by combining portions of undergraduate and graduate coursework. Students enrolled in this option can take eligible 500-level courses during their junior and senior years, with up to 9 credit hours of such coursework being double-counted toward both degrees. Additionally, another 6 credit hours earned but not applied to the bachelor degree can later be counted toward the master's degree. Depending on the number of graduate courses taken while working toward the bachelor program, students will need to complete 15-21 credit hours to finish the master's program after earning their undergraduate degree.

Students enrolled in the BSE in Mechanical Engineering degree program have access to the following 4+1 sequences:

- BSE in Mechanical Engineering combined with MSE in Mechanical Engineering--graduate-level courses may include ME 518, ME electives, and cognates (limit one course)
- BSE in Mechanical Engineering combined with MSE in Automotive and Mobility Systems Engineering (limited to Vehicle Powertrain and Performance, Vehicle Design and Manufacturing, and General concentrations)--graduate-level courses may include core, elective core, and concentration electives
- BSE in Mechanical Engineering combined with MSE in Materials Science and Engineering--graduate-level courses may include ME 518, electives, and cognates (limit one course)
- BSE in Mechanical Engineering combined with MSE in Bioengineering--graduate-level courses may include core, electives, and cognates (limit one course)

Please see the Mechanical Engineering 4+1 Option webpage (https://umdearborn.edu/cecs/departments/mechanical-engineering/undergraduate-programs/new-fall-2024-41-mechanical/) for more information.

The Bachelor of Science in Engineering in Mechanical Engineering program is accredited by the Engineering Accreditation Commission of ABET (https://www.abet.org/).

Program Educational Objectives

The Program Educational Objectives of the mechanical engineering program are that our graduates will:

- Be successfully employed in their discipline or a closely related field and contribute to the economy of the state and the nation
- Continue to enhance their knowledge base and skills, through graduate degrees or other professional development, to keep abreast of ongoing changes in technology and related disciplines
- Be well rounded and well suited to work with colleagues and professionals with diverse backgrounds and cultures, and a wide range of competencies

Student Outcomes

To achieve the educational objectives, the graduates of the program will have:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations. and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Dearborn Discovery Core (General Education)

All students must satisfy the University's Dearborn Discovery Core requirements (http://catalog.umd.umich.edu/undergraduate/gen_ed_ddc/), in addition to the requirements for the major

Major Requirements

A candidate for the degree Bachelor of Science in Engineering (Mechanical Engineering) is required to pursue scholastic quality and to complete satisfactorily the following program of study:

In addition to completion of the Dearborn Discovery Core, the following courses are required to earn a BSE degree in Mechanical Engineering from UM-Dearborn.

Code	Title	Credit Hours
Prerequisite Courses		
COMP 270	Tech Writing for Engineers (Also fulfills 3 credits of DDC Written and Oral Communication)	3
MATH 115	Calculus I	4
MATH 116	Calculus II	4
MATH 215	Calculus III	4
MATH 228	Diff Eqns with Linear Algebra	4
CHEM 134	General Chemistry IA	4
CHEM 136	General Chemistry IIA	4
PHYS 150	General Physics I	3
PHYS 150L	General Physics I Lab/Dis	1
PHYS 151	General Physics II	3
PHYS 151L	General Physics II Lab/Dis	1
ECON 201	Prin: Macroeconomics (ECON 201 or 202 also fulfill 3 credits of DDC Social and Behavioral Analysis)	3
or ECON 202	Prin: Microeconomics	
ENGR 100	Introduction to Engineering and Engineering Design	3
ENGR 126	Engineering Computer Graphics	2
ENGR 216	Computer Meth for Engineers	2
ENGR 250	Principles of Eng Materials	3
ME 230	Thermodynamics	4
ME 260	Design Stress Analyses	4
Mechanical Engineering Major Core		**37**
ECE 305	Intro to Electrical Eng	4
ME 325	Thermal Fluid Sciences I	4
ME 345	Engineering Dynamics	4
ME 349	Instrument & Measuremt Systems	3
ME 3601	Design and Analysis of Machine Elements	4
ME 364	Prob, Stats, and Rel in Mach D	3
ME 375	Thermal Fluid Sciences II	4
ME 379	Thermal-Fluids Laboratory	3
ME 381	Manufacturing Processes I	4
ME 442	Control Systems Analysis and Design	4
ME 4671	Senior Design I	4
Program Electives		**16**

Select a minimum of 16 credit hours of upper-level design, technical, and general electives. At least 12 credit hours must be in the upper-level technical or design electives from the lists below. At least two courses (6-8 credit hours) must be ME or BENG courses. At least one course (3-4 credit hours) must be an upper-level design course. Interested students may select elective courses following one of these recommended tracks: engineering mechanics, engineering design, energy and sustainability, materials and manufacturing, mechatronics and robotics, and vehicles and mobility. Undergraduate certificate credentials can be declared for each track. The courses suggested for each track can be found on the program's website. [1]

Upper-Level Design Electives	
select at least one course (3-4 credits) from this area	
BENG 370	Biomechanics I
BENG 426	Fundamentals of Drug Delivery
BENG 451	Microfluidics
BENG 470	Advanced Biomechanics
BENG 480	Mechanotransduction
BENG 481	Biomimetics
ENGR 360	Design Thinking : Process, Method & Practice
ENGR 493	Exper Hnrs Dir Dsgn
ME 4191	Structural Mech & Design
ME 4202	Design Turbo. and Wind Gen.
ME 423	Thermal Sys Des & Optimization
ME 4361	Design of HVAC Systems
ME 440	Intro to Mechanical Vibrations
ME 445	Sound and Noise Controls
ME 4461	Mech Vibration & Noise Control
ME 4471	Solar Energy Sys Analy&Design
ME 4500	Design of Automotive Chassis and Body Systems
ME 452	Sustainable Energy & Environment
ME 460	Design for Manufacturing
ME 469	Senior Design II
ME 472	Prin & Appl of Mechatronic Sys
ME 483	Dsgn Cons in Poly and Comp Mat
ME 490	Directed Design Project
ME 493	Advanced Vehicle Energy Systems
Upper-Level Technical Electives	
BENG 375	Biomaterial Tissue Engrg
BENG 381	Bioprocessing
BENG 425	Transport in Biosystems
ENGR 345	Effective Use of AI Tools for Scientists and Engineers
ENGR 350	Nanoscience and Nanotechnology
ENGR 399	Experiential Honors Prof. Prac
ENGR 492	Exper Honors Directed Research
IMSE 381	Industrial Robots
IMSE 421	Eng Economy and Dec Anlys
IMSE 440	Applied stat models in engin
ME 410	Finite Element Method wth Appl
ME 4301	Computational Thermo-Fluids
ME 4550	Computational Uncertainty Quantification for Engineering Applications
ME 4640	Linear Systems Control

ME 481	Manufacturing Processes II
ME 491	Directed Research Problems
ME 4910	Degradation of Materials
ME 492	Guided Study in Mechanical Engineering
ME 4950	Digital Manufacturing and Product Innovation
ME 496	Internal Combustion Engines I
ME 4981	Automotive Engineering

General Electives

Select 3-4 credits, as needed, of general elective coursework. Fewer than 3-4 credits are needed if additional CECS credits were taken from the electives area.

[1] The courses suggested for each track can be found on the Mechanical Engineering department website (https://umdearborn.edu/cecs/departments/mechanical-engineering/undergraduate-programs/program-tracks-and-undergraduate/).

Students admitted to the **BSE-ME to MSE-ME 4+1 Option** may substitute ME 513 for BENG 470, ME 510 for ME 410, ME 525 for ME 4301, ME 555 for ME 4550, ME 564 for ME 4640, ME 591 for ME 4910, ME 595 for ME 4950, and ME 596 for ME 496. Students admitted to the **BSE-ME to MSE-BENG 4+1 Option** may substitute BENG 526 for BENG 426, BENG 551 for BENG 451, BENG 570 for BENG 470, BENG 580 for BENG 480, BENG 595 for ME 4950, ME 510 for ME 410, ME 525 for ME 4301, ME 555 for ME 4550, ME 564 for ME 4640, ME 591 for ME 4910. Students admitted to the **BSE-ME to MSE-MSCI 4+1 Option** may substitute ME 555 for ME 4550, ME 591 for ME 4910, and ME 595 for ME 4950. Students admitted to the **BSE-ME to MSE-AMSE 4+1 Option** may substitute AENG 596 for ME 496, AENG 550 for ME 4500, ME 591 for ME 4910, and ME 595 for ME 4950.

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

ME 230 Thermodynamics 4 Credit Hours
The course is a general introduction to thermodynamics. Properties of pure substances. Work and heat. The first and second laws of thermodynamics. and their applications to engineering systems. Energy, Entropy, Exergy and efficiency. (F, S, W).
Prerequisite(s): PHYS 150 and MATH 116 and (CHEM 134 or CHEM 144)
Corequisite(s): ME 230R
Restriction(s):
Can enroll if College is Engineering and Computer Science
Cannot enroll if Major is

ME 230R Thermodynamics 0 Credit Hours
Recitation component for ME 230. Must be taken concurrently with ME 230.
Corequisite(s): ME 230

ME 260 Design Stress Analyses 4 Credit Hours
Vector treatment of static force and moment equilibrium of particles, rigid bodies and plane structures. Fundamental mechanics of materials: stresses and deformation in axial loading; torsion; bending; shear. Combined loadings. Stress and strain transformations. (F,W,S).
Prerequisite(s): PHYS 150 and (ENGR 250* or ECE 385*) and (MATH 205* or MATH 215*)
Corequisite(s): ME 260R
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 260R Design Stress Analysis 0 Credit Hours
Recitation component of ME 260. Must be taken concurrently with ME 260.
Corequisite(s): ME 260

ME 265 Applied Mechanics 4 Credit Hours
A comprehensive introduction to the science of applied mechanics, encompassing a study of forces and the stresses, deflections, and motions which they produce. Topics include the concept of equilibrium and static force analysis; the mechanics of deformable bodies (internal stresses, constitutive relationships, strains, deflections, failure); statics of indeterminate systems; kinematics; kinetics of particles, systems of particles, and rigid bodies. Four hours lecture. This course is not open to ME majors (F, S, W).
Prerequisite(s): PHYS 150 and (MATH 205* or MATH 215*)
Restriction(s):
Cannot enroll if Major is Mechanical Engineering,

ME 290 Spec Topics in Mech Engin 1 to 3 Credit Hours
Special topics in mechanical engineering selected according to students' interest and availability of instructors and equipment.

ME 299 Internship/ Co-op 1 Credit Hour
This is a Cooperative Education course. Students wishing to experience a work experience before graduation may elect to participate in the Cooperative Education Program (minimum of two terms). (F,W,S).
Restriction(s):
Can enroll if Class is Junior or Senior or Graduate

ME 325 Thermal Fluid Sciences I 4 Credit Hours
Power and refrigeration cycles. Thermodynamic relations. Ideal gas mixtures and psychrometrics. Reacting ideal gas mixtures. Fluid properties. Fluid flow kinematics. Integral fluid flow analysis; the conservation laws - mass, energy, momentum. Introduction to differential analysis of fluid flow. Dimensional analysis. (F,W,S).
Prerequisite(s): ENGR 216 and ME 230 and ME 260
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 345 Engineering Dynamics 4 Credit Hours
Vector treatment of the kinematics and kinetics of particles, systems of particles and rigid bodies. Newton's laws, work/energy and impulse/momentum principles. Introduction to mechanical vibrations. (F, S, W).
Prerequisite(s): ENGR 216* and ME 260 and (MATH 216 or MATH 228)
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 349 Instrument & Measuremt Systems 3 Credit Hours
Modern instrumentation systems are considered beginning with generic issues such as calibration, error analysis, and dynamic response characteristics of instrumentation. Specific transducer systems (temperature, force and pressure, etc.) are presented, as well as interfacing techniques and elementary signal processing. (F,W,S).
Prerequisite(s): (ME 265 or ME 345) and ECE 305
Corequisite(s): ME 349L
Restriction(s):
Can enroll if Class is Sophomore or Junior or Senior
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ME 3601 Design and Analysis of Machine Elements 4 Credit Hours
Application of mechanics of materials to analysis and design of elementary mechanical components and systems. Topics include: stress and strain analysis; stress concentration; failure theories; safety factor; fatigue; fracture; combined loading; impact; buckling. Components considered: fasteners; springs; bearings; gears; beams; shafts and other power transmission components. Numerical techniques. (F, S, W).
Prerequisite(s): (ENGR 216 or ME 215) and (ME 260 or ME 265)
Restriction(s):
Can enroll if College is Engineering and Computer Science
Cannot enroll if Major is

ME 364 Prob, Stats, and Rel in Mach D 3 Credit Hours
Introduction to probability, statistics, and reliability with emphasis on mechanical engineering applications. The course covers basic probability, descriptive statistics, probability distributions of discrete and continuous variables, statistical inferences, DOE (design of experiments), ANOVA (analysis of variance), regression, and correlation. (F, S, W).
Prerequisite(s): ME 260 and ENGR 216

ME 375 Thermal Fluid Sciences II 4 Credit Hours
Mechanisms of heat transfer processes. Steady state and transient conduction. Numerical methods in conduction. Internal and external flows. Boundary layer theory. Convection heat transfer in internal and external flows. Natural Convection. Heat exchanger theory. Introduction to radiation. (F, S, W).
Prerequisite(s): ME 325 and ECE 305*
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 379 Thermal-Fluids Laboratory 3 Credit Hours
An experimental investigation of thermodynamic, fluid mechanic, and heat transfer principles. Students will learn about thermal-fluids instrumentation and conduct experiments. In addition, they will design their own experiments to demonstrate their understanding of the principles. (F,W,S).
Prerequisite(s): ME 325 and (ME 349 or BENG 351) and ME 375* and (COMP 270 or COMP 106 or Composition Placement Score with a score of 40 or Composition Placement Score with a score of 107 or COMP 220)
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 381 Manufacturing Processes I 4 Credit Hours
This course introduces the students to the fundamentals and principles of manufacturing processes for engineering materials. It seeks to transfer an understanding of the application of principles of engineering materials and their influence on manufacturing processes. Topics covered include structure and properties of materials, various conventional shaping processes viz. solidification, powder and particulate, deformation, and material removal processes; heat treatment and surface processing, and materials joining. Topics on recent advancements including but not limited to microfabrication, nanofabrication, additive manufacturing is also covered. Case studies of design for manufacturing and measurement of product quality; economical aspects and cost considerations in manufacturing systems will be studied. Students complete a project, in which they design and implement a manufacturing process. Three lecture hours and three laboratory hours. (F, W, S).
Prerequisite(s): ENGR 250 and (ME 260 or ME 265)
Corequisite(s): ME 381L
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 399 Internship/ Co-op 1 Credit Hour
This is a Cooperative Education course. Students wishing to experience a work experience before graduation may elect to participate in the Cooperative Education Program (minimum of two terms)
Restriction(s):
Can enroll if Class is Junior or Senior or Graduate

ME 410 Finite Element Method wth Appl 3 Credit Hours
A presentation of the basic concepts and fundamentals of the Finite Element Method of Analysis in general, followed by applications to both continuum and field problems. Selected areas of application: dynamics and vibration including wave propagation; acoustics; fluid mechanics including film lubrication and ground water flow; heat transfer; elasticity and stress/strain analysis including structures; electrical field problems including electrostatics and electromagnetics (YR).
Prerequisite(s): (ME 345 and ME 3601 and ME 375*) or (BENG 370 and BENG 325*)
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 4191 Structural Mech & Design 4 Credit Hours
A presentation of the methods of plane elasticity to solve a variety of problems arising in the analysis and design of structures. Review of the concepts of plane stress and strain, basic equations of plane elasticity and problems, energy methods approximate/numerical techniques, elastic-plastic bending and torsion, fracture and fatigue. (YR).
Prerequisite(s): ME 345 and ME 3601
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ME 4202 Design Turbo. and Wind Gen. 4 Credit Hours
Principles of turbomachinery design and practices with emphasis on wind power generation. Euler's equation for energy transfer calculations. Two- and three-dimensional velocity diagrams. Aerodynamics of wind turbines. Wind turbine design and control. Power generation of wind turbines, wind energy system economics and environmental impacts. Design procedures and characteristics of compressors, fans and blowers. Basic design calculations and selection of pumps. A turbomachinery design project by using the theory learned from the course may be required. (YR).
Prerequisite(s): ME 375
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 423 Thermal Sys Des & Optimization 4 Credit Hours
Design, analysis, and optimization of thermal fluid systems using principles of thermodynamics, fluid mechanics, and heat transfer. Application of thermal sciences in component and system design. Optimized design methodology for improving operations of thermal systems to minimize energy consumption and/or operating costs. (OC)
Prerequisite(s): ME 375*
Restriction(s):
Can enroll if College is Engineering and Computer Science
Cannot enroll if Major is

ME 4301 Computational Thermo-Fluids 3 Credit Hours
This course introduces students to fundamentals and practical skills of computational fluid dynamics and heat transfer. Governing equations and their mathematical classification. Spatial and temporal approximation techniques, stability, consistency, and convergence. Finite-difference and finite-volume formulations. Survey of methods for solving discretized equations. Applications to technological flow and heat transfer problems. (YR).
Prerequisite(s): ME 325 and ME 375*
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 4361 Design of HVAC Systems 4 Credit Hours
A comprehensive treatment of the design principles and practices in the heating, ventilating, and air conditioning. Psychrometrics, design loads, distribution systems, equipment selection. (YR).
Prerequisite(s): ME 325 and ME 375*
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 440 Intro to Mechanical Vibrations 3 Credit Hours
This introductory course on mechanical vibrations covers theories with applications, which include free and forced vibration analysis of damped and undamped, discrete (ranging from single to multi-degree-of-freedom), and simple continuous structures (such as strings, shafts, and beams), and design of vibration absorbers. Students may not receive credit for both ME 440 and ME 4461. (YR)
Prerequisite(s): ME 345 and ME 349
Restriction(s):
Can enroll if College is Engineering and Computer Science
Cannot enroll if Major is

ME 442 Control Systems Analysis and Design 4 Credit Hours
Modeling of mechanical systems and feedback controllers using Laplace transform techniques and block diagram analysis. System response characteristics and stability criterion. Introduction of feedback concepts, including analysis and design of feedback controllers using root locus techniques. Frequency response concepts and use of frequency response measures in stability analysis and controller design. (F, S, W).
Prerequisite(s): ECE 305 and (ME 345 or ME 265)
Corequisite(s): ME 442L
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 445 Sound and Noise Controls 4 Credit Hours
Full Course Title: Introduction to Sound and Noise Controls This course covers basic topics in sound theory, applications, and noise control system design. Topics include sound generation, radiation and transmission, human hearing system mechanism, sound quality metrics, design of silencers, mufflers and resonator, audio system and speaker design, building acoustics, acoustical material properties and material testing, sound measurement, and Octave band analysis. The student is required to conduct a course project related to noise control system design. Students may not receive credit for both ME 445 and ME 4461. (YR)
Prerequisite(s): (ME 265 and BENG 351) or (ME 345 and ME 349)
Restriction(s):
Can enroll if College is Engineering and Computer Science
Cannot enroll if Major is

ME 4461 Mech Vibration & Noise Control 4 Credit Hours
Fundamentals of mechanical vibration and principles of noise control. Use of transducers and instruments to conduct sound and vibration measurements. Free and forced vibration in single and multiple degrees-of-freedom systems, damping, eigenvalues, eigenvectors, frequency response function, modal analysis, description of sound fields, acoustical materials and material testing, acoustics of rooms and enclosures, sound quality, and principles of noise control. Students will be required to conduct either a vibration or a noise control project. Two one-and-one-half hour lectures and one three-hour laboratory. (YR).
Prerequisite(s): (ME 345 or ME 265) and (ME 349* or BENG 351*)
Corequisite(s): ME 4461L
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 4471 Solar Energy Sys Analy&Design 4 Credit Hours
The course introduces students to the fundamentals of solar energy conversion and solar energy systems. Principles in thermodynamics and heat transfer required to understand the solar energy use is reviewed. Design of different types of solar energy systems are explored and assessed. Issues relating to the practical implementation of solar energy will also be considered. (OC).
Prerequisite(s): ME 325 and ME 375*
Restriction(s):
Can enroll if College is Engineering and Computer Science
Cannot enroll if Major is

ME 4500 Design of Automotive Chassis and Body Systems 3 Credit Hours
This course provides a systems approach to the design of automotive chassis and body components and examines the influence of their design on the overall structural performance of the vehicle. Design issues related to structural rigidity, ride comport, safety and crash-worthiness, and durability are covered. Analytical tools used in automotive structural design are also discussed. (YR).
Prerequisite(s): ME 260 and ME 345
Restriction(s):
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ME 452 Sustainable Energy & Environment 4 Credit Hours
This course introduces students to fundamentals of energy sources. It covers a wide range of conventional and alternative, (including renewable) sources, and presents tools for assessing their sustainability and environmental impacts. It also reviews issues related to energy storage, transportation and distribution, challenges, and future opportunities. A course project is completed involving the design and plan for practical implementation of a sustainable energy technology. (YR).
Prerequisite(s): ME 325 and ME 375*
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 4550 Computational Uncertainty Quantification for Engineering Applications 3 Credit Hours
This course focuses on a probabilistic (Bayesian) treatment of uncertainties in modeling a system's behavior, specifically adapted to mechanical engineering and bioengineering problems. This treatment extends to both making predictions under uncertainty (predictive modeling) as well as updating our knowledge about the system model using data/measurements (Bayesian inference). The course will emphasize both (i) applications with physical models as well as (ii) applications with statistical models build entirely based on data/inference. The course will start by briefly reviewing the foundations of probability as a multi-valued logic that quantifies all our available knowledge about a real system and its environment. This leads to a rigorous meaning for the probabilistic model for a system. The main part of the course focuses on computational tools for (i) predictive analysis (i.e., uncertainty propagation) and (b) Bayesian system estimation/identification (i.e., model updating based on experimental observations). (OC).
Prerequisite(s): ME 364 or BENG 364 or IMSE 317

ME 460 Design for Manufacturing 3 Credit Hours
Design decisions based on manufacturability process-property relationships and sustainability. Design for assembly, manufacturing tolerances and quality control. Design methodology in digital age. (OC).
Prerequisite(s): ME 3601 and ME 381
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 4640 Linear Systems Control 3 Credit Hours
This course covers fundamental properties of linear dynamic systems. The topic will include linear space, linear operators, eigen-values/vectors, canonical form, representation, solution of state equations, stability, controllability, observability, design of state feedback control and observer with application examples in mechanical engineering. (YR).
Prerequisite(s): ME 442
Restriction(s):
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ME 467 Senior Design I 4 Credit Hours
A guided design project course with emphasis on the decision-making process associated with establishing alternatives and evaluation procedures to synthesize designs. Students propose design projects and work in teams to produce analytical designs, and conduct evaluative experiments, and/or construct a physical design prototype. Engineering ethics and responsibility. At the end of the semester, the students are required to submit written reports and give oral presentations with a demonstration of their projects. (F, W).
Prerequisite(s): ME 345 and ME 3601 and ME 375 and ME 379*
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if Major is Mechanical Engineering

ME 4671 Senior Design I 4 Credit Hours
A guided design project course with emphasis on the decision-making process associated with establishing alternatives and evaluation procedures to synthesize designs. Students propose design projects and work in teams to produce analytical designs, and conduct evaluative experiments, and/or construct a physical design prototype. Engineering ethics and responsibility. At the end of the semester, the students are required to submit written reports and give oral presentations with a demonstration of their projects. (F,W).
Prerequisite(s): ME 345 and ME 3601 and ME 375 and ME 379*
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if Major is Mechanical Engineering

ME 4681 ME/BENG Dual Senior Design 4 Credit Hours
Full Title: Interdisciplinary Senior Design for ME/BENG Dual Degree Students A guided interdisciplinary design project course where student teams propose design projects, design a device, system or process related to mechanical-and bio-engineering and conduct evaluative experiments and/or construct a physical prototype. Engineering ethics and responsibility. At the end of the semester, the students are required to submit written reports and give oral presentations with a demonstration of their projects. Credit can only be awarded for one of the following courses: BENG 4671, ME 4671, and ME 4681. (F, W).
Prerequisite(s): BENG 351 and BENG 370 and ME 3601 and ME 375 and (BENG 375 or BENG 381)
Restriction(s):
Can enroll if Class is Junior or Senior
Can enroll if Major is

ME 469 Senior Design II 1 to 4 Credit Hours
Student teams develop mechanical or interdisciplinary design projects, or continue projects begun in ME 4671. Work includes mechanical engineering design, and could possibly include fabrication and testing. Projects can involve efforts by interdisciplinary teams. Written and oral presentations are required.
Prerequisite(s): ME 4671
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 472 Prin & Appl of Mechatronic Sys 4 Credit Hours
This course provides the student with hands-on interdisciplinary experience of mechatronic systems, which integrate mechanical, electrical/electronic components with microprocessors to design a high-performance system. Subjects include Mechanical and Electrical Actuators, Digital Transducers and Modulators, Microcomputers and Microcontrollers. Laboratory projects cover robotic programming, materials handling, and fluid power systems. Student will be required to perform a course design project with mechatronic application in nature. (OC)
Prerequisite(s): (ME 265 or ME 345 or ECE 347) and (ECE 305* or ECE 311*)
Restriction(s):
Cannot enroll if Class is Freshman or Sophomore
Can enroll if College is Engineering and Computer Science

ME 481 Manufacturing Processes II 3 Credit Hours
A study of casting, welding, plastic forming, and machining of materials; analysis of forces, energy requirements, and temperature effects; design specifications economically obtainable in terms of dimensional accuracy, surface finish, and material properties, functional characteristics of equipment. Two lectures and a laboratory. (OC).
Prerequisite(s): ME 381
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 483 Dsgn Cons in Poly and Comp Mat 3 Credit Hours
Physical and mechanical behavior of unreinforced and reinforced (composite) polymeric materials in relation to their applications in modern technology. Emphasis is given to the design considerations with these materials in contrast to those with metallic materials. Time-dependent properties, such as creep and stress relaxation, are considered. (OC).
Prerequisite(s): ME 360 or ME 3601
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 490 Directed Design Project 1 to 3 Credit Hours
Directed design project involving not only design but also analysis, fabrication, and/or testing. Topics may be chosen from any of the areas of mechanical engineering. The student will submit a report on their project and give an oral presentation at the end of the term. Enrollment in this course requires approval from the ME department. Registration for more than 1 credit is only permitted in special cases and will be considered on an individual basis. (F, S, W).
Restriction(s):
Cannot enroll if Class is
Can enroll if College is Engineering and Computer Science

ME 491 Directed Research Problems 1 to 3 Credit Hours
Special problems selected for laboratory or library investigation with intent of developing initiative and resourcefulness. Enrollment in this course requires approval from the ME department. Registration for more than 1 credit is only permitted in special cases and will be considered on an individual basis. (F, S, W).
Restriction(s):
Cannot enroll if Class is
Can enroll if College is Engineering and Computer Science

ME 4910 Degradation of Materials 3 Credit Hours
The course will introduce students to the fundamentals of corrosion behavior and environmental degradation of materials. The environmental degradation of metals, polymers, and composites will be discussed. Monitoring and life prediction techniques will be covered. Preventive measures such as 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. (YR).
Prerequisite(s): ENGR 250 and ME 381
Restriction(s):
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ME 492 Guided Study in Mechanical Engineering 1 to 3 Credit Hours
Individual study, design, or laboratory research in a field of interest to the student. Topics may be chosen from any of the areas of mechanical engineering. The student will submit a report on their project at the end of the term. Enrollment in this course requires approval from the ME department. Registration for more than 1 credit is only permitted in special cases and will be considered on an individual basis. (F, S, W).
Restriction(s):
Cannot enroll if Class is
Can enroll if College is Engineering and Computer Science

ME 493 Advanced Vehicle Energy Systems 3 Credit Hours
This course will introduce the advanced energy conversion systems in automotive vehicles and cover the fundamentals, characteristics, and design consideration of the energy systems. The topic includes using alternative fuels in internal combustion engines, advanced power train systems in hybrid, electric, and fuel cell vehicle, and exhaust energy recovery systems. (YR).
Prerequisite(s): ME 325 and ECE 305
Restriction(s):
Can enroll if College is Engineering and Computer Science

ME 4950 Digital Manufacturing and Product Innovation 3 Credit Hours
This combined lecture and hands-on project course aims to familiarize students to optimize the interplay of materials, people, machines and products. The course introduces approaches to develop product concepts with commercial potential. Student teams will explore market needs, conceptualize product ideas to cater to those needs and explore the intellectual property space around their ideas. Students will iteratively develop prototypes via digital manufacturing (e.g., 3D CAD/CAM files manifested via digital printing or machining). Early stage prototypes will progress into more sophisticated designs, scaling up (cost, pricing, tooling, process flow and automation) scenario planning for manufacturing. Concepts of direct digital manufacturing and the associated tools will be discussed. Methods of real time data acquisition, quantitative data analysis, and predictive analytics will be discussed. (YR).
Prerequisite(s): (ME 349 or BENG 351 or IMSE 4825 or ME 442) and (ME 364 or BENG 364 or IMSE 317) and ME 230 and (ME 381* or IMSE 382* or BENG 381*)
Restriction(s):
Can enroll if Level is Undergraduate
Can enroll if College is Engineering and Computer Science

ME 496 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. (OC).
Prerequisite(s): ME 325

ME 4981 Automotive Engineering 4 Credit Hours
The course covers the basic topics in automotive engineering: a) fundamental vehicle dynamics; b) Engine-transmission compatibility and matching; c) analysis of vehicle performance in acceleration, gradability, speed, fuel economy, ride comfort, stability and safety; d) computer modeling and simulation of vehicle systems by numerical techniques; e) transmission design and analysis; f) design of vehicle systems such as brakes, suspensions, steering mechanisms and other subsystems. (YR).
Prerequisite(s): ME 345 and ME 3601
Restriction(s):
Can enroll if College is Engineering and Computer Science
Cannot enroll if Major is

ME 499 Internship/ Co-Op 1 Credit Hour
A four-month professional work experience period of the Engineering Internship Program, integrated and alternated with the classroom terms.
Restriction(s):
Can enroll if Class is Senior or Graduate

*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