MECHANICAL ENGINEERING
(ME)

The Mechanical Engineering Program at UNH is accredited by the:

Engineering Accreditation Commission of ABET, http://www.abet.org

Mission
In support of the University and college missions, the Department of Mechanical Engineering is dedicated to educating the highest quality engineering professionals and leaders. Graduates will be prepared to creatively solve engineering problems through the use of analysis, computation, and experimentation. Students completing the program should be well-informed citizens who have the ability to grow intellectually and are able to solve new, challenging problems with self-confidence. It is the department’s intent to maintain a general and flexible curriculum that prepares students for both industrial practice and graduate education.

Educational Objectives
The objective of the UNH Mechanical Engineering Program is to produce graduates who are ethical professionals and good citizens. As they progress in the first several years following graduation, they are expected to:

1. Use their engineering education and communication skills for success in:
   a. Technical careers in industry, academia, government, or other organizations;
   b. Graduate school in engineering or physical sciences;
   c. Nontechnical careers or education in areas such as law, medicine, business, public policy, secondary education, service industries, etc.;
   d. Careers involving management or entrepreneurship.
2. Exercise lifelong learning to:
   a. Pursue professional development opportunities in their disciplines;
   b. Develop new knowledge and skills;
   c. Pursue new areas of expertise or careers.
3. Use their engineering background to:
   a. Solve technical problems for societal benefit;
   b. Develop new knowledge and products that will promote sustainable economic and environmental developments to improve the quality of life;
   c. Promote the practice of engineering.

Mechanical engineering is a challenging profession and has two major emphases. The first is the general area of mechanical design, which involves all types of mechanical motion and the forces and energy that drive it. The other emphasis deals with energy generation and conversion and is grounded in the principles of the thermal and fluid sciences. Other subject areas, which support both emphases and are frequently part of designs and products, are the materials sciences, manufacturing, and control systems. All of these areas are included in the education and training of mechanical engineers. Ocean engineering is another focus area in our department which emphasizes solving engineering problems associated with the sustainable utilization of ocean resources and the scientific exploration and study of the ocean environment. Mechanical engineering requires significant study in mathematics, engineering computing, and basic sciences such as chemistry and physics, as well as basic engineering courses, before reaching the more specialized courses. Additional information can be found at the mechanical engineering website.

https://ceps.unh.edu/mechanical-engineering

Programs
- Mechanical Engineering Major (B.S.)
- Mechanical Engineering Minor

Courses

Mechanical Engineering (ME)
ME 441 - Introduction to Engineering Design and Solid Modeling
Credits: 0 or 4
Why are some products better than others? What is the definition of "better"? This course uses an inquiry-guided approach to explore the product design process via team design projects and laboratory exercises. Everyday products are examined from historical, societal, design, safety and manufacturing perspectives. Topics include ideation, sketching, design constraints, solid modeling, decision making, statistical quality control, manufacturing methods and engineering analysis. Students develop an appreciation for good design and the ability to communicate design ideas via 3-D solid models, written and oral reports. Prereq: MATH 418 or equivalent.
Attributes: Inquiry (Discovery); Writing Intensive Course

ME 477 - Introduction to Solid Modeling
Credits: 1
Introduction to solid modeling and engineering drawings using computer-aided design software. For Mechanical Engineering students, this course can only be taken with permission as an alternative to the required ME 441 Introduction to Engineering Design and Solid Modeling for students with extensive engineering design experience (e.g., high school or another university course), an engineering project based program (e.g., FIRST Robotics or Project Lead the Way), or similar experience (e.g., working in the industry). Students should not take both ME 441 and ME 477. Lecture and Lab.

ME 503 - Thermodynamics
Credits: 3
Properties of a pure substance, work and heat, laws of thermodynamics, entropy, thermodynamic relations, cycles. Prereq: PHYS 407. Pre- or Coreq: CHEM 405; MATH 528.

ME 523 - Introduction to Statics and Dynamics
Credits: 3
Overview of statics and dynamics applying concepts to particles then to rigid bodies. Topics include two- and three-dimensional force systems; laws of equilibrium; analyses of trusses and frames; friction; relative motion; impulse-momentum principles; work-energy relationships. Prereq: MATH 426; PHYS 407. Not for ME majors.
ME 525 - Statics  
Credits: 4  
Introduces statics. Two- and three-dimensional force systems, the  
concept of equilibrium, analysis of trusses and frames, centroids, bending  
moment and shear force diagrams, and friction. Prereq: PHYS 407 and  
MATH 426.  
Equivalent(s): CEE 500, CIE 525, CIE 528  

ME 526 - Mechanics of Materials  
Credits: 3  
Introduces strength of materials. Analysis of members under torsion,  
axial, shear and bending stresses, superposition of stresses, stability of  
columns. Prereq: ME 525. Writing intensive.  
Attributes: Writing Intensive Course  
Equivalent(s): CIE 501, CIE 526, CIE 529  

ME 561 - Introduction to Materials Science  
Credits: 4  
The concepts of materials science and the relation of structure of  
material properties. Atomic structure, bonding material transport,  
mechanical properties of materials, solidification, phase diagrams,  
solid state transformations, and corrosion and oxidation. Laboratory  
exercises are carried out to demonstrate the basic concepts of the  
course. Prereq: one semester of introductory chemistry with a lab or  
equivalent; MATH 425. Writing intensive.  
Attributes: Writing Intensive Course  
Equivalent(s): ME 661  

ME 603 - Heat Transfer  
Credits: 3  
Analysis of phenomena; steady-state and transient conduction, radiation,  
and convection; engineering applications. Prereq: MATH 527, ME 608.  

ME 608 - Fluid Dynamics  
Credits: 0 or 3  
Dynamics and thermodynamics of compressible and incompressible  
fluid flow; behavior of fluids as expressed by hydrostatic, continuity,  
momentum, and energy equations. Prereq: ME 503. Pre- or Coreq:  
MATH 527, IAM 550.  
Co-requisite: ME 627  
Equivalent(s): ME 508  

ME 627 - Dynamics  
Credits: 3  
Introduction to particle and rigid body dynamics. Rectilinear and  
curvilinear motion, translation and rotation, momentum and impulse  
principles, and work-energy relationships. Prereq: ME 525 or permission.  
Writing intensive.  
Attributes: Writing Intensive Course  
Equivalent(s): CIE 527, ME 527  

ME 643 - Machine Design  
Credits: 3  
Analysis, synthesis, and design of machine elements and systems.  
Development of engineering judgment; selection of materials stress  
and failure analysis; kinematic arrangement design for finite and infinite  
life. Open-ended design problems unify course topics. Prereq: ME 526,  
ME 561, ME 627. Writing intensive.  
Attributes: Writing Intensive Course  

ME 646 - Experimental Measurement and Data Analysis  
Credits: 0 or 4  
Basic and advanced techniques of engineering and scientific parameter  
measurement including statistical data and error analysis, curve  
fitting, calibration and application of transducers, and technical  
writing. Laboratory experiments draw on concepts from mechanics,  
thermodynamics, and fluid mechanics. Prereq: ME 526. Pre- or Co-req:  
ME 608. Writing intensive.  
Attributes: Writing Intensive Course  

ME 670 - Systems Modeling, Simulation, and Control  
Credits: 0 or 4  
Lumped parameter models for mechanical, electrical, thermal, fluid, and  
mixed systems. Matrix representation, eigenvalues, eigenvectors, time  
domain solutions, frequency response plots, and computer simulations  
are used to explore system response. Design of system for desired  
responses. Introduces feedback control, stability, and performance  
criteria. Prereq: ECE 537, ME 627, MATH 527. Writing intensive.  
Attributes: Writing Intensive Course  

ME 695 - Special Topics  
Credits: 2-4  
Course topics not offered in other courses. May be repeated for credit.  
Lab. Prereq: permission.  

ME 696 - Projects  
Credits: 1-4  
Analytical, experimental, or design projects undertaken individually or in  
teams under faculty guidance. May be repeated for credit.  

ME 699 - Engineering Internship  
Credits: 1  
Internship experience provides on-the-job reinforcement of academic  
programs in mechanical engineering. Contact the Mechanical  
Engineering department office for guidelines. Prereq: appropriate class  
standing in major, 2.5 grade point average, and permission. Ct/F.  
Repeat Rule: May be repeated for a maximum of 3 credits.  

ME 705 - Thermal System Analysis and Design  
Credits: 4  
Engineering design of thermal systems that involve real problems and  
analysis of performance of the design. Design criteria include function,  
performance, optimization, economy, safety, and others as appropriate for  
the system. Required for ME seniors. Prereq: ME 503. Writing intensive.  

Co-requisite: ME 608  
Attributes: Writing Intensive Course  
Equivalent(s): ME 605  

ME 706 - Renewable Energy: Physical and Engineering Principles  
Credits: 3  
The goal of this course is to become “Fluent in energy” and to learn about  
the engineering fundamentals of renewable energy technologies. The  
course will begin by giving an overview of U.S. energy usage and sources,  
as well as history and trends. Various renewable energy topics will then  
be discussed. Where applicable, topics will be discussed in detail from a  
fluid and thermal sciences point of view. Guest lecturers and a field trip  
may be included. This course is open to all engineering seniors. Prereq:  
ME 503 - Thermodynamics, ME 608 - Fluid Dynamics, or equivalent, or  
instructor permission.  

ME 707 - Analytical Fluid Dynamics  
Credits: 4  
Kinematics of flow; constitutive relationships; development of the Navier-  
Stokes equations; vorticity theorems; potential flow. Prereq: ME 608.

Credits:
ME 735 - Mechanics of Composite Materials
Credits: 4

ME 743 - Satellite Systems, Dynamics, and Control
Credits: 3
General satellite systems with emphasis on spacecraft dynamics and control. Topics include general satellite information such as types of satellites, missions, and orbits, as well as satellite subsystems. Basic spacecraft dynamics and orbital mechanics topics are covered. Advanced topics include attitude and orbit estimation, and automatic attitude control. Prereq: ME 670 or permission.

ME 747 - Experimental Measurement and Modeling of Complex Systems
Credits: 0 or 4
Experimental measurements for evaluation, design, and control of mechanical, electrical, and thermal/fluid phenomena. Emphasizes the dynamic response of both sensors and systems and the interactions between physical processes. Experimental examples are drawn from mechanics, material science, thermal-fluid science and controls. Prereq: ME 646; ME 670. Writing intensive.

Attributes: Writing Intensive Course

ME 755 - Senior Design Project I
Credits: 2
Part I of this two-part sequence emphasizes problem definition, analysis, development of alternative concepts, decision-making processes, synthesis of an optimum solution and the development of a conceptual design. Lectures on these and other topics are combined with seminars given by professionals from industry, government, and academia. Related topics include ISO9000 quality systems, engineering management, design review process, engineering economics, team building and communications. Students are organized into project teams to develop a conceptual design. Formal design reviews are conducted. A formal proposal documents the semester's work. Prereq: Senior standing in ME. Lab. Writing intensive.

Attributes: Writing Intensive Course
Equivalent(s): ME 656

ME 756 - Senior Design Project II
Credits: 2
Continuation of Senior Design Project I, in which the proposal submitted in the previous course is developed into a prototype system. Part II emphasizes the development, assembly, testing and evaluation of the system designed in Part I. Lectures and seminars focus on the prototype development process, design verification and industry practices. A formal report documents the semester's work. Prereq: ME 755. Writing intensive.

Attributes: Writing Intensive Course
Equivalent(s): ME 656

ME 757 - Coastal Engineering and Processes
Credits: 3
Introduces small amplitude and finite amplitude wave theories. Wave forecasting by significant wave method and wave spectrum method. Coastal processes and shoreline protection. Wave forces and wave structure interaction. Introduces mathematical and physical modeling. Prereq: ME 608 or permission. (Also offered as CIE 757 and OE 757.)
Equivalent(s): CIE 757, OE 757

ME #760 - Physical Metallurgy I
Credits: 0 or 4
Introduction to physical metallurgy; dislocations; thermodynamics of materials, diffusion, phase transformations, and strengthening mechanisms in solids. Prereq: ME 561 or permission. Lab.
ME 761 - Diffraction and Imaging Methods in Materials Science  
Credits: 4  
Introduces x-ray diffraction and electron microscopy. Basic crystallography, reciprocal lattice, x-ray and electron diffraction, x-ray methods, transmission and scanning electron microscopy. Prereq: CHEM 403; PHYS 408 or permission. Lab.

ME 770 - Design with Microprocessors  
Credits: 4  
Basic operation of microprocessors and micro-controllers is explained, and interfacing these devices to sensors, displays and mechanical systems is explored. Topics include: number systems, architecture, registers, memory mapping, interrupts and interfacing for system design. Methods of programming and interfacing with mechanical/electrical systems are covered in class, and then implemented in lab. Prereq: ECE 537 or permission. Lab.

ME 772 - Control Systems  
Credits: 0 or 4  
Development of advanced control system design concepts such as Nyquist analysis, lead-lag compensation, state feedback, parameter sensitivity, controllability, observability, introduction to non-linear and modern control. Includes interactive computer-aided design and real-time digital control. Prereq: ME 747 or permission. (Also offered as ECE 772.) Lab.

Equivalent(s): ECE 772, EE 772

ME 773 - Electromechanical Analysis and Design  
Credits: 4  
Analysis and design of electromechanical systems using lumped parameter models and magnetic finite element analysis (FEA). Electrostatic and magnetic field equations are discussed and used to derive magnetic and electric lumped model elements. Brushless dc motor is analyzed using lumped models and FEA. Various drive types are discussed and the motor system analyzed to obtain torque-speed curves. Design principles are given and utilized in a design project. Prereq: ME 670 or permission.

ME 777 - Computer Aided Engineering  
Credits: 4  
In this course, modules of Solid Works (beyond its basic solid modeling capabilities) and other software is used to demonstrate how computer based tools can be used in engineering practice, in particular design analysis and optimization. Emphasis placed on using knowledge from past engineering courses to obtain theoretical calculations to compare with the results from the computer software package. Prereq: ME 526 Strength of Materials; ME 627 Mechanics III; ME 603 Heat Transfer; and ME 608 Fluid Dynamics (or equivalent).

Attributes: Writing Intensive Course

ME 782 - Industrial Skills and Engineering  
Credits: 3  
In this course, the principles of Lean Manufacturing and Value Stream Mapping (VSM) as pioneered by Toyota and now utilized by most leading manufacturers will be studied and applied. Lean Manufacturing principles will be taught with classroom instruction and a structured model factory exercise. Instruction on the theory of Value Stream Mapping (VSM) will be followed with an actual industrial VSM activity where a process will be studied and a Desired Future State defined with VSM methods. This factory floor activity will be done collaboratively with employees from a manufacturing company.

ME 785 - Solid Mechanics in Manufacturing  
Credits: 4  
Characterization of material properties are studied with emphasis on plastic deformation. Also, numerical approaches to solve for the forces, stresses, and strains in manufacturing processes are covered. In particular, two prominent mass production manufacturing areas, metal forming and cutting, are examined. Prereq: ME 561; ME 627.

ME 786 - Introduction to Finite Element Analysis  
Credits: 4  
Topics include basic matrix theory, potential energy approach, direct stiffness method, calculus of variations, development of finite element theory, and modeling techniques. Applications in solid mechanics, heat transfer, fluids, and electromagnetic devices, via both commercially available codes and student-written codes. Prereq: ME 526 or permission. Lab.

Equivalent(s): CIE 786

ME 795 - Special Topics  
Credits: 1-4  
New or specialized courses and/or independent study.
Repeat Rule: May be repeated for a maximum of 20 credits.

ME 797 - Honors Seminar  
Credits: 1  
Course enrichment and/or additional independent study in subject matter pertaining to a 600- or 700-level ME course other than ME 695, ME 696, ME 697, or ME 795.

https://ceps.unh.edu/directory/all