

# Mechanical and Industrial Engineering

Website (<http://www.mie.neu.edu>)

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The Department of Mechanical and Industrial Engineering offers comprehensive undergraduate programs in both mechanical engineering and industrial engineering, equipping students with the fundamentals in science, mathematics, and engineering. The programs are optimally blended with theory, computation, and laboratory-level practice, as well as with real-world experience through cooperative education programs aligned with Northeastern University's mission in experiential learning. Graduates are positioned to excel in careers in broad areas of engineering as well as in academia.

## Mission of the Department

The mission of the Department of Mechanical and Industrial Engineering is to educate students for professional and technical excellence; to perform research to advance the science and practice of engineering; to engage in service activities that advance the department, the university, and the profession; and to instill in ourselves and our students habits and attitudes that promote ethical behavior, professional responsibility, and careers that advance the well-being of society.

## Mechanical Engineering

Mechanical engineers design, develop, and support the manufacture of machinery and devices to transmit power or to convert energy from thermal to mechanical form in order to power the modern world and its machines. Traditionally, mechanical engineers have designed and tested devices, such as heating and air-conditioning systems, machine tools, internal-combustion engines, and steam power plants. Today they also play primary roles in the development of new technologies in a variety of fields—energy conversion, solar energy utilization, environmental control, robotics, prosthetics, transportation, manufacturing, and new-materials development.

Mechanical engineers use computers to formulate preliminary and final designs of systems or devices, to perform calculations that predict the behavior of the design, and to collect and analyze performance data from system testing or operation. Mechanical engineering has been heavily influenced by recent advances in computer hardware and software.

The curriculum in mechanical engineering focuses on four areas: applied mechanics, thermofluids engineering, materials science, and mechatronics. Applied mechanics is the study of the motion and deformation of structural elements acted on by forces in devices that range from rotating industrial dynamos to dentists' drills. Thermofluids engineering deals with the motion of fluids and the transfer of energy, as in the cooling of electronic components or the design of gas turbine engines. Materials science is concerned with the relationship between the structure and properties of materials and with the control of structure, through processing, to achieve desired properties. Practical applications are in the development of composite materials, metallurgical process industries, and advanced functional materials. Mechatronics is critical to any engineered system in which sensors and actuators of several types communicate and function in order to impart desired behavior from these systems.

Courses in each area form the foundation for advanced analytical and creative design courses that culminate in a two-semester capstone design project. Faculty encourage students throughout the curriculum to use computer-aided design tools and high-performance computer workstations.

## Industrial Engineering

Industrial engineers design and analyze systems that include people, equipment, and materials and their interactions and performance in the workplace. An industrial engineer collects this information and evaluates alternatives to make decisions that best advance the goals of the enterprise. Industrial engineers work in manufacturing firms, hospitals, banks, public utilities, transportation, government agencies, insurance companies, and construction firms. Among the projects they undertake are design and implementation of a computer-integrated supply chain or manufacturing system; facilities planning for a variety of industries; design of a robotics system in a manufacturing environment; long-range corporate planning; development and implementation of a quality-control system; simulation analyses to improve processes and make operational decisions; and design of healthcare operations to enhance patient safety and improve efficiency, productivity, and development of computer systems for information control.

The program in industrial engineering offers students a base of traditional engineering courses, such as work design, human-machine systems, probability, statistics, and engineering economy, while emphasizing such contemporary areas as simulation modeling, engineering database systems, quality assurance, logistics and supply chain management, operations research, facilities planning, and advanced manufacturing technologies/ Industry 4.0. Students integrate the knowledge acquired in these courses in a two-semester capstone design project.

## Other Programmatic Features

More than 90 percent of the department's undergraduate students take advantage of the cooperative education program. Cooperative education assignments increase in responsibility and technical challenge as students progress through the program. Entry-level co-op positions in **mechanical engineering** may be in manufacturing, quality assurance and testing, or involve 3D CAD modeling, robotics, and biomedical devices, while more

advanced-level positions will allow students to gain experience in the design process, including advanced 3D modeling, design for manufacturability, prototyping, and systems engineering. Students in the **industrial engineering** discipline may utilize co-op to concentrate on one industry segment and build an increasingly technical skill set with each experience or explore the breadth of career opportunities over the course of several co-op rotations such as healthcare process improvement, supply chain logistics, business analytics, manufacturing operations, and more.

The department also offers significant research opportunities throughout all fields of mechanical and industrial engineering, including participating in research centers based in our department and college.

Our students have an opportunity to obtain a broad knowledge base in science, engineering, and general studies that allows them flexibility in career development and graduate education. At the same time, our graduates should be responsible and scientifically educated citizens, prepared to contribute personally as well as professionally to an educated, democratic society.

## Programs

### Bachelor of Science in Industrial Engineering (BSIE)

- Industrial Engineering (<http://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/bsie/>)

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

- Mechanical Engineering (<http://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/bsme/>)
- Mechanical Engineering and Bioengineering (<http://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/mechanical-engineering-bioengineering-bsme/>)
- Mechanical Engineering and Design (<http://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/mechanical-engineering-design-bsme/>)
- Mechanical Engineering and History (<http://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/mechanical-engineering-history-bsme/>)
- Mechanical Engineering and Physics (<http://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/mechanical-engineering-physics-bsme/>)

## Minors

- Aerospace (<http://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/aerospace-minor/>)
- Biomechanical Engineering (<http://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/biomechanical-engineering-minor/>)
- Healthcare System Operation (<http://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/healthcare-system-operations-minor/>)s (<http://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/healthcare-system-operations-minor/>)
- Industrial Engineering (<http://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/industrial-engineering-minor/>)
- Mechanical Engineering (<http://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/mechanical-engineering-minor/>)
- Robotics (<http://catalog.northeastern.edu/undergraduate/engineering/electrical-computer/robotics-minor/>)

## Accelerated Programs

See Accelerated Bachelor/Graduate Degree Programs (<http://catalog.northeastern.edu/undergraduate/engineering/accelerated-bachelor-graduate-degree-programs/#programstext>)