Mechanical and Industrial Engineering

Website (https://mie.northeastern.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 real-world experience through cooperative education programs aligned with Northeastern University's mission in experiential learning. MIE 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 structures, machines, and devices that apply, convert, or transmit power. Traditionally, mechanical engineers designed and tested artifacts 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 and conservation, renewable energy utilization, environmental control, robotics, prosthetics, aerospace, transportation, manufacturing, and new-materials development. Further, mechanical engineers use advanced computational techniques to formulate preliminary and final designs of systems or devices, to perform calculations that predict the behavior of a design, and to collect and analyze performance data from system testing or operation.

The curriculum in mechanical engineering focuses on four areas: applied mechanics, thermofluids, 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 vehicular suspensions, to artificial prosthetic hands. Thermofluids engineering deals with the motion of fluids and the transfer of energy, as in the cooling of electronic components, the design of gas turbine engines, or aero/hydrodynamic behavior of structures. 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, advanced functional materials, and materials with sustainable and ethical origins and life cycles. 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, particularly in the fields of automation and robotics. Faculty encourage students throughout the curriculum to use computer-aided design tools and high-performance computer workstations.

The mechanical engineering curriculum culminates in a two-semester capstone design course, in which students work in teams to design, analyze, test, and manufacture prototypes to address relevant challenges across research, industry, and society.

Industrial Engineering

Industrial engineers design, develop, and analyze systems that include people, equipment, processes, products, programs, and materials and their interactions and performance in the workplace and beyond. An industrial engineer collects this information and uses data to evaluate alternatives to make decisions that best advance the goals of the enterprise, system, service, or interaction. Industrial engineers work in manufacturing firms, hospitals and healthcare organizations, consulting and financial firms, banks, public utilities, transportation, government agencies, product R&D, insurance companies, community partnerships, construction companies, sports organizations, and virtual enterprises, to name a few. 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 or automated environment, long-range corporate planning, development and implementation of a quality-control system, simulation analyses to improve processes and make operational decisions for businesses, system audits for safety and performance, design of healthcare operations to enhance patient well-being and to improve efficiency and productivity, the use of data analytics and large language learning models to inform systems functionality, and development of computer-based systems for information and operational control.

The curriculum in industrial engineering offers students a base of foundational engineering courses such as work design, probability, statistics, and engineering economy, while emphasizing emerging areas such as simulation modeling, engineering database systems, quality assurance, logistics and supply chain management, operations research, facilities planning, advanced manufacturing technologies/Industry 4.0, and human-machine systems. Key programming languages are introduced and advanced throughout the curriculum.

Students integrate the knowledge and skills acquired in their courses in a two-semester capstone design experience. In capstone, students further expand their knowledge base beyond the major and work in teams to complete an advanced open-ended project.

Other Programmatic Features

More than 90% 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 and data analytics, consulting and/or finance, manufacturing operations, product design, 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. Students in MIE are encouraged and empowered to reflect, connect, communicate, and collaborate with departmental faculty and staff to develop context for the knowledge and skills they learn as they explore their own personalized mission. In both disciplines in the MIE department, students emerge with significant leadership opportunities.

MIE students have the opportunity to obtain a broad knowledge base in science, engineering, and general studies that allows them flexibility in career development and/or further pursuit of advanced degrees. At the same time, our graduates become responsible and rigorously educated individuals, prepared to contribute personally, professionally, authentically, and ethically toward a better world.

Programs

Bachelor of Science in Industrial Engineering (BSIE)

- Industrial Engineering (https://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/bsie/)
- Industrial Engineering and Business Administration (https://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/industrial-engineering-business-administration-bsie/)
- Industrial Engineering and Computer Science (https://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/industrial-engineering-computer-science-bsie/)

Bachelor of Science in Mechanical Engineering (BSME)

- Mechanical Engineering (https://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/bsme/)
- Mechanical Engineering and Bioengineering (https://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/mechanical-engineering-bioengineering-bsme/)
- Mechanical Engineering and Computer Science (https://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/mechanical-engineering-computer-science-bsme/)
- Mechanical Engineering and Design (https://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/mechanical-engineering-design-bsme/)
- Mechanical Engineering and History (https://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/mechanical-engineering-history-bsme/)
- Mechanical Engineering and Physics (https://catalog.northeastern.edu/undergraduate/engineering/mechanical-industrial/mechanical-engineering-physics-bsme/)

Minors

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

Accelerated Programs

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