

## THE FIELD

Modern society is faced with highly complex technological problems for which engineers are asked to provide solutions. These challenges make engineering a fascinating field of study and give prospective engineering students a wonderful opportunity to make a difference in society. Along with theoretical and practical knowledge, engineering students also gain experience by working in labs, collaborating with professors, joining research projects, participating in internships, working in the field, and completing a culminating senior project. In today's high-tech world, the engineering degree is a great foundation for careers in traditional engineering fields, as well as careers in management, sales, government, medicine, research, law, teaching, and more.

## THE DEPARTMENTS

### BIOMEDICAL ENGINEERING

Biomedical engineering (BME) integrates engineering science, biology, and medicine into a cross-disciplinary field focused on improving human health and solving problems in health-care delivery. Looking at the human body through the lens of engineering, one can apply the concepts of design, optimization, and programming to complex biological systems in order to detect, repair, and treat disease, as well as to create diagnostic and therapeutic tools.

Graduates of the biomedical engineering undergraduate degree program will be prepared for a broad range of careers, including medical equipment design and manufacturing, scientific research and development services, pharmaceutical and medicine manufacturing, and work with medical professionals.

### CHEMICAL ENGINEERING

Chemical engineers invent, develop, design, and operate processes and devices to convert raw materials into useful products, as well as working to improve the efficiency, safety, and sustainability of existing processes. Chemical engineers engage in fundamental research, product development, economic and market analysis, design, construction, operations, supervision, sales, technical service, management, patent law and public policy. Their expertise is critical in the pharmaceutical and biotechnology industries, as well as renewable energy and sustainability efforts, environmental remediation, petroleum refining and petrochemical production, plastics, synthetic fibers and textiles, pulp and paper, semiconductor manufacturing, and food and beverage industries. The training of a bachelor of science (BS) chemical engineer provides a broad background in chemistry, physics, mathematics, and their applications. This background enables alumni to be employed in both traditional fields and emerging areas. Chemical engineering also serves as a strong foundation for future graduate work in areas ranging from biotechnology and pharmacology to advanced materials to energy and sustainability.

### CIVIL ENGINEERING

The field of civil engineering is quite broad and encompasses a variety of interrelated disciplines: structural engineering, environmental engineering, hydraulics, transportation, water resources, geotechnical engineering, construction, and surveying. Civil engineering originated as a field involved with civil works—the planning, design, construction, and operation of facilities that serve the general population. Today, the field is still largely centered in the public arena and is a profession dedicated to the needs and progress of humankind.

Civil engineers design and construct the infrastructure that we use every day—roadways, transportation systems, drinking water treatment plants, tunnels, subways, buildings, solid waste landfills, bridges, wastewater treatment plants, canals and waterways, water supply pipe networks, railroads, dams and reservoirs, and even ski lifts and amusement rides. They analyze and solve problems of water, land, and air pollution and oversee the operation of water supply, pollution control, and hazardous waste control facilities. Civil engineers participate in city planning and in planning the uses of natural systems, river basins, and other public areas. They perform reliability and economic feasibility studies to ensure safe and economically efficient outcomes. Using satellite images and global positioning systems, they survey and monitor the environment and assist in overall resource planning and asset management.

The research and expertise of the civil and environmental engineering faculty are focused in the areas of environmental and water resources engineering, geotechnical engineering, structural engineering and mechanics, and transportation engineering. Students are exposed to all these areas during their academic studies at UMass Amherst.

### **ELECTRICAL AND COMPUTER ENGINEERING**

Electrical and Computer Engineering (ECE) employs principles of physics, mathematics, and computer science to engineer solutions that profoundly impact the world. ECE is responsible for engineering and architecting the billions of transistors in today's computers; responsible for engineering the smartphone; and responsible for engineering the cellular, satellite, and computer networks that make up the internet.

The scale of ECE's impact is tremendous, from these nanometer-scaled transistors, circuits, and devices to the global reach of the internet. The future before ECE is exciting! On one hand, Moore's Law has ended, ECE will have a major role in engineering the next computing platform, and the excitement is the unknown. What will "it" be: a quantum computer, a brain-inspired platform, or something we haven't imagined yet? On the other hand, ECE is right in the middle of the evolving Internet of Things (IoT), where smart "things" (packed with electronic sensors, embedded computers, and intelligence) interact with the Cloud. This evolution will change the ways we live, travel, conduct commerce, play, and manage our health.

### **MECHANICAL AND INDUSTRIAL ENGINEERING**

Mechanical engineers design, analyze, develop, and test engineering systems and their myriad components, ranging from power plants to jet aircraft to prosthetic limbs to offshore wind platforms. Industrial engineers design, analyze, and improve integrated systems of people, material, and equipment.

Mechanical and industrial engineers often collaborate in manufacturing operations to ensure that a system of people and manufacturing equipment produces products from a supply of materials and other resources. Logistics coordination, quality control, simulation, human factors, and economics are all part of industrial engineering. Often industrial engineers focus on enhancing the effectiveness of technological and logistics systems by gathering, structuring, and managing information.

Industrial engineers apply their knowledge not only in industry, but also in government, health care, transportation, and many service industries. Mechanical engineers are engaged in many facets of product and system realization ranging from concept design to production. Along with industrial engineers, they usually determine what gets made and how. Their task is to integrate aspects of mechanical engineering, including design, energy, materials, and controls to deliver cost-effective, high-quality products. Both industrial and mechanical engineers work in a wide variety of industries and in many types of organizations. They are employed not only as engineering professionals, but also as technical and corporate managers.

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