University of Massachusetts Amherst

CHEMICAL ENGINEERING

THE FIELD

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, 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 the food and beverage industries. The training associated with a bachelor of science (BS) degree in chemical engineering provides a broad background in chemistry, physics, mathematics, and their applications. The curriculum can be tailored to meet student interest in biochemical engineering, materials science and engineering, and engineering management. This background enables alumni to be employed in both traditional fields and emerging areas. Furthermore, 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.

There is no minor available in chemical engineering.

THE MAJOR

The chemical engineering program is focused on the achievement of a set of educational objectives. Within a few years of graduation, our students are expected to: 1a) achieve positions of leadership* within industry and related sectors by applying their knowledge of mathematics, science, and engineering in the professional practice of chemical engineering and allied professions after graduation; or 1b) enter and excel in research positions in post-graduation careers following graduate or professional school; and 2) provide leadership* in the professional field through a knowledge of the needs, trends, and directions of contemporary and emerging technologies. Graduates are expected to be able to: identify, formulate, and solve complex (chemical) engineering problems by applying principles of engineering, science (particularly chemistry), and mathematics; 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; communicate effectively with a range of audiences; recognize ethical and professional responsibilities in (chemical) engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts; function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives; develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions; acquire and apply new knowledge as needed using appropriate learning strategies.

**Leadership is defined broadly and includes producing useful change by developing and communicating a vision, convincing people to buy in, and empowering others. Leadership may be technical, project oriented, community/outreach oriented, or organizational in nature.*

ADMISSION TO THE MAJOR

Admission to the major is contingent upon a cumulative and most recent regular semester, i.e., fall or spring, GPA of 2.0 or higher, and a grade of C or better in the following courses: PHYSICS 151, CHEM 111 or PHYSICS 152, MATH 131, MATH 132, ENGLWRIT 112, ChE 120 and ENGIN 100, 110, 111, 112, 113, or 114.

CURRICULUM

Major requirements include Thermodynamics I & II, Fluid Mechanics, Writing in Engineering, Kinetics and Reactor Design, Heat and Mass Transfer, Separations, Mathematical Modeling, Professional Development Seminars, Chemical Engineering Lab I & II, Chemical Process Design, and Chemical Process Control. The curriculum is designed to afford flexibility in the junior and senior years for elective courses and the opportunity to participate in co-ops, internships, and/or laboratory research.

THE CONCENTRATION IN BIOCHEMICAL ENGINEERING

The concentration in biochemical engineering provides students with specialized coursework and training to better prepare them for engineering careers in the pharmaceutical and biotechnology industries. The courses for this program fit into the required advanced chemistry and technical electives that all chemical engineering students are required to take.

MATERIALS ENGINEERING CERTIFICATE

This 15-credit certificate program provides students with specialized coursework and training in the interdisciplinary field of materials engineering to prepare them for professional careers in the materials engineering, manufacturing, and device fabrication industries. The courses for this program (12 credits from classroom instruction and 3 credits from projects/laboratories) fit into the technical elective categories that all chemical engineering students are required to take.

COOPERATIVE EXPERIENCE

Internships and co-op experiences in an industrial, hospital, or academic setting provide significant advantages to students in their education and in the opportunities available to them upon graduation. Students are encouraged to discuss opportunities with the college's Career Center as well as with their academic advisor.

HONORS

UMass Amherst honors (Commonwealth Honors College) and departmental honors programs provide engineering students with the opportunity to participate in an honors experience on campus, including honors courses, seminars, undergraduate research projects, and a senior research thesis. Students interested in participating in departmental honors and Commonwealth Honors College should contact the honors coordinator in their respective College of Engineering department.

STUDY ABROAD

Engineering students are encouraged to consider study abroad. These can be semester or yearlong experiences taking General Education courses, engineering courses, and other technical electives to fulfill engineering degree requirements. Prior departmental approval is required for engineering and technical elective courses. For more information, contact the International Programs Office (413-545-2710, umass.edu/ipo).

CAREER OPPORTUNITIES

Chemical engineering graduates are prepared to enter careers in both chemical engineering and allied professions or to go on to further study at graduate and professional schools. Graduates are expected to be able to apply knowledge of mathematics, science (particularly chemistry), and chemical engineering; design and conduct experiments and analyze and interpret data; synthesize, design, and optimize systems, components, and processes; function on multidisciplinary teams; identify, formulate, and solve chemical engineering problems; communicate effectively; and use the techniques, skills, and modern science and engineering tools necessary for chemical engineering practice. Students acquire a broad education necessary to understand the impact of chemical engineering systems in a global and societal context; an understanding of professional and ethical responsibility; a knowledge of contemporary issues in chemical engineering; and a recognition of the need for, and an ability to engage in, lifelong learning.

THE COLLEGE OF ENGINEERING

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.

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