Chemical Engineering, B.S.E.

Requirements

The Bachelor of Science in Engineering requires a minimum of 128 s.h. of credit. Students must have a g.p.a. of at least 2.00 on all college work used to satisfy degree requirements as well as on all work undertaken at the University of Iowa. Seminars do not count toward the 128 s.h. required for the degree.

The major in chemical engineering provides a broad education at the leading edge of technology. It emphasizes fundamental concepts, problem solving, laboratory techniques, and communication skills. The biological sciences join physics, chemistry, and mathematics as foundation disciplines for chemical engineering.

All engineering students complete the B.S.E. core requirements, which include RHET:1030 Rhetoric; ENGR:1100 Introduction to Engineering Problem Solving and ENGR:1300 Introduction to Engineering Computing; and courses in chemistry, physics, engineering mathematics and fundamentals, and the general education component. For information about the B.S.E. requirements, see Bachelor of Science in Engineering, B.S.E. in the Catalog.

The sophomore, junior, and senior years emphasize chemical engineering courses such as process calculations, fluid flow, chemical engineering thermodynamics, heat and mass transfer, separations, chemical reaction engineering, chemical process safety, chemical engineering laboratories, biochemical engineering, process dynamics and control, and process design. Experience in instrumentation, analysis, and design is obtained through an integrated laboratory program. Routine use is made of computer-based data analysis, simulation, and design.

Students are required to participate in at least one enriching activity, which may include a research experience, a cooperative education or internship experience, study abroad, completion of the Certificate in Technological Entrepreneurship, or other approved experiences.

Chemical engineering students may gain depth of knowledge related to a career path through their selection of science, engineering, and general education electives. Several preapproved focus areas may help students define potential careers.

Students must select focus area courses according to guidelines established by the Department of Chemical and Biochemical Engineering. See “Focus Area” below.

Focus Area

The focus area enables students to gain depth of knowledge in a career path. Students meet with their chemical engineering academic advisor to discuss career options and develop a plan for choosing electives based on their career interests. The department offers preapproved focus areas in biochemical engineering; business; chemical process engineering; computation, data science, and machine learning; energy and environment; entrepreneurship; oil and gas engineering; pharmaceuticals; polymers; pre-medicine; and sustainability.

Students may prefer to develop an individualized focus area, which is subject to approval by the department’s curriculum committee. See Chemical Engineering Curriculum on the Department of Chemical and Biochemical Engineering website for detailed descriptions of preapproved focus areas, guidelines for tailored focus areas, and typical four-year study plans based on focus areas.

Biochemical Engineering

This focus area allows students to choose from a selection of courses that combines concepts of biology, biochemistry, and engineering. Biochemical engineers combine knowledge of these three areas to manufacture products of biological nature, including fermentation products and pharmaceuticals. Students often go on to work in the biotechnology and pharmaceutical industries as production leaders or researchers.

Business

This focus area consists of eight core courses from the Tippie College of Business. Students gain foundational business knowledge on topics including finance, economics, accounting, marketing, law, and management. Past students have applied their integrated business and technical knowledge to many different settings ranging from manufacturing plants to consulting and to corporate offices.

Chemical Process Engineering

Process engineering is the design, optimization, and operation of systems that transform raw materials into valuable products. Process engineers are involved with products, including foods and beverages, electronic materials, metals, plastics, fuels, building materials, and pharmaceuicals. Since chemical process engineering spans many aspects of engineering, business, applied math, and science, students can choose 12 s.h. of electives from a broad selection of 3000-level engineering, math, and science courses. This focus area provides ample room for customization and opportunities to tailor to individualized interests.

Students who do not declare a specific focus area are automatically placed in chemical process engineering.

Computation, Data Science, and Machine Learning

This focus area is for students who intend to blend advanced computation and programming with their chemical engineering degree. This area is customizable based on student interest areas, and can accommodate introductory training in cyber-physical systems, remote sensing, advanced simulation, supply chain management, in silico chemistry and biology, bioinformatics, software design, next-generation controls, machine learning, and artificial intelligence.

Energy and Environment

Students who are passionate about the environment should consider this focus area. Courses prepare students to solve environmental challenges and to revolutionize energy systems. Topics include air pollution, climate change, clean and renewable energy, environmental regulations, and sustainable systems.

Entrepreneurship

This focus area allows students to focus on the process of succeeding in the world of startups, innovation, business ownership, and new products. The area is well suited
for students who intend to start and operate their own business. It also serves students interested in gaining a better understanding of managing innovation in an existing business environment. The wide range of electives permits students to tailor business courses best suited to their individual interests.

**Oil and Gas Engineering**
Meant for students interested in pursuing careers in oil and gas engineering, this focus area explores foundational elements of chemistry, geology, petrochemical refining, and environmental science. The course plan offers several recommendations put in place by experienced advisors with petrochemical backgrounds. Often viewed as the birth of chemical engineering, the petroleum industry provides a host of challenging and lucrative opportunities for chemical engineers. This path provides a unique and focused introduction to the field.

**Pharmaceuticals**
Chemical and biochemical engineering is central to the design, formulation, and manufacturing of pharmaceutical products. Students who are passionate about medical applications can align their chemical engineering skills toward a career in pharmaceuticals by choosing this focus area. The curriculum features biology, drug delivery, and the mechanisms and chemistry of drug interactions. Course options span many departments besides chemical and biochemical engineering, including biomedical engineering, biochemistry and molecular biology, pharmacy, and pharmacology.

**Polymers**
This focus area enables students to study the development of chemical compounds by polymerization, including combining small molecules into engineered networks to produce valuable plastics and other advanced materials. The program is well suited for students who intend to use their knowledge to design new materials; it also serves students interested in gaining a better understanding of the links between molecular scale structure and macroscopic scale properties.

**Pre-Medicine**
Concepts of chemical engineering are naturally applicable to the processes in living organisms. This focus area enables students to apply these concepts to gain a deeper understanding of the atoms and molecules that comprise living organisms, and the pathways through which they operate. This program is for students who intend to use their knowledge to gain acceptance to post-graduate education in the medical field.

**Safety and Health**
This focus area prepares students to (1) prevent incidents and accidents in chemical and pharmaceutical manufacturing, particularly those resulting from the unintentional release of hazardous materials and energy into the environment; and (2) provide a safe and healthy workplace by preventing injuries and hazards in the workplace environment.

**Sustainability**
This focus area covers the most important and current topics in environmental science, societal impacts, energy usage, and natural systems. Courses prepare students to understand and discuss these topics as they relate to chemical engineering.