

# CHEMICAL ENGINEERING

Chemical engineers use knowledge of how nature works (science) and the language of science (mathematics) to create value and solve difficult problems for the benefit of society. The key skill that differentiates chemical engineering from other disciplines is the ability to understand, design and operate transformation (physical or chemical) processes. Chemical engineers literally change (transform) the world. Many in the public assume chemical engineers work only in chemical plants and petroleum refineries. The reality is that chemical engineers work in a broad range of industries including pharmaceuticals, biochemicals, semiconductor materials, foods, plastics, paper, steel, consumer goods, automotive, specialty materials, oil & gas production, renewable energy, engineering services, and the list goes on. Key to providing a benefit to society, chemical engineers are responsible for resource conservation, minimizing pollution, minimizing costs, and maximizing quality and safety of processes that make the products.

The emphasis on the molecular or chemical nature of everything people use is what makes chemical engineers different from other engineers. The emphasis on the processes that make the products is what makes chemical engineers different from chemists.

Chemical engineers often find themselves defining a problem or product, developing a process to do what is needed, and then designing the equipment to carry out the process. After the installation, chemical engineers commonly manage operations, oversee equipment maintenance and supervise control of product quality. They troubleshoot problems that hinder smooth operations, and they plan for future expansions or improvements. Their training and knowledge make them well qualified to market products and processing equipment. The varied background and experience of chemical engineers make them ideally suited for advancement into top-level managerial and executive positions. An advanced degree in chemical engineering is not required.

Many who aspire to careers in medicine or law first obtain BS degrees in chemical engineering. The rigor of the program and the emphasis on critical thinking and analytical reasoning are highly valued by professional school admission committees. A career as a research scientist or academic typically requires a PhD degree.

## Vision

1. Sustain a nationally competitive undergraduate program recognized for quality, fundamental-practice balance, and educational leadership.
2. Attain widespread recognition for contributions to professional knowledge and tools, which are useful, widely accepted, and practiced by others.
3. Sustain and create infrastructures that facilitate synergism, creativity, personal and professional growth, and productivity by students and professional personnel both within OSU and the outside world.

## Mission

The mission of the School of Chemical Engineering at Oklahoma State University is to develop human resources, professional knowledge, and the infrastructure through which chemical engineering can contribute to human welfare. We expect to maintain national recognition for our contributions.

## Program Educational Objectives

The goal of the BS degree program is to produce graduates who possess broad-based knowledge, skills and judgment that prepares them to succeed in the profession of engineering or in further studies at the graduate level, including medical school. To achieve this goal, the program is designed to progressively develop both technical and human skills. The School has three broad objectives. Within the first few years after graduation, our BS graduates will have demonstrated:

Competencies – skill in tools and techniques that are fundamental to the job and the ability and drive to be life-long learners.

Professionalism – applying technical skills in combination with business acumen, teamwork, and communication skills to advance the mission of the enterprise with ethics and integrity.

Balance – a holistic, integrated understanding of self and society to empower self-direction, wise life choices, and deployment of skills in a global context.

## Student Learning Outcomes

Graduating students possess an understanding of fundamental chemical engineering concepts, methodologies and technologies as demonstrated by:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to 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
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The curriculum consists of three primary parts:

1. general education,
2. core engineering, and
3. chemical engineering topics.

In the first two years of study in the chemical engineering program, the focus is on the underlying scientific and mathematical principles of engineering, supplemented by appropriate general education courses in English, social sciences, history and humanities. Students who demonstrate proficiency in this portion of the program continue to the last two years of the program with a focus on core chemical engineering courses.

Students have the opportunity to focus in one of three options in the program:

1. the regular course prepares a graduate for a wide range of employment opportunities;
2. the pre-medical option is for those who wish preparation for medical school; and
3. the biomedical/biochemical option is for those who seek employment in bio-related professions.

Each option prepares a student for success in both employment and graduate study at OSU or other universities. A detailed description of degree requirements for the bachelor's-level curricula is given in the publication Undergraduate Programs and Requirements.

Each option builds upon the preceding chemical engineering courses to develop the ability to identify and solve meaningful engineering problems. The coursework is specifically sequenced and interrelated to provide design experience at each level, leading to progressively more complex, open-ended problems. The coursework includes sensitizing students to socially-related technical problems and their responsibilities as engineering professionals to behave ethically and protect occupational and public safety. The program culminates in the senior-year design courses in which the students integrate the analysis, synthesis and other abilities they have developed throughout the earlier portions of their study into a capstone experience. At this point, students will be able to design components, systems and processes that meet specific requirements, including such pertinent societal considerations as ethics, safety, environmental impact and aesthetics. The students will have developed and displayed the ability to design and conduct experiments essential to specific studies, and to analyze the experimental results and draw meaningful conclusions within an enterprise context.

Integral parts of this educational continuum from basic science through comprehensive engineering design are learning experiences that facilitate the students' abilities to function effectively in both individual and collaborative environments. To achieve this, the program provides every student with adequate learning experiences to develop effective written and oral communication skills. State-of-the-art computational tools are introduced and utilized as a part of their problem-solving experiences. Finally, the students' experience in solving ever-more-challenging problems gives them the ability to continue to learn independently throughout their professional careers.

Students are offered opportunities to enhance their classroom and laboratory experiences through student organizations such as the student chapter of American Institute of Chemical Engineers. Outstanding scholars are recognized by Omega Chi Epsilon, the national honor society for chemical engineering students. Additionally, opportunities for internship and co-op experiences are offered to chemical engineering students so that they can gain professional experience during their collegiate program. Please visit our Internet site <http://che.okstate.edu> (<http://che.okstate.edu/>) for more information.

The Bachelor of Science Program in Chemical Engineering Program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://www.abet.org/>), under the general criteria and the Chemical Engineering Program criteria. <https://ceat.okstate.edu/che/abet-and-educational-outcomes.html>.