

Chemical Engineering

Chemical engineering is an extraordinarily broad discipline that is applied in industries ranging from petroleum to biotechnology to business management and beyond.

Chemical engineers are in great demand in so many industries because their specialization in chemistry combined with solid engineering problem-solving skills creates a professional whose talents are widely useful and adaptable.

They design, develop, and manufacture new materials, products, and processes that enhance our quality of life. Their skills and expertise are also valued in fields like finance, medicine, law, education, and others that rely on high-level analytical, technical, and social skills.

Mission, objectives, and outcomes

Mission: The mission of the chemical engineering undergraduate program is to produce graduates who strive to better the human condition throughout the world by application of their technical knowledge and professional skill.

Undergraduate program objectives:

As engineers, the graduates of the Department of Chemical Engineering will:

1. Be well grounded in the fundamentals of chemical engineering so as to be prepared for the spectrum of career opportunities available to them.
2. Have developed the professional skills, such as communication, teamwork and engineering ethics, necessary to practice their profession in a diverse world.
3. Be capable of meeting the challenges of a world characterized by rapidly increasing technical complexity.

4. Have an awareness of the impact of technology on society.
5. Contribute both to society in general and to their profession in particular.
6. Compete favorably while pursuing advanced studies and become lifelong learners.

Undergraduate program outcomes:

Graduates of the chemical engineering department at K-State will have:

1. An ability to apply knowledge of mathematics, science, and engineering.
2. An ability to identify, formulate, and solve engineering problems.
3. An ability to design and conduct experiments, as well as to analyze and interpret data.
4. An ability to design a system, component, or process to meet desired needs.
5. An ability to function on multi-disciplinary teams.
6. An understanding of professional and ethical responsibility.
7. An ability to communicate effectively.
8. The broad education necessary to understand the impact of engineering solutions in a global and societal context.
9. A recognition of the need for, and an ability to engage in, lifelong learning.
10. A knowledge of contemporary issues.
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Chemical engineering options

You may study chemical engineering along with an area of emphasis, a minor, or a secondary major.

For an area of emphasis, such as biotechnology, environmental engineering, or materials science, you will select appropriate technical electives. A list of recommended electives is available in the department office or on our website, www.che.ksu.edu.

You may also acquire a minor in an area of concentration or complete requirements for admission to medical or law school. Interested students should consult the pre-professional section of the undergraduate catalog.

You may also get a secondary major in an area such as biological engineering or natural resources and environmental sciences. Selection of technical electives and choices for areas of concentration should be made in consultation with the academic advisor.

Curriculum

Chemical engineering is best suited to highly motivated students with excellent abilities and interest in chemistry, physics, and mathematics. The first two years build the necessary intellectual base in the pure sciences and essential communication skills. The last two years contain a carefully structured sequence of courses that blend engineering sciences and design. Graduates of the program desiring to either work in industry or do advanced study at other universities will be well prepared.

Chemical engineering

(128 hours)

Freshman

| Hrs. | Fall semester | |
|------|---------------|--|
| 0 | DEN 015 | New Student Orientation Session |
| 1 | CHE 110 | Current Topics in Chemical Engineering |
| 4 | CHM 210 | Chemistry I** |
| 3 | ENGL 100 | Expository Writing I |
| 4 | MATH 220 | Analytical Geometry and Calculus I |
| 0 | CHE 015 | Engineering Assembly |
| 3 | | Humanities/social science elective |

Hrs. Spring semester

| | | |
|----|------------------------------------|-------------------------------------|
| 4 | CHM 230 | Chemistry II** |
| 4 | MATH 221 | Analytical Geometry and Calculus II |
| 3 | ECON 110 | Principles of Macroeconomics I |
| 2 | SPCH 105 | Public Speaking 1A |
| 0 | CHE 015 | Engineering Assembly |
| 3 | Humanities/social science elective | |
| 16 | | |

Sophomore**Hrs. Fall semester**

| | | |
|----|----------|--------------------------------------|
| 4 | MATH 222 | Analytical Geometry and Calculus III |
| 5 | PHYS 213 | Engineering Physics I |
| 4 | CHM 371 | Chemical Analysis † |
| 3 | CHE 320 | Chemical Process Analysis* |
| 0 | CHE 015 | Engineering Assembly |
| 16 | | |

Hrs. Spring semester

| | | |
|----|----------|---|
| 4 | MATH 240 | Elementary Differential Equations |
| 5 | PHYS 214 | Engineering Physics II |
| 3 | CHM 531 | Organic Chemistry I |
| 3 | CHE 416 | Computational Techniques in Chemical Engineering* |
| 2 | CHE 350 | Electronic Materials or |
| | CHE 352 | Structural Materials |
| 0 | CHE 015 | Engineering Assembly |
| 17 | | |

Junior**Hrs. Fall semester**

| | | |
|----|------------------------------------|--|
| 2 | CHE 520 | Chemical Engineering Thermodynamics I* |
| 3 | CHE 530 | Transport Phenomena I* |
| 0 | CHE 015 | Engineering Assembly |
| 3 | Humanities/social science elective | |
| 3 | ENGL 415 | Written Communication for Engineers |
| 3 | Chemistry/biochemistry elective ‡ | |
| 2 | Advanced laboratory experience § | |
| 16 | | |

Hrs. Spring semester

| | | |
|----|--------------------|---|
| 3 | CHM 595 | Physical Chemistry II |
| 3 | CHE 521 | Chemical Engineering Thermodynamics II* |
| 3 | CHE 531 | Transport Phenomena II* |
| 3 | CHE 535 | Transport Phenomena Lab* |
| 0 | CHE 015 | Engineering Assembly |
| 3 | Technical elective | |
| 15 | | |

Senior**Hrs. Fall semester**

| | | |
|----|---------------------|--|
| 3 | CHE 550 | Chemical Reaction Engineering* |
| 3 | CHE 560 | Separational Process Design* |
| 2 | CHE 570 | Chemical Engineering Systems Design I* |
| 0 | CHE 015 | Engineering Assembly |
| 6 | Elective | |
| 3 | Technical electives | |
| 17 | | |

Hrs. Spring semester

| | | |
|----|-------------------------------|---|
| 3 | CHE 542 | Unit Operations Laboratory* |
| 3 | CHE 561 | Chemical Process Dynamics and Control |
| 4 | CHE 571 | Chemical Engineering Systems Design II* |
| 0 | CHE 015 | Engineering Assembly |
| 3 | Elective unrestricted | |
| 3 | Chemical engineering elective | |
| 16 | | |

*These courses form the chemical engineering core program.

**Chemical Principles I (CHM 220) and Chemical Principles II (CHM 250) may be taken instead of CHM 210, CHM 230, and CHM 371. If this option is elected, two additional credit hours of technical electives are to be selected.

†Instrumental Methods of Analysis (CHM 566) (3 credit hours) and Instrumental Analysis Laboratory (CHM 567)

(1 credit hour) may be substituted for Chemical Analysis (CHM 371). However, prerequisites would require that these courses be taken following Organic Chemistry I (CHM 531).

‡**Chemistry/biochemistry/biology electives**
Chemistry: Possible selections include Organic Chemistry II (CHM 550), Instrumental Analysis (CHM 566), and Physical Chemistry I (CHM 585)

Biochemistry: Possible selections include General Biochemistry (BIOCH 521), Physical Studies of Biomacromolecules (BIOCH 590), Biochemistry I (BIOCH 755), and Biochemistry II (BIOCH 765).

Biology: BIOL 450 or above; some possible courses include Modern Genetics (BIOL 450), General Microbiology

(BIOL 455), Plant Physiology (BIOL 500), Fundamentals of Ecology (BIOL 529) or Cell Biology (BIOL 541).

§The advanced laboratory experience is to be a 2-credit-hour laboratory course selected from the following courses: Organic Chemistry Laboratory (CHM 532), Physical Methods Laboratory (CHM 596), General Biochemistry Laboratory (BIOCH 522), or Biochemistry I Laboratory (BIOCH 756).

Departmental requirements

The departmental requirements below must be satisfied.

▶ 32 credit hours of electives are required, and they are to be selected in consultation with the student's advisor. All electives must be on the lists approved by the department or have the approval of the department head and must support the educational objectives of the chemical engineering program. Both the required and elective components of a student's overall program of study must meet UGE criteria.

▶ 14 credit hours of technical electives are required. These electives must include one chemistry/biochemistry/biology (3 credit hours) course, an advanced laboratory experience (2 credit hours), and a chemical engineering elective (3 credit hours).

▶ The remaining 6 credit hours of technical electives are to be selected from engineering topics to enhance the student's professional development. At least one course selected from either analytical mechanics (both statics and dynamics must be represented) or circuits, fields, and electronics must be included.

▶ 15 credit hours of social sciences and humanities electives are required. These courses are to be selected from the list approved by the College of Engineering. At least 6 hours of 300-level or higher UGE courses must be included within these 15 hours. All courses must be taken for a letter grade.

▶ A grade of C or higher in each course within the chemical engineering core program is required for graduation.

Extracurricular activities

Many opportunities exist for professional and social development. The American Institute of Chemical Engineers has rated the K-State student chapter as an outstanding chapter for 13 consecutive years. Students hold meetings to provide tips for interviewing for summer and full-time jobs, attend seminars by professional engineers, compete regionally and nationally in the Chem-E car competition, and arrange plant trips to see chemical engineering as practiced in industry. The CHUMS program links freshmen to upper-class mentors who can answer questions about K-State and chemical engineering courses.

For more information about chemical engineering, contact:

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