

CHEMICAL ENGINEERING

Director of undergraduate studies: Michael Loewenberg (michael.loewenberg@yale.edu), 303 ML, 432-4334; seas.yale.edu/departments/chemical-and-environmental-engineering

Energy, the environment, and health care are key challenges facing humanity in the twenty-first century. Chemical engineering is a discipline well placed to confront these challenges. Chemical engineering is rooted in the basic sciences of mathematics, chemistry, physics, and biology; a traditional engineering science core of thermodynamics, transport phenomena, and chemical kinetics; a rigorous design component; and an expanding focus on emerging topics in materials, nanotechnology, and life sciences. The discipline has grown from its petrochemical origins to become central to state-of-the-art technologies in microelectronics, alternative energy, biomedicine, and pharmaceuticals.

The Chemical Engineering program, with two degree programs (see below), is principally focused on basic and engineering sciences and on problem solving. Additional emphasis is on communication, analysis of experiments, and chemical process design. A special feature of the program is the accessibility of laboratory research—most chemical engineering majors participate in faculty-led research projects, often resulting in publication and/or presentation at national meetings.

Chemical engineering graduates find a wide range of professional opportunities in academia, industry, government, business, and the nonprofit sector. Many majors go on to graduate programs in chemical, biomedical, or environmental engineering, or to medical, law, or business schools.

The educational objectives of the Chemical Engineering program are the following. Graduating students will achieve positions of leadership within academia, industry, and government; excel in top graduate programs in chemical, biomedical, environmental, and related engineering fields; excel in top professional schools in fields such as law, medicine, or management; join and rise in the ranks of large and small corporations; become successful entrepreneurs; and practice engineering toward the benefit of humankind.

PREREQUISITES

Students considering a Chemical Engineering major are encouraged to take two terms of chemistry and mathematics during the first year, and to contact the director of undergraduate studies (DUS).

Students in both degree programs (see below) take the following prerequisite courses: MATH 112, 115, and ENAS 151 or MATH 120; CHEM 161 and 165 or CHEM 163 and 167; CHEM 134L and 136L; ENAS 130 (mandatory for both degree programs); PHYS 180, 181. Students with advanced high school preparation may reduce the number of prerequisites by placing out of certain courses.

REQUIREMENTS OF THE MAJOR

All students majoring in Chemical Engineering and Engineering Sciences (Chemical) must follow the requirements listed below as approved by the program's faculty. Two degree programs are offered: a B.S. in Chemical Engineering accredited by the Engineering Accreditation Commission of ABET, Inc., and a B.S. in Engineering Sciences (Chemical).

B.S. degree program in Chemical Engineering The curriculum for the ABET-accredited B.S. degree in Chemical Engineering requires nineteen courses, totaling eighteen credits, including the senior requirement, CENG 416, and the following courses beyond the prerequisites:

1. Mathematics: ENAS 194
2. Chemistry: CHEM 174 and 175 or CHEM 220 and 221; CHEM 222L and 223L; CHEM 332 and 333
3. Engineering science: Three term courses chosen from engineering electives
4. Chemical engineering: CENG 150 or CENG 210; 300, 301, 314 (or MENG 361), 315, 411, 412L, 480

B.S. degree program in Engineering Sciences (Chemical) The B.S. degree in Engineering Sciences (Chemical) requires eleven term courses, including the senior requirement, CENG 416 or CENG 490, and the following courses beyond the prerequisites, chosen in consultation with the DUS:

1. Mathematics: ENAS 194
2. Chemistry: 3 advanced chemistry courses: *option 1*: CHEM 174 and 175 or CHEM 220 and 221; and CHEM 332; or *option 2*: CHEM 174 or 220; CHEM 332 and 333
3. Chemical engineering: CENG 150 or CENG 210; 300, 301, 314 (or MENG 361), CENG 315, 411

SENIOR REQUIREMENT

B.S. degree program in Chemical Engineering In their senior year students must complete a senior research project in CENG 416.

B.S. degree program in Engineering Sciences (Chemical) In their senior year students must complete a senior research project in CENG 416 or CENG 490.

REQUIREMENTS OF THE MAJOR**CHEMICAL ENGINEERING, B.S.**

Prerequisites MATH 112, 115; ENAS 151 or MATH 120; CHEM 161 and 165 or CHEM 163 and 167; CHEM 134L and 136L; PHYS 180, 181; ENAS 130

Number of courses 19 courses, totaling 18 credits, beyond prereqs (incl senior req)

Specific courses required ENAS 194; CHEM 174 and 175 or CHEM 220 and 221; CHEM 222L and 223L; CHEM 332, 333; CENG 150 or CENG 210; 300, 301, 314 (or MENG 361), CENG 315, 411, 412L, 480

Distribution of courses 3 addtl electives in engineering

Senior requirement CENG 416

ENGINEERING SCIENCES (CHEMICAL), B.S.

Prerequisites MATH 112, 115; ENAS 151 or MATH 120; CHEM 161 and 165 or CHEM 163 and 167; CHEM 134L and 136L; PHYS 180, 181; ENAS 130

Number of courses 11 term courses beyond prereqs (incl senior req), chosen in consultation with DUS

Specific courses required ENAS 194; 3 adv chem courses, as specified; CENG 150 or CENG 210; 300, 301, 314 (or MENG 361), CENG 315, 411

Senior requirement CENG 416 or CENG 490

The program in Chemical Engineering principally focuses on basic and engineering sciences and on problem solving. It also emphasizes communication, analysis of experiments, and chemical process design. A special feature of the program is the accessibility of laboratory research. Most chemical engineering majors participate in faculty-led research projects that can lead to publication and/or presentation at national meetings.

The program's educational objectives include providing graduates with an excellent engineering science background for graduate study in chemical, biomedical, or environmental engineering programs, or in medicine or law; preparing graduates for a diverse range of industrial careers; and providing graduates with a broad liberal arts education.

Two degree options are offered: a B.S. degree in Chemical Engineering that is accredited by the Engineering Accreditation Commission of ABET, Inc., and an unaccredited B.S. degree in Engineering Sciences (Chemical). The prerequisites for both degree programs are three terms of calculus, two terms of general chemistry with laboratory, and two terms of physics. Students with advanced high school preparation may move ahead to more advanced courses.

There is considerable flexibility for tailoring the program to match individual interests. Students are encouraged to contact the DUS (michael.loewenberg@yale.edu) directly.

FACULTY OF THE DEPARTMENT OF CHEMICAL AND ENVIRONMENTAL ENGINEERING

Professors Eric Altman, †Paul Anastas, †Michelle Bell, †Ruth Blake, Menachem Elimelech, Gary Haller (*Emeritus*), †Edgar Hertwich, †Edward Kaplan, Jaehong Kim, Michael Loewenberg, †Andrew Miranker, Jordan Peccia, Lisa Pfefferle, Daniel Rosner (*Emeritus*), †Mark Saltzman, †Udo Schwarz, T. Kyle Vanderlick, Paul Van Tassel, Julie Zimmerman

Assistant Professors Drew Gentner, Amir Haji-Akbari, †Shu Hu, Desirée Plata, Mingjiang Zhong

Lecturers †Anikò Bezur, †Paul Whitmore

†A joint appointment with primary affiliation in another department or school.

View Courses