Chemical Engineering, B.S.E.

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.

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.

Focus Areas

Chemical engineering students may gain depth of knowledge related to a career path through their selection of science, engineering, and general education courses. Several preapproved focus areas may help students define potential careers; 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; safety and health; and sustainability. Students may prefer to develop an individualized focus area, which is subject to approval by the department's curriculum committee.

Biochemical Engineering

This focus area allows students to choose from a selection of courses that combine 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 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 pharmaceutics.

Since chemical process engineering spans many aspects of engineering, business, applied math, and science, students can choose from a broad selection of 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 permit 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, petroleum 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 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 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.

**Educational Objectives**

The chemical engineering program produces graduates with a strong foundation of scientific and technical knowledge who are equipped with problem solving, teamwork, and communication skills that will serve them throughout their careers consistent with the following educational objectives. Within a few years following graduation, graduates will:

- attain careers as practicing chemical engineers in fields such as biotechnology, chemicals, computation, energy, environmental engineering, food processing, microelectronics, pharmaceuticals, or polymers/advanced materials;
- pursue advanced studies in disciplines such as business, chemical engineering, dentistry, environmental engineering, law, medicine, or pharmaceuticals; or
- assume professional leadership roles.

The following methods and strategies are used in the chemical engineering undergraduate program to achieve these program educational objectives:

- foster a unique and personalized undergraduate experience by leveraging the advantages of a small college atmosphere within a comprehensive liberal arts and research university;
- provide a diverse, inclusive, and equitable environment for all students;
- enrich the undergraduate experience through cultural diversity, international opportunities, and/or experiential learning;
- provide a solid foundation and understanding of the fundamental principles of mathematics, science, and engineering;
- provide students with experience in learning and applying tools, and analyzing and interpreting data, to solve theoretical and open-ended chemical engineering problems;
- provide students with opportunities to participate in collaborative teams;
- develop students’ written and oral communication skills to a wide range of audiences;
- provide students with opportunities to design and conduct chemical engineering experiments and to design systems, components, and chemical processes to meet specific needs and constraints;
- provide a contemporary grounding in ethical and professional responsibility, including global, economic, environmental, safety, and societal impacts of engineering decisions; and
- instill the desire and the understanding of the need for lifelong learning.

**Requirements**

The Bachelor of Science in Engineering with a major in chemical engineering requires a minimum of 134 s.h. of credit, including one 0 s.h. seminar. Students must have a g.p.a. of at least 2.00 in all college work used to satisfy degree requirements as well as in all coursework attempted at the University of Iowa.

All B.S.E. students are required to take the same collegiate curriculum. For information about these collegiate requirements, see the Bachelor of Science in Engineering, B.S.E. in the Catalog. Students completing the major in chemical engineering fulfill the collegiate statistics requirement by completing CBE:3020 Applied Statistics for Chemical and Natural Resources Engineering, STAT:2020 Probability and Statistics for the Engineering and Physical Sciences, or STAT:3510 Biostatistics. Some focus areas may suggest or require specific courses to fulfill the General Education Component of the collegiate curriculum; see “Focus Area” below.

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.

The major in chemical engineering requires the following coursework.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Collegiate Curriculum</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Major Requirements (includes one 0 s.h. seminar)</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>Focus Area</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total Hours</strong></td>
<td></td>
<td><strong>134</strong></td>
</tr>
</tbody>
</table>

**Major Requirements**

Major requirements include a set of common courses (53 s.h.), an advanced chemistry or biochemistry course (3 s.h.), an advanced science course (3-4 s.h.), six departmental seminars (5 s.h., including one 0 s.h. course), and two capstone design courses (5 s.h.).

**Common Courses**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>All of these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBE:2105</td>
<td>Process Calculations</td>
<td>3</td>
</tr>
</tbody>
</table>
CBE:2110  Computational Tools for Chemical Engineers  2
CBE:3105  Chemical Engineering Thermodynamics  3
CBE:3109  Fluid Flow  2
CBE:3113  Heat and Mass Transfer  3
CBE:3117  Separations  3
CBE:3120  Chemical Reaction Engineering  3
CBE:3125  Chemical Process Safety  3
CBE:3150  Thermodynamics/Transport Laboratory  3
CBE:3155  Chemical Reaction Engineering/Separations Laboratory  3
CBE:3205  Introduction to Biochemical Engineering  3
CBE:4105  Process Dynamics and Control in Design  3
CHEM:1120  Principles of Chemistry II  4
CHEM:2210  Organic Chemistry I  3
or CHEM:2230  Organic Chemistry I for Majors
CHEM:2220  Organic Chemistry II  3
or CHEM:2240  Organic Chemistry II for Majors
CHEM:2410  Organic Chemistry Laboratory  3
or CHEM:2420  Organic Chemistry Laboratory for Majors
ENGR:2130  Thermodynamics  3
ENGR:2720  Materials Science  3

Advanced Chemistry or Biochemistry Course

Some focus areas may suggest or require a specific course; see "Focus Area" below. Students select a course considered advanced for the minor in chemistry (College of Liberal Arts and Sciences) or one of the following courses in the Department of Biochemistry and Molecular Biology (Carver College of Medicine).

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMB:3110</td>
<td>Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>BMB:3120</td>
<td>Biochemistry and Molecular Biology I</td>
<td>3</td>
</tr>
<tr>
<td>BMB:3130</td>
<td>Biochemistry and Molecular Biology II</td>
<td>3</td>
</tr>
</tbody>
</table>

Acceptable courses from the Department of Chemistry (College of Liberal Arts and Sciences) include but are not limited to the following.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM:3110</td>
<td>Analytical Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:3120</td>
<td>Analytical Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4430</td>
<td>Principles of Physical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4431</td>
<td>Physical Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4432</td>
<td>Physical Chemistry II</td>
<td>3</td>
</tr>
</tbody>
</table>

Advanced Science Course

Students select an advanced science-based course either within or outside of the College of Engineering. Appropriate subject areas could include biochemistry and molecular biology (prefix BMB), biology (prefix BIOL), chemistry (prefix CHEM), microbiology and immunology (prefix MICR), and physics (PHYS). Some focus areas may suggest or require a specific course; see "Focus Area" below. Students may consult an advisor or visit the Department of Chemical and Biochemical Engineering website for more information.

Acceptable courses include but are not limited to the following. Consult an academic advisor for approval to take a course not on this list.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE:4420</td>
<td>Environmental Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5315</td>
<td>Polymer Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5425</td>
<td>Atmospheric Chemistry and Physics</td>
<td>3</td>
</tr>
<tr>
<td>BIOL:4213</td>
<td>Bioinformatics</td>
<td>4</td>
</tr>
<tr>
<td>BME:2400</td>
<td>Cell Biology for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>CEE:5440</td>
<td>Foundations of Environmental Chemistry and Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>EES:4520</td>
<td>Isotope Geochemistry</td>
<td>3</td>
</tr>
<tr>
<td>PHYS:3741</td>
<td>Introduction to Quantum Mechanics I</td>
<td>3</td>
</tr>
</tbody>
</table>

Advanced chemistry and biochemistry courses in the areas listed above

The following courses do not fulfill this requirement.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE:5210</td>
<td>Bioseparations</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5310</td>
<td>Polymer Science and Technology</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5405</td>
<td>Green Chemical and Energy Technologies</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5410</td>
<td>Electrochemical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>BIOL:1411</td>
<td>Foundations of Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL:1412</td>
<td>Diversity of Form and Function</td>
<td>4</td>
</tr>
<tr>
<td>PHYS:1612</td>
<td>Introductory Physics II</td>
<td>3-4</td>
</tr>
</tbody>
</table>

Courses used to satisfy the engineering electives requirements for a focus area

Departmental Seminars

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>All of these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBE:1000</td>
<td>CBE Departmental Seminar</td>
<td>1</td>
</tr>
<tr>
<td>CBE:3000</td>
<td>Professional Seminar: Chemical Engineering (taken four times for 1 s.h. each)</td>
<td>4</td>
</tr>
<tr>
<td>CBE:4195</td>
<td>Senior Enriching Activities Seminar</td>
<td>0</td>
</tr>
</tbody>
</table>

Capstone Design Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both of these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBE:4109</td>
<td>Chemical Engineering Process Design I</td>
<td>2</td>
</tr>
<tr>
<td>CBE:4110</td>
<td>Chemical Engineering Process Design II</td>
<td>3</td>
</tr>
</tbody>
</table>

Focus Area

Students must select focus area courses according to guidelines established by the Department of Chemical and Biochemical Engineering. The department offers preapproved
focus areas in biochemical engineering [p. 4]; business [p. 4]; chemical process engineering [p. 4]; computation, data science, and machine learning [p. 5]; energy and environment [p. 5]; entrepreneurship [p. 6]; oil and gas engineering [p. 6]; pharmaceuticals [p. 7]; polymers [p. 7]; pre-medicine [p. 8]; safety and health [p. 8]; and sustainability [p. 8].

Students may prefer to develop an individualized focus area, which is subject to approval by the department's curriculum committee. Visit 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.

Focus areas in chemical engineering consist of content area courses (12 s.h.) and an elective course (3 s.h.); carefully selected courses may contribute to earning a minor and/or certificate. Some focus areas also may suggest or require specific courses to fulfill the General Education Component of the collegiate curriculum, the chemical engineering major's advanced science requirement, and/or the major's advanced science requirement.

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

Biochemical Engineering

Students in the biochemical engineering focus area are encouraged to complete BMB:3110 Biochemistry to satisfy the chemical engineering major's advanced chemistry/biochemistry or advanced science requirement.

**Required Biochemical Course**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE:5210</td>
<td>Bioseparations</td>
<td>3</td>
</tr>
</tbody>
</table>

**Biochemical Electives**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 s.h. from these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBE:3998</td>
<td>Individual Investigations: Chemical Engineering</td>
<td>arr.</td>
</tr>
<tr>
<td>BIOL:1411</td>
<td>Foundations of Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL:1412</td>
<td>Diversity of Form and Function</td>
<td>4</td>
</tr>
<tr>
<td>BMB:3120</td>
<td>Biochemistry and Molecular Biology I</td>
<td>3</td>
</tr>
<tr>
<td>BMB:3130</td>
<td>Biochemistry and Molecular Biology II</td>
<td>3</td>
</tr>
<tr>
<td>BMB:3140</td>
<td>Experimental Biochemistry</td>
<td>2</td>
</tr>
<tr>
<td>BME:2400</td>
<td>Cell Biology for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>BME:5430</td>
<td>Biotransport</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4850/ PHAR:4850</td>
<td>Upstream Biotechnology Processes</td>
<td>2</td>
</tr>
<tr>
<td>MICR:2157</td>
<td>General Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>MICR:2158</td>
<td>General Microbiology Laboratory</td>
<td>2</td>
</tr>
</tbody>
</table>

In addition to the courses listed above, students may select courses with prefix BIOL, BMB, CHEM, or MICR numbered 3000 or above. Advisor approval is required for courses that center on experiential learning, such as research (e.g., MICR:4161 Undergraduate Research in Microbiology), science communication (e.g., CHEM:4000 Scientists and Writers), service learning (e.g., BIOL:4806 Service Learning in Biology), or teaching internships/practica (e.g., BMB:3800 Biochemistry Teaching Practicum).

**Additional Elective**

Students may select an additional focus area content course or consult academic advisors for other acceptable courses.

**Business**

The business focus area requires the following courses to fulfill the collegiate curriculum General Education Component approved course subjects requirement.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>All of these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECON:1100</td>
<td>Principles of Microeconomics</td>
<td>4</td>
</tr>
<tr>
<td>ECON:1200</td>
<td>Principles of Macroeconomics</td>
<td>4</td>
</tr>
<tr>
<td>MKTG:3000</td>
<td>Introduction to Marketing Strategy</td>
<td>3</td>
</tr>
</tbody>
</table>

**Required Business Course**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>One of these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIN:3000</td>
<td>Introductory Financial Management</td>
<td>3</td>
</tr>
<tr>
<td>ISE:2500</td>
<td>Engineering Economy</td>
<td>3</td>
</tr>
</tbody>
</table>

**Business Electives**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three of these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACCT:2100</td>
<td>Introduction to Financial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>ACCT:2200</td>
<td>Managerial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>MGMT:2000</td>
<td>Introduction to Law</td>
<td>3</td>
</tr>
<tr>
<td>MGMT:2100</td>
<td>Introduction to Management</td>
<td>3</td>
</tr>
</tbody>
</table>

**Additional Elective**

Students may select an additional focus area content course in consultation with academic advisors. Consider requirements for the degree, minors, or certificates when selecting an elective course. Students interested in completing the minor in business administration in the Tippie College of Business are especially encouraged to complete all four courses listed under Business Electives, above.

**Chemical Process Engineering**

Students choose 12 s.h. from a broad selection of engineering, math, and science courses numbered 3000 or above. Students are encouraged to complete MATH:4820 Optimization Techniques and should consult academic advisors for additional course selection.

Students who do not declare a specific focus area are automatically placed in chemical process engineering.
### Computation, Data Science, and Machine Learning Electives

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE:3020</td>
<td>Applied Statistics for Chemical and Natural Resources Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CBE:3998</td>
<td>Individual Investigations: Chemical Engineering</td>
<td>arr.</td>
</tr>
<tr>
<td>CBE:5417/IGPI:5417</td>
<td>Physical Meteorology and Atmospheric Radiative Transfer</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5425/CEE:5115</td>
<td>Atmospheric Chemistry and Physics</td>
<td>3</td>
</tr>
<tr>
<td>ACCT:4200</td>
<td>Accounting for Management Analysis and Control</td>
<td>3</td>
</tr>
<tr>
<td>BAIS:3500</td>
<td>Data Mining</td>
<td>3</td>
</tr>
<tr>
<td>BAI:4213/GENE:4213/IGPI:4213</td>
<td>Bioinformatics</td>
<td>2,4</td>
</tr>
<tr>
<td>BME:4310/MBM:4310</td>
<td>Computational Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>CEE:4511/ME:4111</td>
<td>Scientific Computing and Machine Learning</td>
<td>3</td>
</tr>
<tr>
<td>CEE:4512/ME:4112</td>
<td>Engineering Design Optimization</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4480</td>
<td>Introduction to Molecular Modeling</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:5431</td>
<td>Statistical Thermodynamics I</td>
<td>3</td>
</tr>
<tr>
<td>CS:2110</td>
<td>Programming for Informatics</td>
<td>4</td>
</tr>
<tr>
<td>CS:2210</td>
<td>Discrete Structures</td>
<td>3</td>
</tr>
<tr>
<td>CS:2230</td>
<td>Computer Science II: Data Structures</td>
<td>4</td>
</tr>
<tr>
<td>CS:3330</td>
<td>Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>CS:4740/IGPI:4740/MATH:4740/STAT:4740</td>
<td>Large Data Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CS:5110/IGPI:5110</td>
<td>Introduction to Informatics</td>
<td>3</td>
</tr>
<tr>
<td>ECE:2400</td>
<td>Linear Systems I</td>
<td>3</td>
</tr>
<tr>
<td>ECE:3330/IGPI:3330</td>
<td>Introduction to Software Design</td>
<td>3</td>
</tr>
<tr>
<td>ECE:5330/IGPI:5331</td>
<td>Graph Algorithms and Combinatorial Optimization</td>
<td>3</td>
</tr>
<tr>
<td>ECE:5411/CEE:4511</td>
<td>Scientific Computing and Machine Learning</td>
<td>3</td>
</tr>
<tr>
<td>ECE:5450</td>
<td>Artificial Intelligence in Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ME:5114</td>
<td>Nonlinear Control in Robotic Systems</td>
<td>3</td>
</tr>
<tr>
<td>ME:5143</td>
<td>Computational Fluid and Thermal Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ME:6115</td>
<td>Cooperative Autonomous Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Additional Elective

Students may select an additional focus area content course in consultation with academic advisors.

### Energy and Environment

#### Required Energy and Environment Course

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE:5405</td>
<td>Green Chemical and Energy Technologies</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Energy and Environment Electives

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE:2040</td>
<td>Environment, Energy, and Climate Change</td>
<td>3</td>
</tr>
<tr>
<td>CBE:2050/CEE:2050</td>
<td>Severe and Unusual Weather</td>
<td>3</td>
</tr>
<tr>
<td>CBE:4420/CEE:4150</td>
<td>Environmental Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CBE:4459/CEE:4159/IGPI:4159</td>
<td>Air Pollution Control Technology</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5410</td>
<td>Electrochemical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5412</td>
<td>Atmospheric Modeling</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5417/IGPI:5417</td>
<td>Physical Meteorology and Atmospheric Radiative Transfer</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5425/CEE:5115</td>
<td>Atmospheric Chemistry and Physics</td>
<td>3</td>
</tr>
<tr>
<td>CEE:4107/CEE:4410</td>
<td>Sustainable Systems</td>
<td>3</td>
</tr>
<tr>
<td>CEE:5380</td>
<td>Fluid Flows in Environmental Systems</td>
<td>3</td>
</tr>
<tr>
<td>CEE:5440</td>
<td>Foundations of Environmental Chemistry and Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4873</td>
<td>Atmospheric and Environmental Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:5107</td>
<td>Electrochemistry</td>
<td>2-3</td>
</tr>
<tr>
<td>CHEM:5438</td>
<td>Surface Chemistry and Heterogeneous Processes</td>
<td>3</td>
</tr>
<tr>
<td>ECE:5630</td>
<td>Sustainable Energy Conversion</td>
<td>3</td>
</tr>
<tr>
<td>EES:4490</td>
<td>Elements of Geochemistry</td>
<td>3</td>
</tr>
<tr>
<td>EES:4520</td>
<td>Isotope Geochemistry</td>
<td>3</td>
</tr>
<tr>
<td>EES:4630</td>
<td>Hydrogeology</td>
<td>4</td>
</tr>
<tr>
<td>EES:4790</td>
<td>Applied Environmental Geology</td>
<td>3</td>
</tr>
</tbody>
</table>
ENGR:2995 Introduction to Artificial Intelligence and Machine Learning in Engineering 3
ME:4048 Energy Systems Design 4
OEH:6710 Human Toxicology and Risk Assessment 3

In addition to the courses listed above, students may select courses with prefix CHEM, EES, GEOG, or OEH numbered 3000 or above. Advisor approval is required for courses that center on experiential learning, such as research (e.g., GEOG:3992 Undergraduate Research), science communication (e.g., CHEM:4000 Scientists and Writers), or practical experiences/field trip courses (e.g., EES:3000 Geologic Training Assignment).

Additional Elective
Students may select an additional focus area content course in consultation with academic advisors.

Entrepreneurship

Required Entrepreneurship Course

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>One of these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIN:3000</td>
<td>Introductory Financial Management</td>
<td>3</td>
</tr>
<tr>
<td>ISE:2500</td>
<td>Engineering Economy</td>
<td>3</td>
</tr>
</tbody>
</table>

Entrepreneurship Electives

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 s.h. from these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENTR:2000</td>
<td>Entrepreneurship and Innovation</td>
<td>3</td>
</tr>
<tr>
<td>ENTR:3100</td>
<td>Entrepreneurial Finance</td>
<td>3</td>
</tr>
<tr>
<td>An approved course with prefix ENTR that counts toward the technological entrepreneurship certificate</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Additional Elective
Students should consult academic advisors for course selection. It is recommended that students choose a course with prefix ENTR that counts toward the Certificate in Technological Entrepreneurship.

Oil and Gas Engineering

The following courses are prerequisites for many of the oil and gas engineering focus area courses. Due to their introductory nature, they do not count toward the focus area's content requirements, but one of the two may be counted as the focus area elective.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE:1030/EES:1030</td>
<td>Introduction to Earth Science</td>
<td>3-4</td>
</tr>
<tr>
<td>EES:1050</td>
<td>Introduction to Geology</td>
<td>4</td>
</tr>
</tbody>
</table>

The following courses are recommended to students in the oil and gas engineering focus area to fulfill part of the collegiate curriculum General Education Component approved course subjects requirement.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both of these:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Students in this focus area are encouraged to select courses for the chemical engineering major's advanced science requirement from the following list.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EES:3110/ENVS:3110</td>
<td>Chemical Evolution of the Oceans</td>
<td>3</td>
</tr>
<tr>
<td>EES:4490</td>
<td>Elements of Geochemistry (recommended for students specializing in petroleum)</td>
<td>3</td>
</tr>
<tr>
<td>EES:4630</td>
<td>Hydrogeology (recommended for students specializing in petroleum)</td>
<td>4</td>
</tr>
<tr>
<td>EES:4640</td>
<td>Contaminant Hydrogeology</td>
<td>3</td>
</tr>
</tbody>
</table>

Required Oil and Gas Course

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>This course:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBE:5405</td>
<td>Green Chemical and Energy Technologies</td>
<td>3</td>
</tr>
</tbody>
</table>

Oil and Gas Electives

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 s.h. from these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBE:5199</td>
<td>Contemporary Topics: Chemical and Biochemical Engineering</td>
<td>arr.</td>
</tr>
<tr>
<td>CBE:5425/CEE:5115</td>
<td>Atmospheric Chemistry and Physics</td>
<td>3</td>
</tr>
<tr>
<td>EES:1290</td>
<td>Energy and the Environment</td>
<td>3</td>
</tr>
<tr>
<td>EES:2410</td>
<td>Mineralogy (recommended for students specializing in petroleum)</td>
<td>4</td>
</tr>
<tr>
<td>EES:2831</td>
<td>Geologic Field Methods</td>
<td>3</td>
</tr>
<tr>
<td>EES:3100/ENVS:3100</td>
<td>Earth and Planetary Remote Sensing</td>
<td>4</td>
</tr>
<tr>
<td>EES:3300</td>
<td>Sedimentary Geology (recommended for students specializing in petroleum)</td>
<td>4</td>
</tr>
<tr>
<td>EES:3500</td>
<td>Igneous and Metamorphic Petrology (recommended for students specializing in petroleum)</td>
<td>4</td>
</tr>
<tr>
<td>EES:3770</td>
<td>Global Stratigraphy</td>
<td>3</td>
</tr>
<tr>
<td>EES:3840</td>
<td>Structural Geology (recommended for students specializing in petroleum)</td>
<td>4</td>
</tr>
<tr>
<td>EES:4300</td>
<td>Quantitative Methods in the Geosciences</td>
<td>3</td>
</tr>
<tr>
<td>EES:4750</td>
<td>Mineral and Petroleum Exploration Geology</td>
<td>3</td>
</tr>
<tr>
<td>Code</td>
<td>Title</td>
<td>Hours</td>
</tr>
<tr>
<td>----------</td>
<td>----------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>EES:4790</td>
<td>Applied Environmental Geology</td>
<td>3</td>
</tr>
<tr>
<td>EES:4820</td>
<td>Tectonics and Basin Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EES:4832</td>
<td>Geologic Field Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ENGR:2995</td>
<td>Introduction to Artificial Intelligence and Machine Learning in Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

Additional Elective

Students should consult academic advisors for course selection.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One of these:</td>
<td></td>
</tr>
<tr>
<td>CEE:1030/EES:1030</td>
<td>Introduction to Earth Science</td>
<td>3-4</td>
</tr>
<tr>
<td>EES:1050</td>
<td>Introduction to Geology</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>An additional content area course</td>
<td>3-4</td>
</tr>
</tbody>
</table>

Pharmaceuticals

Required Pharmaceuticals Course

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCOL:2220</td>
<td>Drug Use and Abuse</td>
<td>3</td>
</tr>
<tr>
<td>PCOL:3101</td>
<td>Pharmacology I: A Drug’s Fantastic Journey</td>
<td>3</td>
</tr>
</tbody>
</table>

Pharmaceuticals Electives

Students select from the engineering, pharmaceutics, and science courses listed below to reach a total of 12 s.h. when combined with either or both of the courses listed above.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE:3998</td>
<td>Individual Investigations: Chemical Engineering</td>
<td>arr.</td>
</tr>
<tr>
<td>CBE:5210</td>
<td>Bioseparations</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5300</td>
<td>Drug Delivery Devices</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5740</td>
<td>Engineering Principles of Drug Delivery</td>
<td>3</td>
</tr>
<tr>
<td>BIOL:1411</td>
<td>Foundations of Biology</td>
<td>4</td>
</tr>
<tr>
<td>BMB:3110</td>
<td>Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>BMB:3120</td>
<td>Biochemistry and Molecular Biology I</td>
<td>3</td>
</tr>
<tr>
<td>BMB:3140</td>
<td>Experimental Biochemistry</td>
<td>2</td>
</tr>
<tr>
<td>BME:4310/BMB:4310</td>
<td>Computational Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>BME:5421</td>
<td>Cell Material Interactions</td>
<td>3</td>
</tr>
<tr>
<td>BME:5430</td>
<td>Biotransport</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:3110</td>
<td>Analytical Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:3120</td>
<td>Analytical Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:3430</td>
<td>Analytical Measurements</td>
<td>3</td>
</tr>
<tr>
<td>ENGR:2995</td>
<td>Introduction to Artificial Intelligence and Machine Learning in Engineering</td>
<td>3</td>
</tr>
<tr>
<td>HHP:1300</td>
<td>Fundamentals of Human Physiology</td>
<td>3</td>
</tr>
<tr>
<td>OEH:6450</td>
<td>Aerosol Technology</td>
<td>3</td>
</tr>
<tr>
<td>PCOL:3102</td>
<td>Pharmacology II: Mechanisms of Drug Action</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:4146</td>
<td>Drug Disposition and Pharmacokinetics</td>
<td>2</td>
</tr>
<tr>
<td>PHAR:4501</td>
<td>Basic Principles of Toxicology</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:4537</td>
<td>Principles of Drug Metabolism</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:4736</td>
<td>Properties of Dosage Forms I</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:4737</td>
<td>Properties of Dosage Forms II</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:4740</td>
<td>Materials in Drug and Gene Delivery</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:4741</td>
<td>Immunology and Immunotherapies</td>
<td>2</td>
</tr>
<tr>
<td>PHAR:4800</td>
<td>Chemical and Biophysical Properties of Drugs</td>
<td>1</td>
</tr>
<tr>
<td>PHAR:5521</td>
<td>High Throughput Screening for Pharmaceutical and Biomedical Sciences</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>A course with prefix CHEM numbered 3000 or above</td>
<td>3</td>
</tr>
</tbody>
</table>

Advisor approval is required to select additional chemistry courses that center on experiential learning, such as research (e.g., CHEM:3994 Undergraduate Research) or science communication (e.g., CHEM:4000 Scientists and Writers).

Additional Elective

Students may select an additional focus area content course in consultation with academic advisors.

Polymers

Required Polymers Course

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE:5310</td>
<td>Polymer Science and Technology</td>
<td>3</td>
</tr>
</tbody>
</table>

Polymers Electives

Students select from the following courses to reach a total of 9 s.h. when combined with either or both of the courses listed above.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE:3998</td>
<td>Individual Investigations: Chemical Engineering</td>
<td>arr.</td>
</tr>
<tr>
<td>CBE:5199</td>
<td>Contemporary Topics: Chemical and Biochemical Engineering</td>
<td>arr.</td>
</tr>
<tr>
<td>CBE:5300</td>
<td>Drug Delivery Devices</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5390</td>
<td>Photopolymerization Topics</td>
<td>1</td>
</tr>
<tr>
<td>CBE:5740</td>
<td>Engineering Principles of Drug Delivery</td>
<td>3</td>
</tr>
<tr>
<td>BME:2500</td>
<td>Biomaterials and Biomechanics</td>
<td>4</td>
</tr>
<tr>
<td>BME:5421</td>
<td>Cell Material Interactions</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4372</td>
<td>Advanced Organic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:5118</td>
<td>Nanomaterials</td>
<td>3</td>
</tr>
<tr>
<td>ME:5146</td>
<td>Modeling of Materials Processing</td>
<td>3</td>
</tr>
<tr>
<td>ME:5167/CEE:5137</td>
<td>Composite Materials</td>
<td>3</td>
</tr>
<tr>
<td>PHAR:4740</td>
<td>Materials in Drug and Gene Delivery</td>
<td>3</td>
</tr>
<tr>
<td>PHYS:3750</td>
<td>Fundamentals of Micro and Nanofabrication</td>
<td>3</td>
</tr>
</tbody>
</table>
Engineering, math, or science courses numbered 3000 or above

Additional Elective
Students may select an additional focus area content course in consultation with academic advisors.

Pre-Medicine
Students in this focus area are encouraged to complete the major's advanced chemistry or biochemistry and advanced science requirements by completing either the sequence BMB:3120 Biochemistry and Molecular Biology I and BMB:3130 Biochemistry and Molecular Biology II to satisfy both requirements, or BMB:3110 Biochemistry to satisfy one of the two requirements.

The following courses are recommended to students in the pre-medicine focus area to fulfill the collegiate curriculum General Education Component approved course subjects requirement.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSY:1001</td>
<td>Elementary Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PSY:2130</td>
<td>Advanced Psychology for Pre-Medical Track</td>
<td>3</td>
</tr>
<tr>
<td>SOC:1010</td>
<td>Introduction to Sociology</td>
<td>3-4</td>
</tr>
</tbody>
</table>

Required Pre-Medicine Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL:1411</td>
<td>Foundations of Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL:1412</td>
<td>Diversity of Form and Function</td>
<td>4</td>
</tr>
<tr>
<td>PHYS:1612</td>
<td>Introductory Physics II</td>
<td>4</td>
</tr>
</tbody>
</table>

Additional Elective
Consult an academic advisor for course selection.

Safety and Health
Students in this focus area are encouraged to complete OEH:6710 Human Toxicology and Risk Assessment to satisfy the chemical engineering major's advanced science requirement.

The following courses are recommended to students in the safety and health focus area as part of the collegiate curriculum General Education Component.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNW:2740</td>
<td>The Art and Craft of Writing about the Environment</td>
<td>3</td>
</tr>
<tr>
<td>ENGL:1510</td>
<td>Introduction to Environmental Literature</td>
<td>3</td>
</tr>
<tr>
<td>or JMC:1800</td>
<td>Twenty-first-Century Science: Environmental Communication in the Digital Age</td>
<td>3</td>
</tr>
<tr>
<td>GEOG:1070</td>
<td>Contemporary Environmental Issues</td>
<td>3</td>
</tr>
</tbody>
</table>

Approved Course Subjects

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EES:1080/ ENV:1080</td>
<td>Introduction to Environmental Science</td>
<td>3-4</td>
</tr>
</tbody>
</table>

Safety and Health Electives

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE:4459/ CEE:4159/ IGPI:4159</td>
<td>Air Pollution Control Technology</td>
<td>3</td>
</tr>
<tr>
<td>CEE:4158/ OEH:4920</td>
<td>Solid and Hazardous Wastes</td>
<td>3</td>
</tr>
<tr>
<td>CPH:3200</td>
<td>Death at Work: Case Studies of Workplace Safety and Health</td>
<td>3</td>
</tr>
<tr>
<td>ISE:4175</td>
<td>Safety Engineering</td>
<td>3</td>
</tr>
<tr>
<td>OEH:5410</td>
<td>Occupational Safety</td>
<td>3</td>
</tr>
<tr>
<td>OEH:5620</td>
<td>Occupational Health</td>
<td>3</td>
</tr>
<tr>
<td>OEH:6420</td>
<td>Methods in Exposure Science</td>
<td>3</td>
</tr>
<tr>
<td>OEH:6440</td>
<td>Control of Occupational Hazards</td>
<td>3</td>
</tr>
<tr>
<td>OEH:6450</td>
<td>Aerosol Technology</td>
<td>3</td>
</tr>
<tr>
<td>OEH:6720</td>
<td>Advanced Toxicology</td>
<td>4</td>
</tr>
</tbody>
</table>

Additional Elective
Students may select an additional focus area content course in consultation with academic advisors.

Sustainability
Students in the sustainability focus area are encouraged to complete CBE:5425 Atmospheric Chemistry and Physics to satisfy the chemical engineering major's advanced science requirement.

Students in this focus area are required to complete the following courses to fulfill the collegiate curriculum General Education Component.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE:4125</td>
<td>Advanced Chemical Process Safety</td>
<td>3</td>
</tr>
</tbody>
</table>

The following courses are recommended to students in the sustainability focus area as part of the collegiate curriculum General Education Component.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>GHS:3560</td>
<td>Global Garbage and Global Health</td>
<td>3</td>
</tr>
<tr>
<td>GHS:3760/ GEOG:3760</td>
<td>Hazards and Society</td>
<td>3</td>
</tr>
<tr>
<td>HHP:1045</td>
<td>Diversity and Inclusion in Healthy Living</td>
<td>3</td>
</tr>
</tbody>
</table>

Required Safety and Health Course

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE:4125</td>
<td>Advanced Chemical Process Safety</td>
<td>3</td>
</tr>
</tbody>
</table>

12 s.h. from these:
CBE:4410/CEE:4107 Sustainable Systems | 3     |
A course that counts toward the Certificate in Sustainability | 3-4     |
A science or engineering course numbered 3000 or above
May include one of these:
EES:1080/ ENV:1080 | Introduction to Environmental Science | 3-4     |
Additional Elective
Consult academic advisors for course selection. It is recommended that students choose a course that contributes to earning a certificate or minor.

Combined Programs

B.S.E./M.S. in Chemical and Biochemical Engineering
The College of Engineering offers a combined Bachelor of Science in Engineering/Master of Science for chemical engineering undergraduate students who intend to earn a M.S. in chemical and biochemical engineering. B.S.E./M.S. students may count 12 s.h. of coursework (typically advanced chemistry sequences and electives) toward both degrees. Once students complete the requirements for the bachelor's degree, they are granted the B.S.E., and they typically complete the M.S. one year later.

To be admitted to the degree program, students must have a cumulative g.p.a. of at least 3.25, and must apply to the Graduate College for acceptance into the program before starting their final two semesters. Visit Undergraduate to Graduate (U2G) Programs on the Department of Chemical and Biochemical Engineering website to learn more.

B.S.E./M.S. in Civil and Environmental Engineering
Bachelor of Science in Engineering students majoring in chemical engineering who are interested in earning a Master of Science in civil and environmental engineering may apply to the combined B.S.E./M.S. program offered by the College of Engineering. The combined program enables undergraduate students to begin work on the M.S. degree while completing their B.S.E. degree. Students admitted to the program may count 9 s.h. of coursework toward both the B.S.E. and the M.S. degree requirements. They also may count an additional 3 s.h. toward the M.S. degree requirements before they have been awarded the B.S.E. degree. For more information, see the M.S. in civil and environmental engineering in the Catalog.

Career Advancement
Chemical and biochemical engineers work in a wide range of industries, including petroleum and specialty chemical production, polymer and plastic production, food processing, energy, microelectronics production, pharmaceutical production, biochemical processing, and environmental compliance. Potential jobs include production, process development, plant design and construction, and fundamental research. Many experienced chemical and biochemical engineers move through management ranks to high-level administrative positions. On average, 93-98 percent of graduates are employed in their field of study or pursuing advanced education within seven months of graduation.

The engineering profession is a foundation for a variety of careers in industry, medicine, law, government, and consulting. Engineering majors hold eight of the top ten spots on the list of top-paid majors for bachelor's degree graduates, according to the National Association of Colleges and Employers (NACE).