**CHEMICAL ENGINEERING UNDERGRADUATE MAJOR**

See the "Department of Chemical Engineering (http://exploredegrees.stanford.edu/schoolofengineering/chemicalengineering)" section of this bulletin for additional information on the department, and its programs and faculty.

The department offers a B.S. as well as a minor in Chemical Engineering.

**Chemical Engineering**

Completion of the undergraduate program in Chemical Engineering leads to the conferral of the Bachelor of Science in Chemical Engineering.

**Mission of the Undergraduate Program in Chemical Engineering**

Chemical engineers are responsible for the conception and design of processes for the purpose of production, transformation, and transportation of materials. This activity begins with experimentation in the laboratory and is followed by implementation of the technology in full-scale production. The mission of the undergraduate program in Chemical Engineering is to develop students’ understanding of the core scientific, mathematical, and engineering principles that serve as the foundation underlying these technological processes. The program’s core mission is reflected in its curriculum which is built on a foundation in the sciences of chemistry, physics, and biology. Course work includes the study of applied mathematics, material and energy balances, thermodynamics, fluid mechanics, energy and mass transfer, separations technologies, chemical reaction kinetics and reactor design, and process design. The program provides students with excellent preparation for careers in the corporate sector and government, or for graduate study.

**Requirements**

### Mathematics

- **Units:** 10
  - The following sequence or approved AP credit
    - MATH 19: Calculus
    - MATH 20: Calculus
    - MATH 21: Calculus
  - Select one of the following:
    - CME 100: Vector Calculus for Engineers
    - MATH 51: Linear Algebra, Multivariable Calculus, and Modern Applications
    - MATH 52: Integral Calculus of Several Variables
  - Select one of the following:
    - CME 102: Ordinary Differential Equations for Engineers
    - MATH 53: Ordinary Differential Equations with Linear Algebra
  - Select one of the following:
    - CME 104: Linear Algebra and Partial Differential Equations for Engineers
    - CME 106: Introduction to Probability and Statistics for Engineers

### Science

- **Units:** 4-5
  - CHEM 31M: Chemical Principles: From Molecules to Solids
  - CHEM 33: Structure and Reactivity of Organic Molecules
  - CHEM 121: Organic Chemistry of Bioactive Molecules
  - CHEM 123: Organic Polyfunctional Compounds
  - PHYSICS 41: Mechanics
  - or PHYSICS 41E: Mechanics, Concepts, Calculations, and Context

### Electives

- **Units:** 5-10
  - CHEMENG 110A: Introduction to Chemical Engineering Thermodynamics
  - CHEMENG 110B: Multi-Component and Multi-Phase Thermodynamics
  - CHEMENG 120A: Fluid Mechanics
  - CHEMENG 120B: Energy and Mass Transport
  - CHEMENG 130A: Microkinetics - Molecular Principles of Chemical Kinetics
  - CHEMENG 150: Biochemical Engineering
  - CHEMENG 170: Kinetics and Reactor Design
  - CHEMENG 180: Chemical Engineering Plant Design
  - CHEMENG 181: Biochemistry I
  - CHEMENG 185A: Chemical Engineering Laboratory A (WIM)
  - CHEMENG 185B: Chemical Engineering Laboratory B
  - Select four of the following: 2,3

### Total Units

115-125

1. Unit count is higher if program includes one or more of the following: MATH 51 and MATH 52 in lieu of CME 100; or CHEM 31A and CHEM 31B in lieu of CHEM 31M.
2. Students may substitute two of the depth electives with 100-level lecture or lab course(s) offered in one of the following engineering disciplines: BIOE, CEE, CME, CS, EE, MS&E, MATSCI, and ME (must be taken for a minimum of 3 units each). One or two 100-level lecture or lab course(s) offered in chemistry, math, biology, or physics. Students may also use courses with the prefix ENERGY (with dept approval). Courses at the 200, 300, and 400 level may be used as long as the department receives documentation from the instructor that shows the student has been received their permission to enroll in the course. See Handbook for Undergraduate Engineering Programs (UGHB) (http://ughb.stanford.edu) for additional details.
Chemical Engineering Undergraduate Major

A course may only be counted towards one requirement; it may not be double-counted. All courses taken for the major must be taken for a letter grade if that option is offered by the instructor. Minimum Combined GPA for all courses in Engineering Fundamentals and Depth is 2.0.

Students who completed CHEM 171 prior to academic year 2019-20 may substitute CHEMENG 110A with CHEM 171.

Students who completed CHEMENG 110 prior to academic year 2019-20 may substitute CHEMENG 110B with CHEMENG 110.

Students who completed CHEMENG 130 prior to academic year 2019-20 may substitute CHEMENG 130A with CHEMENG 130.

* For additional information and sample programs, see the Handbook for Undergraduate Engineering Programs (UGHB) (http://ughb.stanford.edu)

Chemical Engineering Minor

The following core courses fulfill the minor requirements:

<table>
<thead>
<tr>
<th>Units</th>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>ENGR 20</td>
<td>Introduction to Chemical Engineering</td>
</tr>
<tr>
<td>3</td>
<td>CHEMENG 100</td>
<td>Chemical Process Modeling, Dynamics, and Control</td>
</tr>
<tr>
<td>3</td>
<td>CHEMENG 110A</td>
<td>Introduction to Chemical Engineering Thermodynamics</td>
</tr>
<tr>
<td>3</td>
<td>CHEMENG 110B</td>
<td>Multi-Component and Multi-Phase Thermodynamics</td>
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<tr>
<td>3</td>
<td>CHEMENG 170</td>
<td>Kinetics and Reactor Design</td>
</tr>
<tr>
<td>4</td>
<td>CHEMENG 185A</td>
<td>Chemical Engineering Laboratory A</td>
</tr>
<tr>
<td>4</td>
<td>CHEMENG 180</td>
<td>Chemical Engineering Plant Design</td>
</tr>
<tr>
<td>3</td>
<td>CHEMENG 140</td>
<td>Micro and Nanoscale Fabrication Engineering</td>
</tr>
<tr>
<td>3</td>
<td>CHEMENG 142</td>
<td>Basic Principles of Heterogeneous Catalysis with Applications in Energy Transformations</td>
</tr>
<tr>
<td>3</td>
<td>CHEMENG 160</td>
<td>Polymer Science and Engineering</td>
</tr>
<tr>
<td>3</td>
<td>CHEMENG 174</td>
<td>Environmental Microbiology I</td>
</tr>
<tr>
<td>3</td>
<td>CHEMENG 181</td>
<td>Biochemistry I</td>
</tr>
</tbody>
</table>

Total Units 35

1 Students who completed CHEM 171 prior to academic year 2019-20 may substitute CHEMENG 110A with CHEM 171.

2 Students who completed CHEMENG 110 prior to academic year 2019-20 may substitute CHEMENG 110B with CHEMENG 110.