BIOCHEMICAL ENGINEERING, BACHELOR OF SCIENCE

College of Engineering

The Department of Chemical Engineering offers two undergraduate programs: Chemical Engineering (https://catalog.ucdavis.edu/departments-programs-degrees/chemical-engineering/chemical-engineering-bs/#requirementstext) and Biochemical Engineering (p. 1).

Biochemical Engineering Undergraduate Program

The Biochemical Engineering program is accredited by the Engineering Accreditation Commission of ABET (http://www.abet.org).

As the biotechnology industry expands and matures, there is an increasing need for engineers who can move products from the research stage to large-scale manufacturing. As they fill this need, engineers must also understand the production, purification, and regulatory issues surrounding biopharmaceutical manufacturing.

Biochemical engineers—with their strong foundations in chemistry, biological sciences, and chemical process engineering—are in a unique position to tackle these problems. Biochemical engineers apply the principles of cell and molecular biology, biochemistry, and engineering to develop, design, scale up, optimize, and operate processes that use living cells, organisms, or biological molecules for the production and purification of products (such as monoclonal antibodies, vaccines, therapeutic proteins, antibiotics, and industrial enzymes); for health and/or environmental monitoring (such as diagnostic kits, microarrays, biosensors); or for environmental improvement (such as bioremediation). An understanding of biological processes is also becoming increasingly important in the industries that traditionally employ chemical engineers, including the industries that process materials, chemicals, foods, energy, fuels, and semiconductors.

Objectives

We educate students in the fundamentals of chemical and biochemical engineering, balanced with the application of these principles to practical problems; educate students as independent, critical thinkers who can also function effectively in a team; prepare students with a sense of community, ethical responsibility, and professionalism; prepare students for careers in industry, government, and academia; teach students the necessity for continuing education and self-learning; and foster proficiency in written and oral communications.

Students are encouraged to adhere carefully to all prerequisite requirements. The instructor is authorized to drop students from a course for which stated prerequisites have not been completed.

Exclusive of General Education units, the minimum number of units required for the Biochemical Engineering major is 161.

Honors Program

An Honors Program is available to qualified students in the Chemical Engineering & Biochemical Engineering majors. It is a two-year program designed to challenge the most talented students in these majors. Students are invited to participate in their sophomore year. In the upper division coursework, students will complete either an honors thesis or a project that might involve local industry. Students must maintain a grade point average of 3.500 to continue in the program. Successful completion of the Honors Program will be acknowledged on the student's transcript.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
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<tr>
<td>MAT 021A</td>
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<td>or MAT 027A</td>
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<td>or BIS 027A</td>
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<td>MAT 022B</td>
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<td>CHE 004C</td>
<td>General Chemistry for the Physical Sciences &amp; Engineering</td>
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<td>BIS 002A</td>
<td>Introduction to Biology: Essentials of Life on Earth</td>
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<td>ECH 005</td>
<td>Introduction to Analysis &amp; Design in Chemical Engineering</td>
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<td>ECH 051</td>
<td>Material Balances</td>
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<td>ECH 060</td>
<td>Numerical Methods in Engineering</td>
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<td>Introduction to Programming</td>
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<td>ENG 045Y</td>
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BACHELOR OF SCIENCE

Biochemical Engineering, Bachelor of Science
Choose eight units from the following:

- Biochemical Engineering Technical Electives
  - CHE 129A
  - CHE 128B
  - CHE 128A
  - Chemistry
  - MIC 103L
  - MIC 102
  - Microbiology
  - BIS 102
  - Biological Science
  - ECH 161L
  - ECH 161C
  - ECH 161AN
  - ECH 148A
  - ECH 158BN
  - ECH 158C
  - ECH 157
  - ECH 152B
  - ECH 152A
  - ECH 145B
  - ECH 145A
  - ECH 140

Upper Division Required Courses

Engineering Chemical

- ECH 140: Mathematical Methods in Biochemical & Chemical Engineering 4
- ECH 141: Fluid Mechanics for Biochemical & Chemical Engineers 4
- ECH 142: Heat Transfer for Biochemical & Chemical Engineers 4
- ECH 143: Mass Transfer for Biochemical & Chemical Engineers 4
- ECH 145A: Chemical Engineering Thermodynamics Laboratory 3
- ECH 145B: Chemical Engineering Transport Lab 3
- ECH 148A: Chemical Kinetics & Reaction Engineering 3
- ECH 152A: Chemical Engineering Thermodynamics 3
- ECH 152B: Chemical Engineering Thermodynamics 4
- ECH 157: Process Dynamics & Control 4
- ECH 158BN: Process Economics & Green Design 4
- ECH 158C: Plant Design Project 4
- ECH 161AN: (Pending Approval) 4
- ECH 161BN: Biochemical Engineering Fundamentals 4
- ECH 161C: Biotechnology Facility Design & Regulatory Compliance 4
- ECH 161L: Bioprocess Engineering Laboratory 4

Biological Science

- BIS 102: Structure & Function of Biomolecules 3

Microbiology

- MIC 102: Introductory Microbiology 3
- MIC 103L: Introductory Microbiology Laboratory 2

Chemistry

- CHE 128A: Organic Chemistry 3
- CHE 128B: Organic Chemistry 3
- CHE 129A: Organic Chemistry Laboratory 2

Biochemical Engineering Technical Electives

Choose eight units from the following:

1. Choose at least one laboratory course from the Laboratory Elective list.

2. Complete at least 3 units in any upper division engineering course(s) not numbered 190C and/or 198.

3. Remainder of units, for a total of 8 units, may be completed in any upper division engineering and/or science course(s) excluding courses numbered 190 and 198.

4. You may receive biochemical engineering elective credit up to a maximum of 4 units of an internship (192) and/or independent study (199). Research does not replace the required lab elective.

a. Credit for independent studies (199s) or internships (192s) completed outside of the department must be approved by the department’s Undergraduate Affairs Committee. Additionally, students applying for these credits must submit an essay of at least 4 pages and no more than 10 pages detailing the engineering and/or science aspects of their work, results or outcomes (figures and graphs may be included), and how the experience relates to their educational program and objectives. The report must be submitted in pdf format and use 1.5 line spacing, 1” margins, and 12pt Times New Roman font. No intellectual property should be contained in the report. Applications must also include a written evaluation of the students’ performance by the student’s supervisor or faculty advisor.

5. Courses used to satisfy other major requirements cannot be used to satisfy the technical elective requirements.

Laboratory Electives

- BIM 161L: Biomolecular Engineering Laboratory
- BIT 161A: Genetics & Biotechnology Laboratory
- BIT 161B: Plant Genetics & Biotechnology Laboratory
- FST 102B: Practical Malting & Brewing
- FST 104L: Food Microbiology Laboratory
- FST 123L: Enzymology Laboratory
- MCB 120L: Molecular Biology & Biochemistry Laboratory
- MCB 160L: Principles of Genetics Laboratory
- NPB 101L: Systemic Physiology Laboratory
- NPB 104L: Cellular Physiology/Neurobiology Laboratory
- VEN 123L: Analysis of Musts & Wines Laboratory
- VEN 124L: Wine Production Laboratory

Upper Division Composition Requirement

A grade of C- or better is required:

Choose one:

- UWP 102E: Writing in the Disciplines: Engineering
- UWP 102F: Writing in the Disciplines: Food Science & Technology
- UWP 104A: Writing in the Professions: Business Writing
- or UWP 104AY: Writing in the Professions: Business Writing
- UWP 104E: Writing in the Professions: Science
- UWP 104T: Writing in the Professions: Technical Writing

Passing the Upper Division Composition Exam.

Upper Division Required Courses Subtotal 84-88

Total Units 161-167
Acceptable science courses must carry one of the following subject designations: BIS, BIT, FST, MIC, MCB, NPB, PLB, PLS, STA, and VEN. 

With the exception for ECH 198.