

CHEMICAL ENGINEERING, BS

for the degree of Bachelor of Science, Major in Chemical Engineering
(Specialized Curriculum)

The first two years of the Chemical Engineering curriculum provide a strong foundation in basic sciences through Physics, Mathematics, Chemistry, an introduction to what Chemical Engineers do, and the fundamental basis of Chemical Engineering (Mass and Energy Balances and Thermodynamics.) In the third year, students delve deeper into more specialized Chemistry courses such as Physical and Analytical Chemistry, while exploring fundamental Chemical Engineering courses such as Momentum Transfer, Separations, and Reactor Design. The Senior year incorporates all of this learning through high level technical electives, Process Control, Capstone Lab, and Capstone Design courses. It is through the lab and design class that students apply everything they have learned in previous Chemical Engineering courses to real-world team projects and presentations.

The Chemical Engineering specialized curriculum provides two areas of concentration: 1.) Chemical Engineering and 2.) Biomolecular Engineering. Each area is based on a strong fundamental understanding of Chemical Engineering, however the Biomolecular concentration's technical electives focus more on bio-applied processing and technology.

Areas of Concentration

- Chemical Engineering (p. 1): The chemical engineering concentration is designed to prepare students for careers in the energy, chemical, food, energy, pharmaceutical, semiconductor processing, personal care, fiber and materials industries.
- Biomolecular Engineering (<http://catalog.illinois.edu/undergraduate/las/chemical-engineering-bs/biomolecular-engineering/#degreerequirementstext>): The Biomolecular Engineering concentration builds upon the traditional principles of chemical engineering, but specializes in biological and biotechnological systems in order to better prepare students who are interested in or seek employment in the food, pharmaceutical, and biotechnology industries.

Current Program Educational Objectives (<https://chbe.illinois.edu/about/accreditation/>)

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General education: Students must complete the Campus General Education (<https://courses.illinois.edu/gened/DEFAULT/DEFAULT/>) **requirements including the campus general education language requirement.**

Minimum required major and supporting course work: A grade point average of 2.5 or higher in all courses required for the major earned on the UIUC campus is required in order to be accepted by the department as juniors and seniors.

Minimum hours required for graduation: The curriculum requires 129 hours for graduation and is organized as shown below.

Orientation and Professional Development

These courses introduce opportunities and resources the college, department, and curriculum offers students. They also provide background on the Chemical Engineering curriculum, what chemical

engineers do, and the skills to work effectively and successfully in the engineering profession.

Code	Title	Hours
CHBE 121	CHBE Profession ¹	1
ENG 100	Grainger Engineering Orientation Seminar ¹	0
Total Hours		1

Foundational Mathematics and Science

These courses stress the basic mathematical and scientific principles upon which the engineering discipline is based.

Code	Title	Hours
CHEM 202	Accelerated Chemistry I ²	3
CHEM 203	Accelerated Chemistry Lab I	2
CHEM 204	Accelerated Chemistry II	3
CHEM 205	Accelerated Chemistry Lab II	2
MATH 221	Calculus I ³	4
MATH 231	Calculus II	3
MATH 241	Calculus III	4
MATH 285	Intro Differential Equations ⁴	3
MATH 415	Applied Linear Algebra	3
PHYS 211	University Physics: Mechanics	4
PHYS 212	University Physics: Elec & Mag	4
PHYS 214	Univ Physics: Quantum Physics	2
Total Hours		37

Chemical and Biomolecular Engineering Technical Core

These courses stress fundamental concepts and basic laboratory techniques that comprise the common intellectual understanding of chemical engineering and chemical science.

Code	Title	Hours
CHBE 221	Principles of CHE	3
CHBE 321	Thermodynamics	4
CHBE 421	Momentum and Heat Transfer	4
CHBE 422	Mass Transfer Operations	4
CHBE 424	Chemical Reaction Engineering	3
CHBE 430	Unit Operations Laboratory	4
CHBE 431	Process Design	4
CHBE 440	Process Control and Dynamics	3
CHEM 236	Fundamental Organic Chem I	4
CHEM 237	Structure and Synthesis	2
CHEM 315	Instrumental Chem Systems Lab ⁵	2
CHEM 420	Instrumental Characterization	2
CHEM 442	Physical Chemistry I	4
CS 101	Intro Computing: Engrg & Sci	3
IE 300	Analysis of Data	3
Total Hours		49

For Chemical Engineering

Code	Title	Hours
Technical Core		49
CHEM 436	Fundamental Organic Chem II	3

or MCB 450	Introductory Biochemistry	
Total Hours		52

Technical Electives

These courses stress the rigorous analysis and design principles practiced in the major subdisciplines of chemical engineering embodied in the chemical engineering and biomolecular engineering concentrations.

For Chemical Engineering

Code	Title	Hours
Selected from the departmentally approved List of Approved Chemical Engineering Technical Electives, satisfying these distribution requirements: ⁶		
400-level ChBE courses, with not more than 3 hours being CHBE 497 or CHBE 499 ⁷		6
Any 400-level course from List 1 ⁷		3
Any courses from List 1 ⁷		6
Any 400-level course from List 2		4
Total Hours		19

Social Sciences and Humanities

The social sciences and humanities courses ensure that students have exposure in breadth and depth to areas of intellectual activity that are essential to the general education of any college graduate.

Code	Title	Hours
General education courses to satisfy the university requirements for social & behavioral sciences, humanities & the arts, and cultural studies (Non-Western, U.S. Minority, and Western Cultures).		
		16

Composition

These courses teach fundamentals of expository writing.

Code	Title	Hours
RHET 105	Writing and Research	4
Advanced Composition (satisfied by completing the sequence CHBE 430 and CHBE 431 in the Chemical Engineering Technical Core).		
Total Hours		4

¹ For students entering the curriculum after the freshman year, 1 additional hour of credit from the list of approved engineering technical electives may be substituted in place of CHBE 121.

² Students who do not place into CHEM 202, or who do not satisfy the mathematics prerequisite for CHEM 202, may substitute the sequence CHEM 102, CHEM 103, CHEM 104, CHEM 105, CHEM 222, and CHEM 223 for CHEM 202, CHEM 203, CHEM 204, and CHEM 205.

³ MATH 220 may be substituted, with four of the five credit hours applying toward the degree. MATH 220 is appropriate for students with no background in calculus.

⁴ MATH 441 may be substituted for MATH 285. MATH 286 (4 hours) may be substituted for MATH 285 (3 hours).

⁵ Students must register in one of the Chemical Engineering-specific CHEM 315 lab sections.

⁶ List of Approved Chemical Engineering Technical Electives. (<http://chbe.illinois.edu/wp-content/uploads/2015/11/Technical.Electives.Current.pdf>)

⁷ A maximum of 10 total hours of undergraduate research may be counted toward Technical Elective credit.

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The schedule that follows is illustrative, showing the typical sequence in which courses would be taken by a student with no college course credit already earned and who intends to graduate in four years. Each individual's case may vary, but the position of required named courses is generally indicative of the order in which they should be taken. The first three semesters of the Suggested Sequence is the same for all chemical engineering students. The fifth through eighth semesters vary with the area of concentration chosen. Refer to the appropriate sequence continuation below.

First Year

First Semester	Hours	Second Semester	Hours
CHEM 202 ¹		3 CHBE 121 ²	1
CHEM 203		2 CHEM 204	3
ENG 100 ²		0 CHEM 205	2
MATH 221 ³		4 CS 101	3
RHET 105		4 MATH 231	3
Elective in Social Sciences or Humanities ^{4,5}		3 PHYS 211 ⁶	4
		16	16

Second Year

First Semester	Hours
CHBE 221	3
CHEM 236	4
CHEM 237	2
MATH 241	4
PHYS 212 ⁶	4
	17

Total Hours 49

Major in Chemical Engineering

For the Concentration in Biomolecular Engineering, see below (p. 3)

Second Year

First Semester	Hours	Second Semester	Hours
Second Year First Semester course information is above in the Suggested Sequence that is common for all students		17 CHBE 321	4
		CHEM 436 or MCB 450	3
		MATH 285 ^{7a}	3
		MATH 415	3
		PHYS 214 ⁶	2

		Elective in Social Sciences or Humanities or Technical Elective ^{4,5,8a}	3
	17		18

Third Year

First Semester	Hours	Second Semester	Hours
CHBE 421		4 CHBE 422	4
CHEM 315 ⁹		2 CHBE 424	3
CHEM 420		2 IE 300	3
CHEM 442		4 Elective in Social Sciences or Humanities or Technical Elective ^{4,5,8a}	7
Elective in Social Sciences or Humanities or Technical Elective ^{4,5,8a}		3	
	15		17

Fourth Year

First Semester	Hours	Second Semester	Hours
CHBE 430 ^{10,11}		4 CHBE 431 ^{10,11}	4
CHBE 440		3 Elective in Social Sciences or Humanities or Technical Elective ^{4,5,8a}	10
Elective in Social Sciences or Humanities or Technical Elective ^{4,5,8a}		9	
	16		14

Total Hours 97**Concentration in Biomolecular Engineering****Second Year**

First Semester	Hours	Second Semester	Hours
Second Year First Semester course information is above in the Suggested Sequence that is common for all students		17 CHBE 321	4
		MCB 450	3
		MATH 285 ^{7b}	3
		MATH 415	3
		PHYS 214 ⁶	2

		Elective in Social Sciences or Humanities or Technical Elective ^{4,5,8a}	3
	17		18

Third Year

First Semester	Hours	Second Semester	Hours
CHBE 421		4 CHBE 422	4
CHEM 315		2 CHBE 424	3
CHEM 420		2 IE 300	3
CHEM 442		4 Elective in Social Sciences or Humanities or Technical Elective ^{4,5,8a}	7
Elective in Social Sciences or Humanities or Technical Elective ^{4,5,8a}		3	
	15		17

Fourth Year

First Semester	Hours	Second Semester	Hours
CHBE 430 ^{10,11}		4 CHBE 431 ^{10,11}	4
CHBE 440		3 Elective in Social Sciences or Humanities or Technical Elective ^{4,5,8a}	10
Elective in Social Sciences or Humanities or Technical Elective ^{4,5,8a}		9	
	16		14

Total Hours 97

- ¹ Students who do not place into CHEM 202, or who do not satisfy the mathematics prerequisite for CHEM 202, may substitute the sequence CHEM 102, CHEM 103, CHEM 104, CHEM 105, CHEM 222, and CHEM 223 for CHEM 202, CHEM 203, CHEM 204, and CHEM 205.
- ² For students entering the curriculum after the freshman year, 1 additional hr of credit from the list of approved engineering technical electives (List 1) may be substituted in place of CHBE 121. The ENG 100 requirement will be waived. Under no circumstances will these requirements be waived for students who are in the chemical engineering curriculum during their freshman year.
- ³ MATH 220 may be substituted, with four of the five credit hours applying toward the degree. MATH 220 is appropriate for students with no background in calculus.
- ⁴ At least 16 hours must be taken. All Campus General Education requirements must be satisfied, including those in approved course work in the Humanities/Arts, Social/Behavioral Sciences, and Cultural Studies, including the Western, Non-Western and/or U.S. Minorities components. The requirements for the Campus General Education categories Natural Sciences/Technology, Quantitative Reasoning I and II, Composition I, and

Advanced Composition are fulfilled through required course work in the curriculum.

⁵ Three semesters of college credit in one foreign language is required. Three years of high school credit in one foreign language are equivalent to three semesters of college credit and satisfy the requirement.

⁶ Under no circumstances will PHYS 101-PHYS 102 be accepted as a substitute for any part of the Physics sequence.

7a MATH 441 may be substituted for MATH 285. MATH 286 may be substituted for MATH 285.

7b MATH 441 may be substituted for MATH 285. MATH 286 may be substituted for MATH 285.

8a At least 19 hours must be selected from the departmentally approved List of Approved Chemical Engineering Technical Electives (<http://chbe.illinois.edu/wp-content/uploads/2015/11/Technical.Electives.Current.pdf>), satisfying these distribution requirements:

a) 6 hours must be 400-level ChBE courses, with not more than 3 hours being CHBE 497 or 499.

b) 3 hours any 400-level course from List 1.

c) 6 hours any courses from List 1.

d) 4 hours any 400-level courses from List 2.

A maximum of 10 total hours of undergraduate research may be counted toward Technical Elective credit. The List of Approved Chemical Engineering Technical Electives may be obtained in 99 RAL or from the department Web site. (<http://chbe.illinois.edu/undergraduate/explore-chbe-at-illinois/curriculum-academic-advising/>)

8b At least 19 hours must be selected from the departmentally approved List of Approved Biomolecular Engineering Technical Electives Categories (<http://chbe.illinois.edu/wp-content/uploads/2015/11/Technical.Electives.Current.pdf>), satisfying these distribution requirements:

a) 9 hours must be from Category A

b) 6 hours must be from Category B

c) 4 hours must be 400-level courses from List 2.

A maximum of 3 hours from Category A may be undergraduate research credit. A maximum of 9 total hours of undergraduate research may be counted toward Technical Elective credit. The List of Approved Biomolecular Engineering Technical Electives may be obtained in Room 99 RAL or from the department Web site. (<http://chbe.illinois.edu/undergraduate/explore-chbe-at-illinois/curriculum-academic-advising/>)

⁹ Students must register in one of the Chemical Engineering-specific CHEM 315 lab sections.

¹⁰ Enrollment in CHBE 430 is limited. Thus CHBE 430 may need to be taken in the second semester and CHBE 431 and/or additional electives taken in the first semester instead. Students in their final semester will have priority for getting into CHBE 430 and CHBE 431.

¹¹ The sequence CHBE 430 and CHBE 431 satisfies the General Education Advanced Composition requirement.

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2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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Chemical & Biomolecular Engineering website (<https://chbe.illinois.edu/>)

Chemical & Biomolecular Engineering faculty (<https://chbe.illinois.edu/directory/>)

SCS Academic Advising (<https://scs.illinois.edu/academics/advising/>)

Overview of College Admissions & Requirements: Liberal Arts & Sciences (<http://catalog.illinois.edu/schools/las/>)

College of Liberal Arts and Sciences website (<https://las.illinois.edu/>)

Student learning outcomes are based on learning outcomes in line with the ABET accreditation process.

Chemical Engineering graduates will have:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.