

BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING (BSChE) DEGREE AND A MAJOR CONCENTRATION IN BIOTECHNOLOGY AND BIOENGINEERING

The program leading to the BSChE degree is accredited by the Engineering Accreditation Commission (EAC) of ABET, <https://www.abet.org>.

Program Learning Outcomes (Student Outcomes) for the BSChE Degree

Upon completing the BSChE degree, students will be able to demonstrate:

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

Program Educational Objectives for the BSChE Degree

Within 3-5 years of graduation, graduates with a Bachelor of Science in Chemical Engineering (BSChE) degree are expected to be:

1. Graduate students, professionals, and entrepreneurs who are moving towards leadership positions as exemplary members of the global workforce; and
2. Professionals who practice their societal, environmental, and ethical responsibilities.

Requirements for the BSChE Degree

For general university requirements, see Graduation Requirements (ga.rice.edu/undergraduate-students/academic-policies-procedures/

[graduation-requirements](#)). Students pursuing the BSChE degree must complete:

- A minimum of 97 credit hours to satisfy major requirements.
- A minimum of 132 credit hours to satisfy degree requirements.
- A minimum of 18 courses (53 credit hours), depending on major concentration declared, taken at the 300-level or above.
- The requirements of a major concentration. When students declare the major (ga.rice.edu/undergraduate-students/academic-opportunities/majors-minors-certificates/#text) in Chemical Engineering, students must additionally identify and declare one of the major concentrations, either in:
 - Biotechnology and Bioengineering (p. 2), **or**
 - Computational Engineering (ga.rice.edu/programs-study/departments-programs/engineering/chemical-biomolecular-engineering/chemical-bsche-concentration-computational/#Computational_Engineering), **or**
 - Environmental Engineering (ga.rice.edu/programs-study/departments-programs/engineering/chemical-biomolecular-engineering/chemical-bsche-concentration-environmental/#Environmental_Engineering), **or**
 - Materials Science and Engineering (ga.rice.edu/programs-study/departments-programs/engineering/chemical-biomolecular-engineering/chemical-bsche-concentration-materials-science/#Materials_Science), **or**
 - Sustainability and Energy Engineering (ga.rice.edu/programs-study/departments-programs/engineering/chemical-biomolecular-engineering/chemical-bsche-concentration-sustainability-energy/#Sustainability_Energy), **or**
 - Engineering Breadth (ga.rice.edu/programs-study/departments-programs/engineering/chemical-biomolecular-engineering/chemical-bsche-concentration-breadth/#Engineering_Breadth) (Engineering Breadth is a major concentration comprised of electives from a mix of engineering disciplines).

Because of the common core requirements, it is possible for students to change their major concentration at any time, even after initially declaring the major. To do so, please contact the Office of the Registrar (registrar@rice.edu).

The courses listed below satisfy the requirements for this major. In certain instances, courses not on this official list may be substituted upon approval of the major's academic advisor, or where applicable, the department's Director of Undergraduate Studies. (Course substitutions must be formally applied and entered into Degree Works by the major's Official Certifier (<https://registrar.rice.edu/facstaff/degreeworks/officialcertifier>)). Students and their academic advisors should identify and clearly document the courses to be taken.

Summary

Code	Title	Credit Hours
	Total Credit Hours Required for the Major in Chemical Engineering	97
	Total Credit Hours Required for the BSChE Degree	132

Degree Requirements

Code	Title	Credit Hours
Core Requirements		
Chemistry ¹		
CHEM 121 & CHEM 123	GENERAL CHEMISTRY I and GENERAL CHEMISTRY LABORATORY I	4
CHEM 122 & CHEM 124	GENERAL CHEMISTRY II and GENERAL CHEMISTRY LABORATORY II	4
CHEM 211 & CHEM 213	ORGANIC CHEMISTRY I and ORGANIC CHEMISTRY DISCUSSION	3
CHEM 217	ORGANIC LABORATORY FOR CHEMICAL ENGINEERS	1
or CHEM 215	ORGANIC CHEMISTRY LAB	
<i>Select 2 from the following:</i>		6
CHEM 212 & CHEM 214	ORGANIC CHEMISTRY II and ORGANIC CHEM DISCUSSION II	
CHEM 301	PHYSICAL CHEMISTRY I	
CHEM 302	PHYSICAL CHEMISTRY II	
Chemical and Biomolecular Engineering Core Courses		
CHBE 301	CHEMICAL ENGINEERING FUNDAMENTALS	3
CHBE 303	COMPUTER PROGRAMMING IN CHEMICAL ENGINEERING	2
CHBE 305	COMPUTATIONAL METHODS IN CHEMICAL ENGINEERING	3
CHBE 310	FUNDAMENTALS OF BIOMOLECULAR ENGINEERING	3
CHBE 343	CHEMICAL ENGINEERING LAB I	3
CHBE 350	PROCESS SAFETY IN CHEMICAL ENGINEERING	1
CHBE 390	CHEMICAL KINETICS AND REACTOR DESIGN	3
CHBE 401	TRANSPORT PHENOMENA I	3
CHBE 402	TRANSPORT PHENOMENA II	3
CHBE 403	DESIGN FUNDAMENTALS	4
CHBE 404	CHEMICAL ENGINEERING DESIGN	4
CHBE 411	THERMODYNAMICS I	3
CHBE 412	THERMODYNAMICS II	3
CHBE 443	CHEMICAL ENGINEERING LAB II	3
CHBE 470	PROCESS DYNAMICS AND CONTROL	3
Mathematics		
MATH 101 or MATH 105	SINGLE VARIABLE CALCULUS I AP/OTH CREDIT IN CALCULUS I	3
MATH 102 or MATH 106	SINGLE VARIABLE CALCULUS II AP/OTH CREDIT IN CALCULUS II	3
MATH 211	ORDINARY DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA	3
MATH 212	MULTIVARIABLE CALCULUS ²	3
CAAM 336	DIFFERENTIAL EQUATIONS IN SCIENCE AND ENGINEERING	3
Physics		
<i>Select 1 from the following:</i>		4
PHYS 101 & PHYS 103	MECHANICS (WITH LAB) and MECHANICS DISCUSSION	
PHYS 111	HONORS MECHANICS (WITH LAB)	
<i>Select 1 from the following:</i>		4
PHYS 102 & PHYS 104	ELECTRICITY & MAGNETISM (WITH LAB) and ELECTRICITY AND MAGNETISM DISCUSSION	
PHYS 112	HONORS ELECTRICITY & MAGNETISM (WITH LAB)	
Major Concentration		
<i>Select 1 from the following Major Concentrations (see below for Major Concentration requirements):</i>		12
Biotechnology and Bioengineering		
Computational Engineering		
Environmental Engineering		
Materials Science and Engineering		
Sustainability and Energy Engineering		
Engineering Breadth		
Total Credit Hours Required for the Major in Chemical Engineering		97
University Graduation Requirements (ga.rice.edu/undergraduate-students/academic-policies-procedures/graduation-requirements) [*]		35
Total Credit Hours		132
Footnotes and Additional Information		
[*] Includes coursework completed as distribution credit, FWIS, LPAP, upper-level, residency (hours taken at Rice), 60 hours outside of the major (if applicable), and any additional academic program requirements. The "hours outside of the major" requirement may include all of the above university requirements.		
¹ Notes regarding the Chemistry course requirements: CHEM 121 and CHEM 123 can be satisfied by completing CHEM 151 and CHEM 153. CHEM 122 and CHEM 124 can be satisfied by completing CHEM 152 and CHEM 154. For students planning advanced studies in medicine or biotechnology, CHEM 217 can be satisfied by completing CHEM 215.		
² MATH 221 and MATH 222 may substitute for MATH 212.		
Major Concentration: Biotechnology and Bioengineering		
To fulfill the remaining requirements for the major in Chemical Engineering with a major concentration in Biotechnology and Bioengineering, students must complete a total of 12 credit hours as listed below.		
Please Note: The following list of approved courses can be used to satisfy the requirements of the major concentration. Courses not on the list may be taken upon approval of the academic advisor. Students and their academic advisors should identify and clearly document the courses to be taken.		
Code	Title	Credit Hours
Core Requirement		
BIOC 201	INTRODUCTORY BIOLOGY	3
Elective Requirements		
<i>Select 3 courses from the following:</i>		9
BIOC 301	BIOCHEMISTRY I	

BIOE 321	CELLULAR ENGINEERING
BIOE 330	BIOREACTION ENGINEERING
BIOE 370	BIOMATERIALS
BIOE 372	BIOMECHANICS
BIOE 381 / ELEC 381	FUNDAMENTALS OF NERVE AND MUSCLE ELECTROPHYSIOLOGY
BIOE 383	BIOMEDICAL ENGINEERING INSTRUMENTATION
BIOE 408	SYNTHETIC BIOLOGY
BIOE 420 / CHBE 420	TRANSPORT PHENOMENA IN BIOENGINEERING
BIOE 422	GENE THERAPY
BIOE 460 / CHBE 460	
BIOE 464 / BIOC 464	EXTRACELLULAR MATRIX
BIOE 470 / COMP 470 / STAT 470	FROM SEQUENCE TO STRUCTURE: AN INTRODUCTION TO COMPUTATIONAL BIOLOGY
BIOE 482 / ELEC 482	PHYSIOLOGICAL CONTROL SYSTEMS
BIOE 485 / COMP 485 / ELEC 485	FUNDAMENTALS OF MEDICAL IMAGING I
BIOE 490	INTRO COMPUTATIONAL SYSTEMS BIOLOGY: MODELING & DESIGN PRINCIPLES OF BIOCHEM NETWORKS
BIOE 620 / CHBE 620	TISSUE ENGINEERING

Total Credit Hours

12

Policies for the BSChE Degree with a Major Concentration in Biotechnology and Bioengineering

Transfer Credit

For Rice University's policy regarding transfer credit, see Transfer Credit (ga.rice.edu/undergraduate-students/academic-policies-procedures/transfer-credit). Some departments and programs have additional restrictions on transfer credit. The Office of Academic Advising maintains the university's official list of transfer credit advisors on their website: <https://oaa.rice.edu>. Students are encouraged to meet with their academic program's transfer credit advisor when considering transfer credit possibilities.

Departmental Transfer Credit Guidelines

Students pursuing the BSChE degree should be aware of the following departmental transfer credit guidelines:

- Requests for transfer credit will be considered by the program director (and/or the program's official transfer credit advisor) on an individual case-by-case basis.

Additional Information

For additional information, please see the Chemical and Biomolecular Engineering website: <https://chbe.rice.edu/>

Opportunities for the BSChE Degree with a Major Concentration in Biotechnology and Bioengineering

Academic Honors

The university recognizes academic excellence achieved over an undergraduate's academic history at Rice. For information on university honors, please see Latin Honors (ga.rice.edu/undergraduate-students/honors-distinctions/university) (*summa cum laude*, *magna cum laude*, and *cum laude*) and Distinction in Research and Creative Work (ga.rice.edu/undergraduate-students/honors-distinctions/university). Some departments have department-specific Honors awards or designations.

Fifth-Year Master's Degree Option for Rice Undergraduate Students

Rice students have an option to pursue the Master of Chemical Engineering (MChE) degree by adding an additional fifth year to their four undergraduate years of science and engineering studies.

Advanced Rice undergraduate students in good academic standing may apply to the MChE degree program during their junior or senior year. Upon acceptance, depending on course load, financial aid status, and other variables, they may then start taking some required courses of the master's degree program. A plan of study will need to be approved by the student's undergraduate advisor and the (MChE) chair of the department graduate studies committee.

As part of this option and opportunity, Rice undergraduate students:

- must complete the requirements for a bachelor's degree and the master's degree independently of each other (i.e. no course may be counted toward the fulfillment of both degrees).
- should be aware there could be financial aid implications if the conversion of undergraduate coursework to that of graduate level reduces their earned undergraduate credit for any semester below that of full-time status (12 credit hours).
- more information on this *Undergraduate - Graduate Concurrent Enrollment* opportunity, including specific information on the registration process can be found here (ga.rice.edu/undergraduate-students/academic-opportunities/undergraduate-graduate-concurrent-enrollment).

Additional Information

For additional information, please see the Chemical and Biomolecular Engineering website: <https://chbe.rice.edu/>