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

The program leading to the BSChE degree is accredited by the Engineering Accreditation Commission (EAC) of ABET, http://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 (ga.rice.edu/programs-study/departments-programs/engineering/chemical-biomolecular-engineering/chemical-bsche-concentration-biotechnology-bioengineering/#Biotechnology_Bioengineering), 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 (p. 2) (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

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Total Credit Hours Required for the Major in Chemical Engineering</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>Total Credit Hours Required for the BSChE Degree</td>
<td>132</td>
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</tbody>
</table>
## Degree Requirements

### Core Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 121</td>
<td>GENERAL CHEMISTRY I and GENERAL CHEMISTRY LABORATORY I</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 122</td>
<td>GENERAL CHEMISTRY II and GENERAL CHEMISTRY LABORATORY II</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 211</td>
<td>ORGANIC CHEMISTRY I and ORGANIC CHEMISTRY DISCUSSION</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 217</td>
<td>ORGANIC LABORATORY FOR CHEMICAL ENGINEERS</td>
<td>1</td>
</tr>
<tr>
<td>or CHEM 215</td>
<td>ORGANIC CHEMISTRY LAB</td>
<td></td>
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</tbody>
</table>

Select 2 from the following:

- CHEM 212 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
- CHBE 303 COMPUTER PROGRAMMING IN CHEMICAL ENGINEERING
- CHBE 305 COMPUTATIONAL METHODS IN CHEMICAL ENGINEERING
- CHBE 310 FUNDAMENTALS OF BIOMOLECULAR ENGINEERING
- CHBE 343 CHEMICAL ENGINEERING LAB I
- CHBE 350 PROCESS SAFETY IN CHEMICAL ENGINEERING
- CHBE 390 CHEMICAL KINETICS AND REACTOR DESIGN
- CHBE 401 TRANSPORT PHENOMENA I
- CHBE 402 TRANSPORT PHENOMENA II
- CHBE 403 DESIGN FUNDAMENTALS
- CHBE 404 CHEMICAL ENGINEERING DESIGN
- CHBE 411 THERMODYNAMICS I
- CHBE 412 THERMODYNAMICS II
- CHBE 443 CHEMICAL ENGINEERING LAB II
- CHBE 470 PROCESS DYNAMICS AND CONTROL

### Mathematics

- MATH 101 or MATH 105: SINGLE VARIABLE CALCULUS I
- MATH 102 or MATH 106: SINGLE VARIABLE CALCULUS II
- MATH 211: ORDINARY DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA
- MATH 212: MULTIVARIABLE CALCULUS
- CAAM 336: DIFFERENTIAL EQUATIONS IN SCIENCE AND ENGINEERING

Select 1 from the following:

- BIOC 201 INTRODUCTORY BIOLOGY
- CHEM 212 ORGANIC CHEMISTRY II
- CHEM 214 ORGANIC CHEMISTRY DISCUSSION II

### Physics

Select 1 from the following:

- PHYS 101 MECHANICS (WITH LAB) & PHYS 103 and MECHANICS DISCUSSION
- PHYS 111 HONORS MECHANICS (WITH LAB)

Select 1 from the following:

- PHYS 102 ELECTRICITY & MAGNETISM (WITH LAB) & PHYS 104 and ELECTRICITY AND MAGNETISM DISCUSSION
- PHYS 112 HONORS ELECTRICITY & MAGNETISM (WITH LAB)

### Major Concentration: Engineering Breadth

Select 1 from the following Major Concentrations (see below for Major Concentration requirements):

- Biotechnology and Bioengineering
- Computational Engineering
- Environmental Engineering
- Materials Science and Engineering
- Sustainability and Energy Engineering

### Total Credit Hours Required for the Major in Chemical Engineering

University Graduation Requirements (ga.rice.edu/undergraduate-students/academic-policies-procedures/graduation-requirements) *

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.

To fulfill the remaining requirements for the major in Chemical Engineering with a major concentration in Engineering Breadth, students must complete a total of 12 credit hours as listed below. (p. 2)

Please Note: The following list of courses can be used to satisfy the requirements of the major concentration. As noted above with major requirements, in certain instances, courses not on the official list may be substituted upon approval of the major’s academic advisor. Students and their academic advisors should identify and clearly document the courses to be taken.

### Major Concentration: Engineering Breadth

<table>
<thead>
<tr>
<th>Code</th>
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<th>Credit Hours</th>
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<tbody>
<tr>
<td>PHYS 111</td>
<td>HONORS MECHANICS (WITH LAB)</td>
<td></td>
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</tbody>
</table>

Select 1 from the following:

- PHYS 102 ELECTRICITY & MAGNETISM (WITH LAB) & PHYS 104 and ELECTRICITY AND MAGNETISM DISCUSSION
- PHYS 112 HONORS ELECTRICITY & MAGNETISM (WITH LAB)
Bachelor of Science in Chemical Engineering (BSChE) Degree and a Major Concentration in Engineering Breadth

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>CHEM 301</td>
<td>PHYSICAL CHEMISTRY I&lt;sup&gt;1&lt;/sup&gt;</td>
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<tr>
<td>CHEM 302</td>
<td>PHYSICAL CHEMISTRY II&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>CHEM 330</td>
<td>ANALYTICAL CHEMISTRY</td>
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<tr>
<td>ESCI 334</td>
<td>GEOLOGICAL TECHNIQUES</td>
</tr>
<tr>
<td>ESCI 340 /</td>
<td>GLOBAL BIOGEOCHEMICAL CYCLES</td>
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<tr>
<td>EBIO 340 /</td>
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<tr>
<td>ENST 340</td>
<td></td>
</tr>
<tr>
<td>PHYS 201</td>
<td>WAVES, LIGHT, AND HEAT</td>
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<tr>
<td>PHYS 202</td>
<td>MODERN PHYSICS</td>
</tr>
<tr>
<td>CHEM 301</td>
<td>PHYSICAL CHEMISTRY I&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>CHEM 302</td>
<td>PHYSICAL CHEMISTRY II&lt;sup&gt;1&lt;/sup&gt;</td>
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<td>ANALYTICAL CHEMISTRY</td>
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<td>ESCI 334</td>
<td>GEOLOGICAL TECHNIQUES</td>
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<td>EBIO 340 /</td>
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<tr>
<td>PHYS 202</td>
<td>MODERN PHYSICS</td>
</tr>
</tbody>
</table>

**Elective Requirements**

Select a total of 9 credit hours from at least 3 categories below:<sup>2</sup> 9

- **Environmental Engineering Courses**
  - CEVE 310: PRINCIPLES OF ENVIRONMENTAL ENGINEERING
  - CEVE 311 / MECH 311: MECHANICS OF SOLIDS AND STRUCTURES
  - CEVE 434: FATE AND TRANSPORT OF CONTAMINANTS IN THE ENVIRONMENT
- **Materials Science Engineering Courses**
  - MSNE 301: MATERIALS SCIENCE
  - MSNE 402: MECH PROPERTIES OF MATERIALS
  - MSNE 406: PHYSICAL PROPERTIES OF SOLIDS
  - MSNE 594 / CHBE 594: PROPERTIES OF POLYMERS
- **Bioengineering Courses**
  - BIOC 540 / CHBE 640: METABOLIC ENGINEERING
  - BIOE 370: BIOMATERIALS
  - BIOE 372: BIOMECHANICS
  - BIOE 420 / CHBE 420: TRANSPORT PHENOMENA IN BIOENGINEERING
  - BIOE 460 / CHBE 460: BIOCHEMICAL ENGINEERING
  - BIOE 470 / COMP 470 / STAT 470: FROM SEQUENCE TO STRUCTURE: AN INTRODUCTION TO COMPUTATIONAL BIOLOGY
- **Sustainability and Energy Courses**
  - CEVE 302 / ENGI 302: SUSTAINABLE DESIGN
  - CHBE 281 / ENST 281: ENGINEERING SUSTAINABLE COMMUNITIES
  - CHBE 450: PETROLEUM PHASE BEHAVIOR AND FLOW ASSURANCE
- **Computation and Applied Mathematics Course**
  - CAAM 335: MATRIX ANALYSIS
- **Other Approved Engineering Courses**
  - CHBE 560 / MSNE 560: COLLOIDAL AND INTERFACIAL PHENOMENA
  - ELEC 242: FUNDAMENTALS OF ELECTRICAL ENGINEERING II
  - ELEC 261: ELECTRONIC MATERIALS AND QUANTUM DEVICES

**Total Credit Hours**

12

**Footnotes and Additional Information**

1. Two of the following courses must be taken to fulfill the Core Chemistry Requirements for the degree: CHEM 212 & CHEM 214, CHEM 301, or CHEM 302. If a student takes all three courses, the third course may be applied to the Core Requirement for the Engineering Breadth.

2. A maximum of 3 credit hours for CHBE 499 or CHBE 495 may replace 3 credit hours of any of the discipline electives above, but not the Core Requirement.

**Policies for the BSChE Degree with a Major Concentration in Engineering Breadth**

**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 Engineering Breadth**

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