Chemical and Biochemical Engineering, MS

The Department of Chemical and Biochemical Engineering provides a stimulating academic community where students engage in a highly personalized learning and research environment. The graduate program provides qualified students with deeper and broader training than is possible at the undergraduate level. The Master of Science program provides students with opportunities to obtain specialized knowledge and expertise through advanced coursework in chemical engineering and related disciplines, to engage in interdisciplinary research opportunities (thesis option), and to impact their communities through service learning.

Faculty within the department have focused research projects in biological and pharmaceutical systems, clean energy and water, air quality and climate, polymers and advanced materials, quantum chemical simulation, machine learning, and remote sensing; see Graduate Program on the Department of Chemical and Biochemical Engineering website.

Learning Outcomes

Graduates will:

- demonstrate a mastery of advanced chemical engineering concepts;
- effectively communicate scientific concepts and/or research results in both written and oral formats to scientific and general audiences;
- demonstrate knowledge of and commitment to safe and ethical behavior through adherence to best safety practices and academic integrity principles; and
- demonstrate the ability to serve as a STEM ambassador through outreach and service activities.

Students completing the program with thesis will additionally demonstrate the abilities to:

- perform independent research on an original topic in chemical engineering; and
- critically identify and solve research problems, summarize disciplinary information, and evaluate research findings.

Requirements

The Master of Science program in chemical and biochemical engineering requires a minimum of 30 s.h. in approved graduate courses with or without thesis, plus 3–5 s.h. of required seminars (nonthesis and Undergraduate to Graduate students complete 3 s.h.; thesis students complete 3–5 s.h.). Students who pursue the thesis option may earn up to 6 s.h. in CBE:5999 MS Thesis Research: Chemical and Biochemical Engineering. All students must maintain a cumulative grade-point average of at least 3.00.

Students who receive assistantships, fellowships, or other awarded financial support are expected to pursue an advanced degree with thesis.

Students entering with a degree other than chemical engineering may need to take additional coursework to attain proficiency in core areas of chemical engineering.

The MS with a major in chemical and biochemical engineering requires the following coursework.

Core Courses

Students must maintain a GPA of at least 3.25 in the five core courses.

<table>
<thead>
<tr>
<th>Course #</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE:5105</td>
<td>Introduction to Literature Review and Proposal Writing</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5110</td>
<td>Intermediate Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5115</td>
<td>Transport Phenomena I</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5120</td>
<td>Data Science in Chemical Engineering Systems</td>
<td>3</td>
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</tbody>
</table>

Kinetics

<table>
<thead>
<tr>
<th>Course #</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE:3205</td>
<td>Introduction to Biochemical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5315</td>
<td>Polymer Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5425</td>
<td>Atmospheric Chemistry and Physics</td>
<td>3</td>
</tr>
</tbody>
</table>

Breadth Requirement

Students take a 3 s.h. course taught in the Department of Chemical and Biochemical Engineering (prefix CBE) in an area outside their prior graduate degree training and research specialization area.

Electives

Students supplement the core curriculum with electives tailored to their interests.

Additional Requirements

All thesis students must take ENGR:7270 Engineering Ethics during their first semester and CBE:5000 Seminar in Chemical and Biochemical Engineering each semester in residence. Nonthesis students must take CBE:5100 Graduate Professional Development Seminar in each of their final two semesters in the program.

Students in the nonthesis program may petition for entry into the thesis program or the PhD program by requesting a change of status through the Graduate College. The request is reviewed by the Graduate Admissions Committee. If approved by the committee, the request is forwarded to the chemical and biochemical engineering faculty for final approval. Students then are assigned to research advisors as though they are newly admitted graduate students. For a detailed description of program requirements, see Graduate Program on the Department of Chemical and Biochemical Engineering website.

All students must pass a final examination.

Admission

Applicants must meet the admission requirements of the Graduate College; see the Manual of Rules and Regulations on the Graduate College website.

Applicants must provide the following.
• Completed application form.
• Unofficial transcript(s). If admitted, official transcripts are required before enrollment. For international students, all academic records should bear the original stamp or seal of the institution and the signature of a school official. Documents not in English must be accompanied by a complete, literal, English translation, certified by the issuing institution.
• Official Graduate Record Examination (GRE) General Test scores (verbal and quantitative) from Educational Testing Services (the university's institutional code is 6681).
• Statement of purpose.
• Three letters of recommendation.
• Test of English as a Foreign Language (TOEFL) or International English Language Testing System (IELTS) scores for applicants whose first language is not English.

Admission to the department is competitive and is based on an applicant's previous coursework, research, and/or industrial experience. The admissions committee looks for evidence that an applicant has demonstrated qualities such as creativity, self-initiative, dedication, and perseverance exhibited by successful master's degree students.

Applicants must have earned a four-year baccalaureate degree (BS or BSE) in chemical engineering or a related science or engineering discipline, such as chemistry, biochemistry, biological engineering, environmental science, atmospheric science, materials science, mathematics, and physics.

Applicants are expected to have a cumulative grade-point average (GPA) of at least 3.00 on a 4.00 scale in work for their undergraduate degree. Applicants through the Undergraduate to Graduate (U2G) BS/MS program must have a cumulative GPA of at least 3.25 on a 4.00 scale.

Financial Support

Full financial support is available to admitted MS thesis students in the form of teaching assistantships, research assistantships, and fellowships. The department provides up to two years of support for all full-time MS thesis students who are making normal progress toward the degree, exhibit satisfactory performance in all duties, and maintain appropriate professional conduct. Students admitted to the nonthesis MS or Undergraduate to Graduate (U2G) BS/MS program must have a cumulative GPA of at least 3.25 on a 4.00 scale.

Career Advancement

Chemical and biochemical engineers work in a wide range of industries, including petroleum and specialty chemical production, polymer and plastic production, food processing, energy, microelectronics production, pharmaceutical production, biochemical processing, and environmental compliance. Potential jobs include production, process development, plant design and construction, and fundamental research. The engineering profession also is a foundation for a variety of careers in medicine, law, government, and consulting. Many experienced chemical and biochemical engineers move through management ranks to high-level administrative positions. Faculty mentors assigned to graduate students aid in their professional development. Students are exposed to opportunities through seminars, speakers who have relevant expertise and are invited to campus.

Engineering Career Services develops and promotes experiential education and professional opportunities for students in the College of Engineering. Professional staff coordinate the college's co-op and internship program, engage in employer outreach, and provide opportunities for students to network with employers, including an engineering career fair each semester and other programming related to career development. Engineering Career Services also offers individual advising and class presentations on résumé and cover letter preparation, job and internship search strategies, interviewing skills, and job offer evaluation.

The Graduate College offers numerous career advancement opportunities and professional development programs for graduate students. For ongoing program offerings, news, and announcements, see Grad Success Center on the Graduate College website.

### Academic Plans

#### Sample Plan of Study

Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

**Chemical and Biochemical Engineering, MS**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBE:5120</td>
<td>Data Science in Chemical and Engineering Systems</td>
<td>3</td>
</tr>
<tr>
<td>ENGR:7270</td>
<td>Engineering Ethics</td>
<td>1</td>
</tr>
<tr>
<td>Kinetics course c</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Elective course d</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>Spring</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBE:5104</td>
<td>Introduction to Literature Review and Technical Writing</td>
<td>3</td>
</tr>
<tr>
<td>CBE:5110</td>
<td>Intermediate Thermodynamics e</td>
<td>3</td>
</tr>
<tr>
<td>or CBE:5115</td>
<td>or Transport Phenomena I</td>
<td></td>
</tr>
<tr>
<td>Breadth requirement course d</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>10</td>
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</table>

| **Second Year**|                                            |       |
| **Fall**       |                                            |       |
| CBE:5100       | Graduate Professional Development Seminar g  | 1     |
| Elective course d |                                      | 3     |
| Elective course d |                                      | 3     |
| Elective course d |                                      | 2     |
| **Total**      |                                            | 9     |
### Spring

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>CBE:5100</td>
<td>Graduate Professional Development Seminar</td>
<td>1</td>
</tr>
<tr>
<td>CBE:5115 or CBE:5110</td>
<td>Transport Phenomena I or Intermediate Thermodynamics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Final Exam**

<table>
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<tr>
<th>Hours</th>
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<tr>
<td>4</td>
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**Total Hours**: 32

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a. Students must complete specific requirements in the University of Iowa Graduate College after program admission. Refer to the Graduate College website and the Manual of Rules and Regulations for more information.
b. Must be completed during first semester.
c. Choose one course from CBE:3205 (offered every spring), CBE:5315 (offered fall of even years), or CBE:5425 (offered spring of even years).
d. Work with faculty advisor to determine appropriate graduate coursework and sequence.
e. CBE:5110 is typically offered spring of even years and CBE:5115 is typically offered spring of odd years.
f. Students take a 3 s.h. course taught in the Department of Chemical and Biochemical Engineering (prefix CBE) in an area outside their prior graduate degree training and research specialization area.
g. Students must take this course in each of their final two semesters in the program; credit earned does not count toward the 30 s.h. required to complete the degree.