Chemical and Biochemical Engineering, Ph.D.

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 Doctor of Philosophy 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, and to impact their communities through service learning. The department emphasizes research, since most opportunities for graduates are in research and development.

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

Requirements

The Doctor of Philosophy program in chemical and biochemical engineering requires a minimum of 72 s.h. of graduate credit. However, the degree is granted primarily on the basis of achievement rather than on the accumulation of semester hours. Students must maintain a cumulative g.p.a. of at least 3.25.

All students must complete a core curriculum, which consists of one course in transport phenomena, chemical thermodynamics, chemical reaction kinetics, technical communication, and data science plus five additional courses (total of 30 s.h.). Students entering with a degree other than chemical engineering may need to take additional coursework to attain proficiency in core areas of chemical engineering.

Core Courses

Students must complete the five core courses with a minimum g.p.a. of 3.50.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tr>
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<tr>
<td>CBE:5105</td>
<td>Introduction to Literature Review and Proposal Writing</td>
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<tr>
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<td>Intermediate Thermodynamics</td>
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</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 and Engineering Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

Kinetics

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 research area.

Additional Requirements

All students are required to take ENGR:7270 Engineering Ethics (1 s.h.) during their first semester and CBE:5000 Seminar in Chemical and Biochemical Engineering every semester in residence. Students earn the remainder of credit for the degree in elective courses and research.

In addition to a minimum grade-point average in the five core courses, students are required to pass a comprehensive examination before they can become candidates for degree. The comprehensive examination is the presentation and defense of the candidate's research proposal. These examinations are arranged by members of the examining committee and may be repeated at the committee's discretion. Comprehensive examination policies are published in the Manual of Rules and Regulations on the Graduate College website. A final examination, which is a defense of the thesis, completes the doctoral program.

For a detailed description of program requirements, see Graduate Program on the Department of Chemical and Biochemical Engineering website.

Combined Programs

Ph.D./M.D.

Students may work toward the Doctor of Medicine degree and a Ph.D. in chemical and biochemical engineering in
a combined degree program offered by the College of Engineering and the Carver College of Medicine. Applicants must be admitted to both programs before they may be admitted to the combined degree program. See the Medical Scientist Training Program (Carver College of Medicine) in the Catalog.

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 will be 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) or International English Language Testing System (IELTS).
- Statement of purpose.
- Three letters of recommendation.
- Test of English as a Foreign Language (TOEFL) 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 Ph.D. or master's degree students.

Applicants must have earned a four-year baccalaureate degree (B.S. or B.S.E.) 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. An M.S. degree is not a prerequisite for admission to the Ph.D. program. Applicants to the Ph.D. program are expected to have a cumulative g.p.a. of at least 3.00 on a 4.00 scale in work for their undergraduate degree.

Financial Support

Full financial support is available to admitted Ph.D. students in the form of teaching assistantships, research assistantships, and fellowships. The department provides up to five years of support for all full-time Ph.D. students that are making satisfactory progress toward the degree and maintain appropriate professional conduct.

Career Advancement

The Ph.D. program is designed to equip students with the skills to pursue a career in industry, academia, or government. Faculty and alumni mentors assigned to graduate students aid in their professional development. Students are exposed to opportunities through seminar speakers who have relevant expertise and are invited to campus.

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, Ph.D.**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
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<tr>
<td><strong>First Year</strong></td>
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<td><strong>Fall</strong></td>
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<td>Data Science in Chemical and Engineering Systems</td>
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<td>ENGR:7270</td>
<td>Engineering Ethics</td>
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<td>Elective course</td>
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<td>Transport Phenomena I or Intermediate Thermodynamics</td>
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<tr>
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<td>Breadth Requirement course</td>
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<tr>
<td><strong>Hours</strong></td>
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*Notes: a, b, c, d, e, f, g, h, i refer to course details in the course catalog.*
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**Third Year**

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| Comprehensive Exam | 0 |

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<table>
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<th>Spring</th>
<th>Hours</th>
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<th>Fourth Year</th>
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<table>
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<th>Spring</th>
<th>Hours</th>
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<table>
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<th>Hours</th>
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<td>Seminar in Chemical and Biochemical Engineering</td>
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<tr>
<td>Final Exam</td>
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**Total Hours** | 72

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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 Students must take this course each semester in residence.
c Must be completed during first semester.
d Choose one course from CBE:3205 (offered every spring), CBE:5315 (offered fall of even years), or CBE:5425 (offered spring of even years).
e Work with faculty advisor to determine appropriate graduate coursework and sequence.
f CBE:5110 is typically offered spring of even years and CBE:5115 is typically offered spring of odd years.
g 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.
h Complete within three years of entering program.
i Dissertation defense.