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 without thesis requires a minimum of 33 s.h. The Master of Science program in chemical and biochemical engineering with a thesis requires a minimum of 30 s.h. in approved graduate courses. 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 UI cumulative grade-point average (GPA) of at least 3.00.

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 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.

Course #	Title	Hours
One of these:		
CBE:5104	Introduction to Literature Review and Technical Writing (non-thesis)	3
CBE:5105	Introduction to Literature Review and Proposal Writing (thesis)	3
All of these:		
CBE:5110	Intermediate Thermodynamics	3
CBE:5115	Transport Phenomena I	3
CBE:5120	Data Science in Chemical and Engineering Systems	3
One of these:		
CBE:3205	Introduction to Biochemical Engineering	3
CBE:5315	Polymer Chemistry	3
CBE:5425	Atmospheric Chemistry and Physics	3

Professional Development Experience

Professional growth extends beyond the curriculum and the research laboratory. Graduate professionals must be able to identify and lead educational and research enterprises that advance the scope and impact of the discipline. Important skills include building professional networks, developing a comprehensive outlook for identifying emerging directions in the field, the ability to explain scientific and engineering principles to a variety of audiences, and more. Some examples of professional development experiences include an industrial internship, a second teaching assistant experience, teacher training, organizing a session at a national conference, and organizing a local conference. A student's professional development experience must be developed in consultation with their research mentor and approved by the director of graduate studies. The professional development experience is required for MS thesis students.

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. MS thesis students are required to present at CBE:5000. MS thesis students are also required to serve as a teaching assistant at least once during the duration of their graduate studies. 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.
- Optional: 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.

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 (Bachelor of Science or Bachelor of Science in Engineering) in chemical engineering or a related science or engineering discipline, such as chemistry, biochemistry, biological engineering, environmental science, atmospheric science, materials science, mathematics, or 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.

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, environmental monitoring and compliance, applied climate research, and big data analytics. Potential jobs include production, process development, plant design and construction, fundamental research, strategic planning, and policy-making. The engineering profession is also a foundation for a variety of careers in medicine, law, government, consulting, and business management. 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 seminar 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.

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Course	Title	Hours
Academic Career		
Any Semester		
33 s.h. must be graduate level coursework; graduate transfer credits allowed upon approval. More information is included in the General Catalog and on department website. [a]		
	Hours	**0**
First Year		
Fall		
CBE:5104	Introduction to Literature Review and Technical Writing	3
CBE:5120	Data Science in Chemical and Engineering Systems	3
ENGR:7270	Engineering Ethics [b]	1
Elective course [c]		3
	Hours	**10**
Spring		
CBE:3205 or CBE:5425 or CBE:5315	Introduction to Biochemical Engineering [d] or Atmospheric Chemistry and Physics or Polymer Chemistry	3
CBE:5110	Intermediate Thermodynamics	3
Elective course [c]		3
	Hours	**9**
Second Year		
Fall		
CBE:5100	Graduate Professional Development Seminar [e]	1
Elective course [c]		3

Elective course [c]		3
Elective course [c]		2
	Hours	**9**
Spring		
CBE:5100	Graduate Professional Development Seminar [e]	1
CBE:5115	Transport Phenomena I	3
Elective course [c]		3
Exam: Master's Final Exam		
	Hours	**7**
	Total Hours	**35**

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 Work with faculty advisor to determine appropriate graduate coursework and sequence.
d CBE:5315 is typically offered only during fall semesters .
e Students must take this course in each of their final two semesters in the program; credit earned does not count toward the 33 s.h. required to complete the degree.