

CHEMICAL ENGINEERING + DATA SCIENCE, BS

for the degree of Bachelor of Science Major in Chemical Engineering plus Data Science

This major is sponsored jointly by the Departments of Statistics, Computer Science, Mathematics, and Chemical and Biomolecular Engineering, and the iSchool. The Chemical Engineering+Data Science major is designed for students wanting a strong foundation in Data Science with a deep B.S. level specialization in Chemical and Biomolecular Engineering. The major prepares students for professional or graduate work in Chemical and Biomolecular Engineering with additional mastery of statistics, data analysis, data modeling, machine learning, and other data science topics.

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Graduation Requirements

Minimum hours required for graduation: 132 hours.

A grade point average of 2.5 or higher in all courses required for the major earned on the UIUC campus is required in order to be accepted by the department as juniors and seniors.

University Requirements

Minimum of 40 hours of upper-division coursework, generally at the 300- or 400-level. These hours can be drawn from all elements of the degree. Students should consult their academic advisor for additional guidance in fulfilling this requirement.

The University and residency requirements can be found in the Student Code (<https://studentcode.illinois.edu/article3/part8/3-801/>) (§ 3-801) and in the Academic Catalog (<http://catalog.illinois.edu/general-information/degree-general-education-requirements/>).

General Education Requirements

Follows the campus General Education (Gen Ed) requirements (<https://courses.illinois.edu/gened/DEFAULT/DEFAULT/>). Some Gen Ed requirements may be met by courses required and/or electives in the program.

Code	Title	Hours
	Composition I	4-6
	Advanced Composition	3
	fulfilled by CHBE 431	
	Humanities & the Arts (6 hours)	6
	Natural Sciences & Technology (6 hours)	6
	fulfilled by CHEM 202 & CHEM 204 or CHEM 102 & CHEM 104; PHYS 211, PHYS 212	
	Social & Behavioral Sciences (6 hours)	6
	Cultural Studies: Non-Western Cultures (1 course)	3
	Cultural Studies: US Minority Cultures (1 course)	3
	Cultural Studies: Western/Comparative Cultures (1 course)	3

Quantitative Reasoning (2 courses, at least one course must be Quantitative Reasoning I) 6-10

fulfilled by CS 101, MATH 221 or MATH 220, MATH 231, MATH 241, PHYS 211, PHYS 212, STAT 207

Language Requirement (Completion of the third semester or equivalent of a language other than English is required) 0-15

Data Science Core

Mathematical Foundations

Code	Title	Hours
MATH 221	Calculus I	4
	or MATH 220	Calculus
MATH 231	Calculus II	3
MATH 241	Calculus III	4
MATH 257	Linear Algebra with Computational Applications	3
MATH 285	Intro Differential Equations	3
	or MATH 441	Differential Equations

Total Hours 17

Data Science Fundamentals

Code	Title	Hours
CHBE 411	Probability and Statistics for ChBE	3
STAT 207	Data Science Exploration	4
CS 307	Modeling and Learning in Data Science	4
	or CHBE 413	Data Science for Chemistry and Engineering
IS 477	Data Management, Curation & Reproducibility	3

Total Hours 14

Computational Fundamentals

Code	Title	Hours
CS 101	Intro Computing: Engrg & Sci	3
CS 277	Algorithms and Data Structures for Data Science	4
CHBE 412	Computational Tools in Chemical Engineering	3

Total Hours 10

Social Impact in Data Science

Code	Title	Hours
IS 467	Ethics and Policy for Data Science	3

Total Hours 3

Coursework in Area of Specialization

Chemical Engineering

Code	Title	Hours
ENG 100	Grainger Engineering Orientation Seminar	1
CHBE 121	CHBE Profession	1

For students entering the curriculum after the freshman year, 1 additional hour of credit may be substituted in consultation with an academic advisor.

CHBE 221	Principles of CHE	3
CHBE 321	Thermodynamics	4
CHBE 421	Momentum and Heat Transfer	4
CHBE 422	Mass Transfer Operations	4
CHBE 424	Chemical Reaction Engineering	3
CHBE 430	Unit Operations Laboratory	4
CHBE 431	Process Design	4
CHBE 440	Process Control and Dynamics	3
Total Hours		31

Chemistry Fundamentals

Code	Title	Hours
Select one group of courses (Accelerated or General Chemistry)		10-12
CHEM 202 & CHEM 203 & CHEM 204 & CHEM 205	Accelerated Chemistry I and Accelerated Chemistry Lab I and Accelerated Chemistry II and Accelerated Chemistry Lab II	
OR		
CHEM 102 & CHEM 103 & CHEM 104 & CHEM 105 & CHEM 222 & CHEM 223	General Chemistry I and General Chemistry Lab I and General Chemistry II and General Chemistry Lab II and Quantitative Analysis Lecture and Quantitative Analysis Lab	
CHEM 236	Fundamental Organic Chem I	4
CHEM 237	Structure and Synthesis	2
CHEM 315	Instrumental Chem Systems Lab	2
Students must register in one of the Chemical Engineering-specific CHEM 315 lab sections.		
CHEM 420	Instrumental Characterization	2
CHEM 442	Physical Chemistry I	4
Total Hours		24-26

Physics Fundamentals

Code	Title	Hours
PHYS 211	University Physics: Mechanics	4
PHYS 212	University Physics: Elec & Mag	4
PHYS 214	Univ Physics: Quantum Physics	2
Total Hours		10

Data Science Experience

Code	Title	Hours
CHBE 415	Chemical Engineering Data Science Experience	3
Total Hours		3

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Student learning outcomes are based on learning outcomes in line with the Accreditation Board of Engineering (ABET) accreditation process.

Upon completing the program, Chemical Engineering + Data Science students are expected to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. 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. Communicate effectively with a range of audiences.
4. 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. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

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This sample sequence is intended to be used only as a guide for degree completion. All students should work individually with their academic advisors to decide the actual course selection and sequence that works best for them based on their academic preparation and goals. Enrichment programming such as study abroad, minors, internships, and so on may impact the structure of this four-year plan. Course availability is not guaranteed during the semester indicated in the sample sequence.

Students must fulfill their Language Other Than English requirement by successfully completing a third level of a language other than English. For more information, see the corresponding section on the Degree and General Education Requirements page (<http://catalog.illinois.edu/general-information/degree-general-education-requirements/>).

The sample sequence below assumes that the student has placed into the Accelerated Chemistry courses.

First Year			
First Semester	Hours	Second Semester	Hours
ENG 100		1 CHBE 121	1
CHEM 202		3 CHEM 204	3
CHEM 203		2 CHEM 205	2
MATH 221 or 220		4 MATH 231	3
General Education course (choose a Humanities course with Cultural Studies designation)		3 PHYS 211	4

General Education course (choose a Social & Behavioral Science course) or Composition I	3	Composition I or General Education course (choose a Social & Behavioral Science course)	4
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Chemical & Biomolecular Engineering faculty (<https://chbe.illinois.edu/directory/>)

SCS Academic Advising (<https://scs.illinois.edu/academics/advising/>)

Overview of College Admissions & Requirements: Liberal Arts & Sciences (<http://catalog.illinois.edu/schools/las/>)

College of Liberal Arts and Sciences website (<https://las.illinois.edu/>)

Second Year

First Semester	Hours	Second Semester	Hours
CHBE 221		3 CHBE 321	4
MATH 241		4 CHBE 411	3
PHYS 212		4 CS 101	3
CHEM 236		4 MATH 257	3
CHEM 237		2 PHYS 214	2
		General Education course (choose a Humanities course with Cultural Studies designation)	3

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Third Year

First Semester	Hours	Second Semester	Hours
CHBE 421		4 CHBE 422	4
STAT 207		4 CHBE 412	3
MATH 285 or 441		3 CHBE 413 or CS 307	4
CHEM 442		4 CHEM 315	2
CHEM 420		2 CS 277	4

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Fourth Year

First Semester	Hours	Second Semester	Hours
CHBE 424		3 CHBE 431	4
CHBE 430		4 CHBE 440	3
IS 467		3 CHBE 415	3
Language Other Than English (3rd level)		4 IS 477	3
General Education course (choose a Social & Behavioral Science Course with Cultural Studies designation)	3		

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Total Hours 132

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Chemical & Biomolecular Engineering website (<https://chbe.illinois.edu/>)