

CHEMICAL ENGINEERING, B.S.

REQUIREMENTS

UNIVERSITY GENERAL EDUCATION REQUIREMENTS

All undergraduate students at the University of Wisconsin–Madison are required to fulfill a minimum set of common university general education requirements to ensure that every graduate acquires the essential core of an undergraduate education. This core establishes a foundation for living a productive life, being a citizen of the world, appreciating aesthetic values, and engaging in lifelong learning in a continually changing world. Various schools and colleges will have requirements in addition to the requirements listed below. Consult your advisor for assistance, as needed. For additional information, see the university Undergraduate General Education Requirements (<http://guide.wisc.edu/undergraduate/#requirementsforundergraduatestudytext>) section of the *Guide*.

General Education	• Breadth—Humanities/Literature/Arts: 6 credits
	• Breadth—Natural Science: 4 to 6 credits, consisting of one 4- or 5-credit course with a laboratory component; or two courses providing a total of 6 credits
	• Breadth—Social Studies: 3 credits
	• Communication Part A & Part B *
	• Ethnic Studies *
	• Quantitative Reasoning Part A & Part B *

* The mortarboard symbol appears before the title of any course that fulfills one of the Communication Part A or Part B, Ethnic Studies, or Quantitative Reasoning Part A or Part B requirements.

SUMMARY OF REQUIREMENTS

The following curriculum applies to students admitted to the chemical engineering degree program.

Code	Title	Credits
Mathematics		19
Physics		10
Chemistry		20
Life Science		6
Core Engineering Requirement		49
Professional Breadth		6
Communication Skills		6
Liberal Studies Requirement		16
Total Credits		132

MATHEMATICS REQUIREMENT

The calculus requirement must be met with a minimum of 12 credits to cover the three-course basic math sequence. Any deficiency in total math credits must be made up with electives in science or engineering.

Code	Title	Credits
MATH 221 or MATH 217 or MATH 275	Calculus and Analytic Geometry I Calculus with Algebra and Trigonometry II Topics in Calculus I	5
MATH 222 or MATH 276	Calculus and Analytic Geometry 2 Topics in Calculus II	4
MATH 234	Calculus--Functions of Several Variables	4
MATH 320 or MATH 319	Linear Algebra and Differential Equations Techniques in Ordinary Differential Equations	3
STAT 324	Introductory Applied Statistics for Engineers	3
Total Credits		19

PHYSICS REQUIREMENT

Credit shortages caused by transfer physics courses at fewer than 6 credits for the required courses must be made up with another physics course.

Code	Title	Credits
PHYSICS 201 or PHYSICS 207	General Physics General Physics	5
PHYSICS 202 or PHYSICS 208	General Physics General Physics	5
Total Credits		10

CHEMISTRY REQUIREMENT

Credit shortages cause by transfer of freshman chemistry courses at fewer than 9 credits must be made up with chemistry, biochemistry, or chemical engineering courses.

Code	Title	Credits
<i>General Chemistry (choose one)</i>		5
CHEM 109	Advanced General Chemistry (preferred)	
CHEM 103 & CHEM 104	General Chemistry I and General Chemistry II	
CHEM 329	Fundamentals of Analytical Science	4
CHEM 343 & CHEM 345 & CHEM 344	Organic Chemistry I and Organic Chemistry II and Introductory Organic Chemistry Laboratory	8
CHEM 562	Physical Chemistry	3
Total Credits		20

LIFE SCIENCE

Students who meet the Introductory Biology requirement with an AP exam are encouraged to take two advanced biology electives.¹

Code	Title	Credits
<i>Introductory Biology requirement (choose one)</i>		3
PL PATH 375	Special Topics (Topic: Intro Biology for Engineers)	
ZOOLOGY 153	Introductory Biology	

ZOOLOGY/ BIOLOGY/ BOTANY 151	Introductory Biology	
<i>Advanced Biology requirement (choose one)</i>		3
BIOCHEM 501	Introduction to Biochemistry	
BIOCHEM 507	General Biochemistry I	
ZOOLOGY 570	Cell Biology	
GENETICS 466	Principles of Genetics	
MICROBIO 303	Biology of Microorganisms	
Total Credits		6

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BIOCORE 381 Evolution, Ecology, and Genetics and BIOCORE 383 Cellular Biology may be used to satisfy the Life Sciences Requirements.

CORE ENGINEERING REQUIREMENT

Code	Title	Credits
CBE 150	Introduction to Chemical Engineering	1
CBE 250	Process Synthesis (with a grade of C or better)	3
CBE 255	Introduction to Chemical Process Modeling	3
CBE 310	Chemical Process Thermodynamics (with a grade of C or better)	3
CBE 311	Thermodynamics of Mixtures (with a grade of C or better)	3
CBE 320	Introductory Transport Phenomena (with a grade of C or better)	4
CBE 324	Transport Phenomena Lab	3
CBE 326	Momentum and Heat Transfer Operations	3
CBE 424	Operations and Process Laboratory	5
CBE 426	Mass Transfer Operations	3
CBE 430	Chemical Kinetics and Reactor Design	3
<i>Select one of the following:</i>		3
CBE 440	Chemical Engineering Materials	
CBE 540	Polymer Science and Technology	
CBE 547	Introduction to Colloid and Interface Science	
CBE 450	Process Design	3
CBE 470	Process Dynamics and Control	3
CBE Electives ²		6
Total Credits		49

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Chemical Engineering electives may be chosen from any of the CBE courses that are not required, numbered 300 or above (excluding seminar courses). A maximum of two credits of co-op work (CBE 1 Cooperative Education Program) may be used to meet the CBE elective requirement. Qualified undergraduates may take graduate-level (600 or 700) courses to fulfill this requirement.

PROFESSIONAL BREADTH

Select 6 credits

Code	Title	Credits
Professional Breadth Credits ³		6
<i>Courses 300+ from the following College of Engineering departments and programs may be used:</i>		
	Biomedical Engineering	
	Civil and Environmental Engineering	
	Electrical and Computer Engineering	
	Engineering Mechanics and Astronautics	
	Engineering Professional Development	
	Geological Engineering	
	Industrial Engineering	
	Interdisciplinary Courses (Engineering)	
	Materials Science and Engineering ⁴	
	Mechanical Engineering	
	Nuclear Engineering	
	Engineering Physics	
<i>Courses 300+ from the following departments in the College of Letters and Sciences may be used:</i>		
	Chemistry	
	Computer Sciences	
	Math	
	Physics	
<i>The following courses may also be used:</i>		
ACCT I S 300	Accounting Principles	
BIOCHEM 501	Introduction to Biochemistry	
BIOCHEM 507	General Biochemistry I	
BIOCORE 381	Evolution, Ecology, and Genetics	
BIOCORE 383	Cellular Biology	
BSE 364	Engineering Properties of Food and Biological Materials	
BSE/ ENVIR ST 367	Renewable Energy Systems	
ECON/A A E/ ENVIR ST 343	Environmental Economics	
ENVIR ST/ GEOSCI 411	Energy Resources	
ENVIR ST/ PHILOS 441	Environmental Ethics	
FINANCE/ ECON 300	Introduction to Finance	
FOOD SCI 550	Fermented Foods and Beverages	
GEN BUS 310	Fundamentals of Accounting and Finance for Non-Business Majors	
GEN BUS 311	Fundamentals of Management and Marketing for Non-Business Majors	
GENETICS 466	Principles of Genetics	
M H R 300	Managing Organizations	
MICROBIO 303	Biology of Microorganisms	
STAT/M E 424	Statistical Experimental Design	
ZOOLOGY 570	Cell Biology	
Total Credits		6

Students may petition the department to allow other courses related to engineering professional practice. To request that a course not listed

above be used, the student should fill out the Professional Breadth Requirement Course Request form available online and submit it to the advisor. The department will then determine if the course can be counted toward the Professional Breadth Requirement. Petitions must be submitted before the beginning of the semester in which the course is to be taken.

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The objective of this requirement is to provide students with skills to interact with professionals from other disciplines. Suitable courses for this requirement include courses in engineering (excluding CBE) and science, as well as a variety of other disciplines.

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Full degree credit is not allowed if a student takes both CBE 440 Chemical Engineering Materials and M S & E 350 Introduction to Materials Science. In this case M S & E 350 Introduction to Materials Science will be awarded only 1 degree credit.

COMMUNICATION SKILLS

Code	Title	Credits
ENGL 100	Introduction to College Composition 5	3
or COM ARTS 100	Introduction to Speech Composition	
or LSC 100	Science and Storytelling	
or ESL 118	Academic Writing II	
INTEREGR 397	Engineering Communication	3

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For Part A of the General Education Communication Requirement (3 cr) students must select one course with an "a" designation in "g" of the "geBLC" information in the Course Guide. Some students will be exempt from this requirement based on their placement test scores or advanced placement in English.

CBE 424 Operations and Process Laboratory satisfies Part B of the General Education Communication Skills Requirement.

LIBERAL STUDIES ELECTIVES

Students must complete 16 credits of liberal studies according to the College of Engineering requirements.

1. Liberal studies elective courses must be classified as either Humanities, Social Studies, or Literature courses (identified by the letters H, S, L, or Z in "B" of the "geBLC" information in the Guide). At least six credits must have a breadth designation of Humanities (H, L, or Z), and at least three credits must have a designation of Social Studies (S or Z). Foreign language courses count as H credits.
2. A three-credit ethnic studies course must be selected from the College of Letters & Science. Acceptable courses are identified by the letter "e" in Guide. If appropriate, the ethnic studies course may be among those used to satisfy the concentration requirement.
3. A minimum of two liberal studies courses must be taken from the same subject area (<https://registrar.wisc.edu/subjectareas/>) (the description before the course number). At least one of these two courses must be at an intermediate or advanced level (designated in Guide).
4. Retroactive credits may be awarded for foreign-language work done in high school. The following conditions apply:
 - a. A university-level foreign language course must be taken before the student has earned 30 college credits in residence.

- b. Retroactive Language Credit Request Form must be completed and submitted to the language instructor during the first two weeks of class
 - c. The student must earn a B or better in this course.
 - d. Such credits do not count toward the 16 liberal-studies credits required. They may, however, be used to satisfy the concentration and depth requirements as stated in number three above and count as degree credits.
5. English composition courses, English as a Second Language courses, and basic communications arts courses are not accepted as liberal studies electives.

FREE ELECTIVES

Students fulfilling their course requirements with fewer than 132 credits must take additional free-elective credits to comply with the 132-credit minimum graduation requirement.

COURSE SUBSTITUTION REGULATIONS

1. Any student may, with advisor approval, replace up to 12 credits of required courses in the curriculum, except CBE 424 Operations and Process Laboratory, by an equal number of credits of other courses within the limitations listed under (3) below.
2. Any student who wishes to amend the curriculum by more than 12 credits or wishes to appeal the advisor's decision in (1) or to request exception to (3) below must submit a written request to the chair of the department, who will bring it to the department faculty for consideration.
3. Restrictions on course substitutions are as follows:
 - a. Physics courses may be replaced by science or engineering courses.
 - b. Chemistry/life science courses must be replaced by courses with significant chemistry/life science content.
 - c. Engineering courses must be replaced by engineering courses.
 - d. Lab courses must be replaced by courses with an equal number of hours of lab courses.
 - e. English as a Second Language courses, and MATH 112 Algebra, MATH 113 Trigonometry, and MATH 114 Algebra and Trigonometry may not be used for course substitutions.

HONORS IN UNDERGRADUATE RESEARCH PROGRAM

The Honors in Research program in Chemical Engineering is designed for students who wish to have a more in-depth research experience and is particularly recommended for students considering enrollment in a PhD program. To be accepted into the Honors in Research program, students must have completed at least two semesters on the UW-Madison campus with a cumulative GPA of at least 3.5 and should find a faculty mentor. Students register for 1-3 credits of CBE 489 Honors in Research and are expected to complete at least 8 credits of CBE 489 over 2-3 semesters. Students must also write a senior thesis and present the work to a committee of faculty. Students meeting all requirements, and maintaining a cumulative GPA of at least 3.3, will receive the Honors in Research designation upon graduation.

UNIVERSITY DEGREE REQUIREMENTS

Total Degree	To receive a bachelor's degree from UW–Madison, students must earn a minimum of 120 degree credits. The requirements for some programs may exceed 120 degree credits. Students should consult with their college or department advisor for information on specific credit requirements.
Residency	Degree candidates are required to earn a minimum of 30 credits in residence at UW–Madison. "In residence" means on the UW–Madison campus with an undergraduate degree classification. "In residence" credit also includes UW–Madison courses offered in distance or online formats and credits earned in UW–Madison Study Abroad/Study Away programs.
Quality of Work	Undergraduate students must maintain the minimum grade point average specified by the school, college, or academic program to remain in good academic standing. Students whose academic performance drops below these minimum thresholds will be placed on academic probation.