

Chemical Engineering

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1. University Requirements: (23)

Writing, Rhetoric and American Cultures (WRA)	4
Integrative Studies in Humanities (IAH)	8
Integrative Studies in Social Sciences (ISS)	8
Bioscience: BS 161 Cell and Molecular Biology	3

2. College Requirements: (30)

CEM 151 General and Descriptive Chemistry	4
EGR 100 Introduction to Engineering Design	2
EGR 102 Introduction to Engineering Modeling	2
MTH 132 Calculus I	3
MTH 133 Calculus II	4
MTH 234 Multivariable Calculus	4
MTH 235 Differential Equations	3
PHY 183 Physics for Scientists & Engineers I	4
PHY 184 Physics for Scientists & Engineers II	4

3. Major Requirements: (67-69)

A. Complete all of the following courses: (51)

CEM 152 Principles of Chemistry	3
CEM 161 Chemistry Laboratory I	1
CEM 162 Chemistry Laboratory II	1
CEM 351 Organic Chemistry I	3
CEM 352 Organic Chemistry II	3
CEM 355 Organic Laboratory I	2
CHE 201 Material and Energy Balances	3
CHE 210 Modeling and Analysis of Transport Phenomena	3
CHE 301 Chemical Engineering as a Profession	1
CHE 311 Fluid Flow and Heat Transfer	3
CHE 312 Mass Transfer and Separations	4
CHE 316 Lab Practice and Statistical Analysis (W)	4
CHE 321 Thermodynamics for Chemical Engineering	4
CHE 431 Chemical Reaction Engineering	4
CHE 432 Process Analysis and Control	3
CHE 433 Process Design and Optimization I (W)	4
CHE 434 Process Design and Optimization II	2
CHE 473 Chemical Engr Princ in Polymers & Mats Sys	3

B. One of the following groups: (4-6)

Group 1

BMB 401 Basic Biochemistry	4
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Group 2

BMB 461 Biochemistry I	3
BMB 462 Biochemistry II	3

C. Select one of the following courses: (3)

CHE 472 Composite Materials Processing	3
CHE 481 Biochemical Engineering	3

D. Select one of the following courses: (3)

CEM 483 Quantum Chemistry	3
CEM 484 Molecular Thermodynamics	3

E. Technical Electives: (6)

Students must complete at least 6 credits of technically oriented subject-related courses approved by the student's advisor. Acceptable subjects include, but are not limited to, composites processing or biochemical engineering (in addition to that required in 3. c. above), electronic materials, environment, advanced mathematics, transport phenomena, advanced chemistry, foods, legal and regulatory issues, advanced materials, advanced biology, statistics, biomedical engineering, bioenergy, and polymers.

Note: Elective courses in item 3. e. must include at least 3 credits of engineering topics, which includes courses taught in the College of Engineering as well as courses taught in advanced mathematics, advanced chemistry, advanced biology, advanced statistics, and advanced physics. If Biochemistry and Molecular Biology 462 is taken to fulfill requirement 3.b. it will count as technical elective credit in item 3.e.

Concentrations in Chemical Engineering

In response to increasing interest in the application of chemical engineering principles to related fields, the Department of Chemical Engineering and Materials Science offers concentrations in biochemical engineering, bioenergy, biomedical engineering, environmental engineering, food science, and polymer science and engineering to students wishing an area of concentration in the degree. Concentrations are available to, but not required of, any student enrolled in the Bachelor of Science degree program in chemical engineering. The concentration will be noted on the student's transcript.

NOTE: Completing the Bachelor of Science degree in chemical engineering with a concentration may require more than 128 credits.

Biochemical Engineering Concentration: (11-15)

To earn a Bachelor of Science degree in Chemical Engineering with a biochemical engineering concentration, students must complete requirements 1., 2., 3.a., 3.b., and 3.e. above and the following:

All of the following courses: (6)

CHE 481 Biochemical Engineering	3
MMG 301 Introductory Microbiology	3

Two or three of the following courses. Students who chose BMB 401 in 3.B. must complete three courses. Students who chose BMB 461 and 462 must complete two courses: (5-9)

BMB 829 Methods of Macromolecular Analysis & Synthesis	2
CHE 882 Advanced Biochemical Engineering	3
CHE 883 Multidisciplinary Bioprocessing Laboratory	3
MMG 409 Eukaryotic Cell Biology	3
MMG 421 Prokaryotic Cell Physiology	3
MMG 431 Microbial Genetics	3
MMG 445 Microbial Biotechnology (W)	3

Bioenergy Concentration: (15-16)

To earn a Bachelor of Science degree in Chemical Engineering with a bioenergy engineering concentration, students must complete requirements 1., 2., 3.a., 3.b., 3.d., and 3.e. above and the following:

All of the following courses: (12)

BE 469	Sustainable Bioenergy Systems	3
CHE 468	Biomass Conversion in Engineering	3
CHE 481	Biochemical Engineering	3
CSS 467	Bioenergy Feedstock Production	3

One of the following courses (3-4 credits):

AEC 829	The Economics of Environ Resources	3
CHE 882	Advanced Biochemical Engineering	3
CHE 883	Multidisciplinary Bioprocessing Laboratory	3
GLG 471	Applied Geophysics	4
MC 450	International Environmental Law and Policy	3
MMG 445	Microbial Biotechnology (W)	3

Biomedical Engineering Concentration: (15-16)

To earn a Bachelor of Science degree in Chemical Engineering with a biomedical engineering concentration, students must complete requirements 1., 2., 3.a., 3.b., 3.d., and 3.e. above and the following:

All of the following courses: (9)

CHE 481	Biochemical Engineering	3
MMG 409	Eukaryotic Cell Biology	3
PSL 431	Human Physiology I	3

Two of the following courses: (6-7)

BMB 471	Biochemistry Laboratory (W)	3
CHE 883	Multidisciplinary Bioprocessing Laboratory	3
ME 494	Biofluid Mechanics and Heat Transfer	3
ZOL 341	Fundamental Genetics	4

Environmental Concentration: (15)

To earn a Bachelor of Science degree in Chemical Engineering with an environmental concentration, the student must complete requirements 1., 2., and 3. a., 3.b., 3.d., and 3.e. above and the following:

All of the following courses: (6)

CHE 481	Biochemical Engineering	3
ENE 280	Principles of Environmental Engr and Science	3

Three of the following courses: (9)

EEP 255	Ecological Economics	3
EEP 320	Environmental Economics	3
EEP 405	Corporate Environmental Management	3
ENE 481	Environ Chemistry: Equilibrium Concepts	3
ENE 483	Water and Wastewater Engineering	3
ENE 485	Landfill Design	3
ESA 200	Intro to Environmental Studies & Agriscience	3
ESA 430	Environmental and Natural Resource Law	3
ZOL 446	Environmental Issues and Public Policy	3

Food Science Concentration: (12-13)

To earn a Bachelor of Science degree in Chemical Engineering with a food science concentration, students must complete requirements 1., 2., 3. a., 3. b., 3.c., 3.d., and 3.e. above and all of the following:

All of the following courses: (9)

FSC 401	Food Chemistry	3
FSC 440	Food Microbiology	3
MMG 301	Introductory Microbiology	3

One of the following courses: (3-4)

BE 477	Food Engineering: Fluids	3
BE 478	Food Engineering: Solids	3
FSC 325	Food Processing: Unit Operations	4
FSC 455	Food and Nutrition Laboratory	3
FSC 470	Integrated Approaches to Food Product Dev	3

Polymer Science and Engineering Concentration: (16-17)

To earn a Bachelor of Science degree in Chemical Engineering with a polymer science and engineering concentration, students must complete requirements 1., 2., 3. a., 3. b., 3.d., and 3.e. above and all of the following:

All of the following courses: (10)

CE 221	Statics	3
CHE 472	Composite Materials Processing	3
ME 222	Mechanics of Deformable Solids	4

Two of the following courses: (6-7)

CHE 871	Materials Surfaces and Interfaces	3
CHE 872	Polymers & Cmposites: Mfg, Strc & Prfrmnce	3
MSE 370	Physical Processing of Materials	3
MSE 426	Introduction to Composite Materials	3
PKG 323	Packaging with Plastics	4

Other Electives (Variable)**Total Credits Required for Degree****128**

These requirements are effective for students admitted to the Chemical Engineering major beginning Fall 2011. The Department of Chemical Engineering and Materials Science constantly reviews program requirements and reserves the right to make changes as necessary. Consequently, each student is strongly encouraged to consult with his/her adviser to obtain assistance in planning an appropriate schedule of courses. Students who have questions about Chemical Engineering should contact the Chemical Engineering and Materials Science Department Advising Office, 1415 Engineering Building, phone (517) 355-6616 extension 1. For scheduling academic advising appointments visit: <https://www.egr.msu.edu/adcalendar/>

Some courses may have prerequisites, which are not otherwise required in the program. Students should check course descriptions to ensure they are aware of prerequisites.

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Sample Program

Freshman Year				Sophomore Year			
Fall	Credits	Spring	Credits	Fall	Credits	Spring	Credits
CEM 151	4	CEM 152	3	CEM 351	3	CEM 352	3
CEM 161	1	CEM 162	1	CHE 201	3	CEM 355	2
EGR 100	2	EGR 102	2	BS 161	3	CHE 210	3
ISS 2XX	4	MTH 133	4	MTH 234	4	MTH 235	3
MTH 132	3	WRA 1XX	4	PHY 183	4	PHY 184	4
Total	14	Total	14	Total	17	Total	15

Junior Year				Senior Year			
Fall	Credits	Spring	Credits	Fall	Credits	Spring	Credits
CEM 483/484	3	BMB 401	4	CHE 432	3	CHE 434	2
CHE 301	1	CHE 312	4	CHE 433	4	CHE 473	3
CHE 311	3	CHE 316	4	CHE 472/481	3	Elective	3
CHE 431	4	CHE 321	4	Elective	3	IAH 211 or higher	4
IAH 201-210	4			ISS 3XX	4	Technical Elective	3
Elective	2					Technical Elective	3
Total	17	Total	16	Total	17	Total	18

CHE Program Educational Objectives

The undergraduate program in chemical engineering builds a strong foundation for the professional development of its students and prepares them to meet the technological challenges of the future. With a bachelor's degree, the graduates are well equipped for a wide variety of positions as practicing chemical engineers or for graduate studies in competitive engineering and scientific disciplines.

The intensive program promotes continued learning and professional development by providing the proper knowledge and stimulation in an ideal setting for personal growth. The program emphasizes its historic, nationally recognized strength in chemical process design, yet draws on the scholarly accomplishments of its faculty to integrate traditional chemical engineering topics with specialized studies in the contemporary fields of materials, bioprocessing, environmental engineering, biomedical engineering, and food engineering.

The faculty of the Chemical Engineering Program is committed to sharing the responsibility of learning with the students, providing a rigorous academic environment that encourages active learning, high quality student performance, and ethical and professional conduct. Through the integration of the knowledge and skills acquired in a demanding set of courses, extracurricular experiences, and faculty expertise and scholarship, the Chemical Engineering Program has established the following objectives.

The Chemical Engineering Program will prepare its graduates

- to be successful in the practice of chemical engineering or in advanced studies in engineering, scientific or complementary disciplines;
- to assume leadership roles in industry and/or their communities;
- to contribute to the economic environment of their communities; and
- to maintain career skills through life-long learning.