Chemical Engineering

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Vision Statement

Our vision is to be recognized for producing highly-valued professionals who are leaders in developing innovative solutions to engineering problems.

Mission Statement

Our mission is to graduate socially-responsible engineers with strong technical, communication, teamwork, and interpersonal skills, while incorporating the Lasallian Heritage of Manhattan College. This mission enables our graduates to pursue wide-ranging career paths in chemical and related industries, advanced graduate studies, and to engage in life-long learning.

Chemical Engineering

Chemical engineers combine mathematics and advanced chemistry with engineering principles to design, develop and operate industrial processes for the manufacture of a host of products including:

- fuels, plastics, synthetic fibers,
- paints, solvents, industrial chemicals and chemical intermediates,
- semiconductor and other advanced materials, and
- biotechnology, pharmaceutical products, medicines and vaccines
- a variety of consumer products such as foods, beverages, and cosmetics.

A chemical engineer's education permits the student to work in process engineering, design and construction, research & development, computer simulation, pollution prevention and remediation, safety and accident management.

The Chemical Engineering program includes course work in material and energy balances, thermodynamics, reaction engineering, heat and mass transfer, separation processes, chemical process control, process safety, and plant design. Lectures are complemented by comprehensive laboratory courses covering experiments in fluid mechanics, material science, and wide range of unit operations such as distillation, filtration, heat-transfer, mass transfer, and reaction engineering. Computer usage including software applications, programming, process simulation packages, and data acquisition are integrated throughout the curriculum. Important aspects of process safety, economics, environmental sustainability, and engineering ethics are also incorporated seamlessly into the curriculum. In addition to core-chemical engineering courses, all students are required to complete three advanced engineering electives and an advanced science/engineering elective to fulfill the degree requirements. The program offers New York State-approved areas of concentration in: (1) Biopharmaceutical Engineering and (2) Cosmetic Engineering, as well as a focus area in (3) Principles and Processing of Novel

Materials. Students can choose their advanced science/engineering electives (total of four) to fulfill the course requirements for the selected concentration/focus area.

Areas of Concentration in Chemical Engineering

In addition to the foundational program in chemical engineering, a student may focus on a concentration area, as described previously:

- **Biopharmaceutical Engineering**: This concentration will prepare students for a variety of roles in the biopharmaceutical and biotechnology sectors, including discovery, development, formulation and production of pharmaceutical products and therapeutic agents.
- **Consumer Products and Cosmetic Engineering**: This concentration, the only one of its kind in the nation, will prepare students for a variety of roles in the cosmetic and consumer product industries, including product formulation and development, process engineering, and research and development. This specialized option in consumer products and cosmetic engineering brings together a unique set of courses designed specifically to prepare chemical engineering graduate students for a successful entry into this highly competitive and rapidly growing industrial sector.
- **Principles and Processing of Novel Materials:** This concentration provides students a competitive advantage at companies specializing in biomaterials, semiconductors, additive manufacturing and smart materials, covering topics in chemical vapor deposition, 3-D printing, and energy storage materials such as solar cells.

Students interested in one of the concentrations must meet with the department chair to plan for the necessary coursework.

Biopharmaceutical Engineering courses

These courses will provide students with specialized training in microbial and cell growth, polymers and emulsions, bioseparation processing, bioprocess design, formulation of pharmaceutical products, and regulatory issues relevant to the biopharmaceutical field. Students are required to complete: CHML 461 Industrial Practice in Pharmaceutical Industry (3 credit hrs), and *at least three* of the following electives for a total of 12 credits: CHML 459 Formulations II (3 credit hrs); CHML 460 Emulsion & Polymer Tech (3 credit hrs); CHML 462 Manufacturing and Analysis of Pharmaceutical Products (3 credit hrs); CHML 463 Industrial Regulations & Quality (3 credit hrs); CHML 470 Bioseparations (3 credit hrs),or CHML 472 Bioreaction Engineering (3 credit hrs).

Consumer Products and Cosmetic Engineering courses

These courses will provide students specialized training in product formulation, polymers and emulsions, complex fluids, and regulatory issues relevant to cosmetic and consumer product industries. Students are required to complete: CHML 458 Formulations I (3 credit hrs); and CHML 460 Emulsions & Polymer Technology (3 credit hrs), and *at least two* of the following electives for a total of 12 credits: CHML 452 Advanced Processing Theory (3 credit hrs); CHML 453 Advanced Processing Techniques (3 credit hrs); CHML 459 Formulations II (3 credit hrs) or CHML 463 Industrial Regulations & Quality (3 credit hrs).

Principles and Processing of Novel Materials courses

These courses focus on the production of biomaterials, polymers, ceramics, and semiconductor materials, as well as processing techniques including additive manufacturing, extrusion, blow molding, and calendaring, and thin-film formation techniques such as chemical vapor deposition. Students are required to complete: CHML 460 Emulsions & Polymer Technology (3 credit hrs): CHML 473 Synthesis & Deposition of Thin Films(3 credit hrs); and CHML 475 Production & Application of Biomaterials (3 credit hrs) for a total of 12 credits.

These areas of concentration prepare students for professional employment as well as graduate studies.

Pre-medical option

Chemical engineering curriculum has a significant overlap with the curricular requirements of a B. S. degree recipient seeking admission to a MD program. Accordingly, Chemical engineering students who plan to enter the medical profession must complete BIOL 111 General Biology I; BIOL 112 General Biology II; BIOL 191 General Biology I Lab; BIOL 192 General Biology II Lab and CHEM 324 Organic Chemistry Laboratory II in addition to the courses required for graduation. Students interested in pursuing an MD degree must also consult with Drs. Bruce Liby (Pre-Health Professions Advisor) and Rani Roy (AVP, Student & Faculty Development) to plan for the necessary coursework.

Environmental Engineering Minor within Chemical Engineering

An environmental engineering minor is available for students within the Chemical Engineering Department. Students pursuing in the environmental engineering minor are required to take ENGS 204 Environmental Engineering Principles I in their Sophomore year, followed by a minimum of four courses from the following: CEEN 405 Construction Planning and Scheduling, CEEN 314 Water & Wastewater Treatment Processes, ENVL 410 Hazardous Waste Design, ENVL 439 Environmental Engineering Projects, ENVL 505 Surface Water Quality Modeling, ENVG 507 Groundwater and ENVG 508 Environmental Chemistry.

Seamless Masters

Academically qualified undergraduate students may be invited to participate in a Seamless Master's Degree program. Additional information can be found on the School of Engineering webpage: https://catalog.manhattan.edu/undergraduate/engineering/.

Program Educational Objectives

Graduates from the Chemical Engineering program at Manhattan College are expected to attain or achieve the following within a few years of graduation:

- Be recognized in the chemical and related industries, consulting firms, government agencies, and other venues as highly valued-professionals
- Progress towards or successfully complete graduate or other professional studies.

Student Outcomes

The Chemical Engineering program uses the standard set of ABET, Inc. Student Outcomes (1) through (7) as described above under the School of Engineering (https://catalog.manhattan.edu/undergraduate/engineering/).

Four-Year Program

The curriculum for the first year is common to all branches of engineering. Students begin to take designated courses from the chemical engineering curriculum in their sophomore year. The junior and senior years allow for concentrated studies in a variety of traditional and focus areas including material and energy balances, mass transfer, heat transfer, thermodynamics, reactor design and kinetics, separations, process safety, process control and computer-based process simulation and process design. Electives in the senior year allow students to choose one of the three Areas of Concentration: Consumer Products and Cosmetic Engineering; Biopharmaceutical Engineering; and Principles and Processing of Novel Materials or a minor in Environmental Engineering. A representative four-year program is shown in the following table.

Chemical Engineering

Freshman

Fall	Credits	Spring	Credits
CHEM 101/CHEM 103*		CHEM 101/CHEM 103*	
or PHYS 101/PHYS 191*	4	or PHYS 101/PHYS 191*	4
ENGL 110 or RELS 110[b]	3	ENGL 110 or RELS 110[b]	3
ENGS 115	3	ENGS 116	3
MATH 185*	4	MATH 186*	4
General Education Elective **	3	General Education Elective**	3
	17		**17**

Sophomore

Fall	Credits	Spring	Credits
CHEM 102*/CHEM104	4	ENGS 204 or 206	3
MATH 285*	4	MATH 286*	3
CHML 201	3	MATH 336	3
CHML 202	1	CHML 208	3
CHML 205[a]	3	CHML 209	3
CHML 207[a]	3	CHML 211	1
		ENGS 302+	0
ENGS 301+	0		
	18		**16**

Junior

Fall	Credits	Spring	Credits
CHEM 319	3	CHML 321	3
CHEM 323	2	CHML 339	3

CHML 305	3	CHEM 320	3
CHML 306	3	CHML 342 or 423	3
CHML 316	3	ENGS 302+	0
ENGS 301+	0	CHML 400 Level Adv. Engg Elective	3
CHML 400 Level Adv. Engg Elective	3		
	17		**15**

Senior

Fall	**Credits**	**Spring**	**Credits**
CHML 403	3	CHML 404	3
CHML 405	3	CHML 406	3
Adv Sci/Eng Elective	3	CHML 423 or 342	3
Gen. Edu. Elective**	3	Adv Engineering Elective 400 level	3
Rel Studies Elective 2xx/3xx	3	CHEM 310/335 or 433	3
Gen Edu. Elective	3	RELS Elective 200/300 Level	3
	18		**18**

Total Credits: 136

* A grade of C (2.0) or better in calculus I, II, III, differential equations, chemistry, and physics is required.

** A list of general education electives can be found in the Academic Advising Manual online (https://inside.manhattan.edu/schools/engineering/advising.php). Students must take two (2) social science courses, one (1) humanities and one (1) additional social science or humanities. For social sciences, these courses may be chosen from economics, political science, psychology, sociology or management (MGMT 201). For humanities, these courses may be chosen from history, philosophy, religious studies (in addition to the three (3) religious studies requirements), English (200 level), modern foreign language (200 level or higher), history-based art, history-based music, business law (LAW 203) and international studies (INTL 312).

a A grade of "C" or better is required in CHML 205 (Introduction to Thermodynamics) in order to take CHML 209 (Chemical Thermodynamics). A grade of "C" or better is required in CHML 207 (Process Calculations), before a student will be allowed to CHML 208 (Chemical Engineering Principles I). These are the gateway courses for the chemical engineering program and students are permitted to take these courses only three times in order to achieve a C or better. Failing to do so will result in the student being dismissed from the program.

b All engineering students are required to take ENGL 110, RELS 110, one RELS 2xx elective and one RELS 3xx elective.

\+ These are zero credit hour pass/fail courses that show up on the transcript with mandatory registration. You need to register for and pass ENGS 301 and ENGS 302 to fulfill graduation requirements.