Chemical Engineering

Dr. Sasidhar Varanasi
Chair, Department of Chemical Engineering

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 (such as gasoline and heating oil), plastics, synthetic fibers, paints, solvents, industrial chemicals and chemical intermediates, and a variety of consumer products such as foods, beverages, medicines, and cosmetics. A chemical engineer’s education permits the student to work in design and construction, computer simulation, specialty chemicals, industrial gases, food processing, petroleum fractionation, power generation, polymers, pollution prevention and remediation, safety and accident management, pharmaceuticals, cosmetics, biotechnology, or pulp and paper industries.

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 sciences, 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, (2) cosmetic engineering, and (3) petroleum engineering. Students can choose their advanced science/engineering electives (total of four) to fulfill the course requirements for the selected concentration.

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. The three New York State
approved concentration areas are biopharmaceutical engineering, cosmetic engineering, and petroleum engineering. The Biopharmaceutical Engineering 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. The Cosmetic Engineering 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. The Petroleum Engineering concentration covers topics of interest to engineers in the refining, fuels, natural gas mining and processing, and petrochemical industries. 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).

**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); CHML 459 Formulations II (3 credit hrs); CHML 460 Emulsions & Polymer Technology (3 credit hrs), and at least one 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); or CHML 463 Industrial Regulations & Quality (3 credit hrs).

**Petroleum Engineering courses**

These courses focus on the production of gaseous and liquid hydrocarbons, the physical chemistry of these hydrocarbon resources and the downstream processing to provide valuable chemical intermediates and products. Students are required to complete: CHML 448 Petroleum Refinery Processing I (3 credit hrs); CHML 449 Natural Gas Processing I (3 credit hrs), and select two of the following three courses (6 credit hrs): CHMG 454 Petroleum Refinery Processing II (3 credit hrs); CHML 455 Natural Gas Processing II (3 credit hrs); and/or CHML 456 Oxidative Conversion of Shale Gas Components (3 credit hrs).

These areas of concentration prepare students for professional employment and for graduate study.

**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 113 General Biology I Laboratory; BIOL 114 General Biology II Laboratory 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 305 Energy & the Environment, ENVL 406 Water and Wastewater Treatment Processes, ENVL 408 Environmental Engineering Design, ENVL 410 Hazardous Waste Design, ENVL 439 Environmental Engineering Projects, ENVL 505 Surface Water Quality Modeling and ENVL 507 Groundwater.

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 study specialty areas such as cosmetic, biopharmaceutical, petroleum
and environmental engineering. A representative four-year program is shown in the following table.

### Chemical Engineering

#### Freshman

**Fall** | **Credits** | **Spring** | **Credits**
--- | --- | --- | ---
CHEM 101/CHEM 103 | 4 | CHEM 101/CHEM 103 | 4
or PHYS 101/PHYS 191 | 4 | or PHYS 101/PHYS 191 | 4
ENGL 110 or RELS 110<sup>b</sup> | 3 | ENGL 110 or RELS 110<sup>b</sup> | 3
ENGS 115 | 3 | ENGS 116 | 3
MATH 185<sup>a</sup> | 3 | MATH 186<sup>a</sup> | 3
General Education Elective<sup>**</sup> | 3 | General Education Elective<sup>**</sup> | 3
--- | --- | --- | ---
16 | 16 |  

#### Sophomore

**Fall** | **Credits** | **Spring** | **Credits**
--- | --- | --- | ---
CHEM 102*/CHEM104 | 4 | ENGS 204 or 206 | 3
MATH 285<sup>*</sup> | 3 | MATH 286<sup>*</sup> | 3
CHML 201 | 3 | MATH 336 | 3
CHML 202 | 1 | CHML 208 | 3
CHML 205<sup>a</sup> | 3 | CHML 209 | 3
CHML 207<sup>a</sup> | 3 | CHML 211 | 1
| | | ENGS 302<sup>+</sup> | 0
| | | ENGS 301<sup>+</sup> | 0
--- | --- | --- | ---
17 | 16 |  

#### Junior

**Fall** | **Credits** | **Spring** | **Credits**
--- | --- | --- | ---
CHEM 310 | 3 | CHML 316 | 3
CHEM 319 | 3 | CHEM 320 | 3
CHEM 323 | 3 | CHML 321 | 3
CHML 305 | 3 | CHML 339 | 3
CHML 306 | 3 | CHML 342 | 3
Rel Studies Elective RELS 2xx/3xx<sup>b</sup> | 3 | ENGS 302<sup>+</sup> | 0
| | | ENGS 301<sup>+</sup> | 0
--- | --- | --- | ---
17 | 15 |  

#### Senior

**Fall** | **Credits** | **Spring** | **Credits**
--- | --- | --- | ---
CHML 403 | 3 | CHML 404 | 3
CHML 405 | 3 | CHML 406 | 3
CHML 423 | 3 | Adv Engineering Elective 400 level | 3
<table>
<thead>
<tr>
<th>Category</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adv Sci/Eng Elective(^c)</td>
<td>3</td>
</tr>
<tr>
<td>Adv Engineering Elective 400 level</td>
<td>3</td>
</tr>
<tr>
<td>Rel Studies Elective RELS 2xx/3xx(^b)</td>
<td>3</td>
</tr>
<tr>
<td>Gen. Edu. Elective(^**)</td>
<td>3</td>
</tr>
<tr>
<td>Total Credits:</td>
<td>133</td>
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</tbody>
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\(^a\) 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.

\(^c\) Students must take an advanced science (chemistry, math or physics) or engineering elective in senior year from an approved list provided by the chemical engineering department chair. Certain advanced level mathematics courses will also count towards mathematics minor.

\(^+\) 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.