# Chemical Engineering

## Freshman Year

**Fall Semester**
- Math 1371 Calculus I (placement into course, or pre-req)
- Phys 1301W Intro Physics I (Math 1371)
- Chem 1065 Chem Princ I Lab (Math 1371)
- Chem 1061 Chem Princ I (placement into course or 1015, 1065)
- CSE 1001 1st Yr Experience (optional)
- Writ 1301

**Spring Semester**
- Math 1372 Calculus II (1371)
- Phys 1302W Intro Physics II (1301, &Math 1372)
- Chem 1066 Chem Princ II Lab (1061/1065, &1062)
- Chem 1062 Chem Princ II (1061/1065, &1066)
- Liberal Education course or Writ 1301 (if not already completed)

## Sophomore Year

**Fall Semester**
- Math 2374 Multivariable Calc (1372)
- Chem 2301 Organic Chem I (1062/66)
- ChEn 2001 Mat & Engy Bal (Math 2301, Math 2374, Phys 1302)
- MatS 3011 Intro MatSci (Chem 1061/65, Math 1372, Phys 1302)
- Liberal Education course

**Spring Semester**
- Math 2373 Lin Alg/Diff Eq (1372)
- Chem 2302 Organic Chem II (2301)
- ChEn 4401W Jr ChEn Lab (UD, 3401W)
- ChEn 4501W Process Design I (UD, 4401W, 4501W)
- Technical Elective I

## Junior Year

**Fall Semester**
- Chem 2311 Org Chem Lab (C– or higher in 2302 or &2302)
- ChEn 3701 Biomolecular Eng (UD, 2001, Chem 2302, Math 2373, HS Bio recommended)
- ChEn 3005 Fluid & Heat Transf (UD, 2001, Math 2373)
- ChEn 3101 ChEn Thermo (UD, 2001, Chem 4501)

**Spring Semester**
- ChEn 3401W Jr ChEn Lab (UD &3006, &3102, 2301, Chem 2121, Chem 2311)
- ChEn 3102 Reaction Kinetics (UD, 3101)
- ChEn 3006 Mass Trns & Sep (UD, 3005, 3101)
- ChEn 3201 Num Methods (UD, 3005, &3006)

**Senior Year**

**Fall Semester**
- ChEn 4401W Sr ChEn Lab (UD, 3401W)
- ChEn 4501W Process Design II (UD, 4401W, 4501W)
- ChEn 4502 Quantum Mech (1062/66 Math 2374 or &2373, Phys 1302)
- Technical Elective II or ChEn 4214 Polymers (UD, Math 3001, 3101 or Math 4001)

**Spring Semester**
- Liberal Education course

### About This Plan

- This plan is not a contract. Curriculum can change. The APAS is the official method for tracking completion of University degree requirements.
- Shaded courses are only offered in the indicated semester.
- Course pre-requisites and co-requisites (designated by &) are listed below the course number and title. Upper Division (UD) requires admission to the major prior to enrollment. All prerequisite courses must be completed with a grade of C– or higher.
- Students can take either the CSE-only or University-wide versions of the math course (Math 1371/1271, 1372/1272, 2373/2243, 2374/2263).

### Applying to your Major

Students who have completed the required courses for admission to this major (indicated with double boxes on plan) and have a 3.2 UM-TC technical GPA at the end of the fall semester will be guaranteed admission. All other students who have completed the required courses will be considered for admission on a space-available basis. Admission following the spring semester is only based on space availability. The major application database is available at z.umn.edu/csemajorapp.

### University Degree Requirements

- **Writing Requirements:**
  - University Writing: Math 1301/1401 or equivalent *
  - Writing Intensive (WI):
    - Two: 1xxx or 2xxx level **
    - One: 3/4/5xxx level (in major)*
    - One: 3/4/5xxx level (any dept.)*
  - Requirements with an (*) will be fulfilled by taking courses at UM-TC required for this major.

- **Liberal Education:**
  - CORES:
    - Bio
    - Mth*
    - His
    - SoS
    - Ltr
    - AH
    - Mth*
  - THEMES:
    - 4 of 5
    - CIV
    - DSJ
    - Env
    - GP
    - TS

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**Total Credits Needed for Degree: 122**

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**Department Contact Information**

- Website: http://www.cems.umn.edu/academics/chen/
- Main Phone: 612-625-1313; Main Office: 151 Amundson Hall
- Director of Undergraduate Studies: Professor Efie Kokkoli
- Departmental Advisor: Kacey Gregerson; kgregers@umn.edu
- Course Access: z.umn.edu/cemspermissions

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What can I do with a major in...

Chemical Engineering?

**ACTIVITIES CHEMICAL ENGINEERING MAJORS DO:**

Chemical engineers build a bridge between science and manufacturing, applying the principles of chemistry and engineering to solve problems involving the production or use of chemicals. They design equipment and develop processes for large-scale chemical manufacturing, plan and test methods of manufacturing products and treating byproducts, and supervise production. Chemical engineers also work in a variety of manufacturing industries other than chemical manufacturing, such as those producing electronics, photographic equipment, clothing, and pulp and paper. They also work in the healthcare, biotechnology, and business services industries.

Chemical engineers apply principles of chemistry, physics, mathematics, and mechanical and electrical engineering. They frequently specialize in a particular chemical process such as oxidation or polymerization. Others specialize in a particular field, such as materials science, or in the development of specific products such as fertilizers and pesticides, automotive plastics, or chlorine bleach. They must be aware of all aspects of chemical manufacturing and how it affects the environment, the safety of workers, and the customers. Chemical engineers use computer technology to optimize all phases of research and production, so they need to understand how to apply computer skills to chemical process analysis, automated control systems, and statistical quality control.

**INDUSTRIES CHEMICAL ENGINEERING MAJORS WORK IN (SAMPLE LISTING):**

<table>
<thead>
<tr>
<th>Pharmaceuticals</th>
<th>Manufacturing</th>
<th>Petroleum</th>
<th>Higher education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consulting</td>
<td>Polymer resins</td>
<td>Healthcare</td>
<td>Tire and rubber</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>Pulp and paper</td>
<td>Clothing/textiles</td>
<td>Industrial products</td>
</tr>
<tr>
<td>Parts design</td>
<td>Food/beverage</td>
<td>Pest control</td>
<td>Packaging</td>
</tr>
<tr>
<td>Mining</td>
<td>Appliance manufacturing</td>
<td>Agriculture</td>
<td>Pharmaceutical products</td>
</tr>
</tbody>
</table>

**EMPLOYERS WHO HIRE CHEMICAL ENGINEERING MAJORS (SAMPLE LISTING):**

- 3M
-Accenture
-Brady Corporation
-ExxonMobil
-Land O’Lakes Inc.
-Phillips 66
-Applied Materials
-Andersen Corporation
-BASF
-Emerson Process Management
-The Dow Chemical Company
-Arkema
-Ecolab
-Aveda
-Flint Hills Resources
-Honeywell
-General Mills
-Bemis Company
-FM Global
-Schlumberger
-Nova-Tech Engineering
-MOM Brands
-Boston Scientific
-Cargill

**TYPES OF POSITIONS FOR CHEMICAL ENGINEERING MAJORS (SAMPLE LISTING):**

- **Design engineer:** Responsible for determining how a process will work. For example, they decide which pieces of equipment will be needed and how big they will be.

- **Operations engineer:** Works “on site,” spending time ensuring that a plant is producing the right amount of product to the correct specification.

- **Research and development engineer:** Develops the ideas for future plants, improving efficiency, environmental performance, and even developing new products.

- **Product engineer:** Follows the production cycle of a particular product to ensure it is meeting specification. Product engineers may work with marketing and R&D to ensure that a product will meet the needs of customers, then sees the product through production. They may work on new products or variations of existing products.

- **Quality control engineer:** Monitors the manufacturing of products to ensure that quality standards are maintained. Quality control engineers may bring samples of a product in from a field test or from a normal application, and then test them to determine how specific properties—such as strength, color, and weatherability—change over time.