### Chemical Engineering

#### Freshman Year

<table>
<thead>
<tr>
<th>Semester</th>
<th>Courses</th>
<th>Credits</th>
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</table>
| **Fall Semester** | Chem 1061/65 Chem Princ I  
(placement into course, or 1015)  | 4 |
| | Math 1371 Calculus I  
(placement into course, or pre-req) | 4 |
| | Phys 1301W Intro Physics I  
(&Math 1371) | 4 |
| | CSE 1001: 1st Yr Experience | 1 |
| | Liberal Education course or Writ 1301 | 4 |
| | ChEn/MatS 1001 (optional) | 1 |

- 1 Liberal Education course or Writ 1301

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| **Spring Semester** | Chem 1062/66 Chem Princ II  
(1061/1065) | 4 |
| | Math 1372 Calculus II  
(1371) | 4 |
| | Phys 1302W Intro Physics II  
(1301, &Math 1372) | 4 |
| | Liberal Education course or Writ 1301 | 3/4 |

- 1 Writ 1301/1401 is required to apply to UD; grade not included in technical GPA.

#### Sophomore Year

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| **Fall Semester** | Chem 2301 Organic Chem I  
(1062-66) | 3 |
| | ChEn 2001 Matl & Engy Bal  
(&Chem 2301, &Math 2374, &Phys 1302) | 4 |
| | MatS 3011 Intro MatSci  
(1061/65, Math 2372, Phys 1302) | 3 |
| | Math 2374 Multivariable Calc  
(1372) | 4 |
| | Liberal Education course | 3/4 |

- 1 Liberal Education course or Writ 1301

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| **Spring Semester** | Chem 2302 Organic Chem II  
(2301) | 3 |
| | Chem 2121 Process An Chem  
(&2302, 4501, CSE Student) | 3 |
| | Chem 4501 Intro to Thermo  
(1062/66, Phys 1302, &Math 2374) | 3 |
| | Math 2373 Lin Alg/Diff Eq.  
(1372) | 4 |
| | Liberal Education course | 3/4 |

#### Junior Year

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| **Fall Semester** | Chem 2311 Org Chem Lab  
(C- or higher in 2302 or &2302) | 4 |
| | ChEn 3701 Biomolecular Eng  
(U.D. 3001, Chem 2302, &Math 2373, High School Biology recommended) | 3 |
| | ChEn 3005 Fluid & Heat Transf  
(U.D. 2001, Math 2373) | 4 |
| | ChEn 3101 ChEn Thermo  
(U.D. 2001, Chem 4501) | 4 |
| | Chem/ChEn dbl mjr should take Chem 4701 this sem & may delay ChEn 5701 to next fall. Note: Chem 4701 has a co-req of Chem 2311. | 3 |

- 1 Liberal Education course or Writ 1301

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| **Spring Semester** | ChEn 3401W Jr. ChEn Lab  
(U.D. 2001, 3005, 3006, 3101, &3102, &3201, Chem 2121, Chem 2311, Writ 1301) | 2 |
| | ChEn 3006 Mass Trns & Sep.  
(U.D. 2001, 3005, 3101) | 4 |
| | ChEn 3102 Reaction Kin.  
(U.D. 2001, 3101) | 4 |
| | ChEn 3201 Comp Meth ChEn  
(U.D. 2001, 3005, &3006) | 3 |

- 1 Liberal Education course or Writ 1301

#### Senior Year

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| **Fall Semester** | ChEn 4401W Sr. ChEn Lab  
(U.D. 3005, 3006, 3101, 3102, 3201, 3401W, Chem 2121, Chem 2311, Writ 1301) | 3 |
| | ChEn 4501W Process Design  
(U.D. 3005, 3006, 3101, 3102, 3201, 3401, Chem 2121, 3101, Writ 1301) | 4 |
| | ChEn 4601 Process Control  
(U.D. 3102) | 3 |
| | Technical Elective I | 3/4 |

- 1 Liberal Education course or Writ 1301

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| **Spring Semester** | ChEn 4502W ChEn Proc Des II  
(U.D. 4401W, 4501W) | 2 |
| | ChEn 4502 Quantum Mech  
(1062/66 &Math 2374 or &2373, Phys 1302) | 3 |
| | ChEn 4214 Polymers  
(Not required; strongly recommended as a technical elective)  
(U.D. Math 3001, ChEn 3101 or MatS 4001)  
*dbl mjr must take Chem 4214 | 3 |
| | Technical Elective II | 3/4 |

- 1 Technical Elective II (If Polymers not completed)  
*Liberal Education course requires WI:
  - Writ 1301/1401 or equivalent  
- Math 2374 or 2374/2375

### About This Plan
- This plan is not a contract. Curriculum can change.
- 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.
- Students can take either the CSE-only or University-wide versions of the math course (Math 1371/1271, 1372/1272, 2373/2243, 2374/2263).
- Double boxed courses are required for application to this major.
- Chemical Principles labs (1065/1066) must be taken concurrently with the lectures (1061/1062).
- All prerequisite courses must be completed with a grade of C- or higher.
- Liberal Education and Writing Requirements with an (*) will be fulfilled by taking courses required for this major at UM-TC.

### Applying to your Major
- Students who have completed the required courses for admission to this major 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.

### 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 Satish Kumar
- Departmental Advisor: Kacey Gregerson; kgregers@umn.edu
- Course Access: z.umn.edu/cemspermissions

### University Degree Requirements
- All students must complete the following Writing & Liberal Education requirements, as noted on their APAS report.
- See link for full Core & Theme names: z.umn.edu/liberaleducation

#### Writing Requirements:
- University Writing:
  - Writ 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.)*

#### Liberal Education
- **CORES:**
  - Hr*  
  - Phys*  
  - His  
  - SocS  
  - Ltr  
  - Mth*  
- **THEMES:**
  - DSJ  
  - Env  
  - GP  
  - TS

### Total Credits Needed for Degree: 125
What can I do with a major in chemical engineering?

Chemical engineers build a bridge between science and manufacturing, applying 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 can 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 may also work in the healthcare, biotechnology, and business services industries.

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

**Employers** *(sample listing)*

<table>
<thead>
<tr>
<th>3M</th>
<th>BASF</th>
<th>General Mills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Materials</td>
<td>Flint Hills Resources</td>
<td>Beckman Coulter</td>
</tr>
<tr>
<td>Ecolab</td>
<td>Emerson Process Management</td>
<td>Boston Scientific</td>
</tr>
<tr>
<td>Accenture</td>
<td>H.B. Fuller Company</td>
<td>Phillips 66</td>
</tr>
<tr>
<td>Anderson Corporation</td>
<td>Land O’Lakes Inc.</td>
<td>Praxair Inc.</td>
</tr>
<tr>
<td>Aveda</td>
<td>The Dow Chemical Company</td>
<td>Schlumberger</td>
</tr>
<tr>
<td>Brady Corporation</td>
<td></td>
<td>USDA</td>
</tr>
</tbody>
</table>

**Industries** *(sample listing)*

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

**Positions** *(sample listing)*

**Project Engineer:** Organizes and manages projects for engineering companies. This can range from managing a small modification to an existing pharmaceutical facility to building a multi-billion dollar petrochemicals complex.

**Design Engineer:** Responsible for determining how a process will work, which pieces of equipment will be needed, and how big they will be.

**Operations Engineer:** Works “on site” ensuring that the plant is producing the right amount of product to the correct specification.

**Research and Development Engineer (R&D):** Develops ideas for future plants, improving efficiency and environmental performance, and even developing new products.

**Product Engineer:** Follows the production cycle of a particular product to ensure it meets specification. Product engineers may work with marketing and R&D to ensure that a product addresses the needs of the customer then sees the product through production.

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

**Sales and Marketing Engineer:** Assists customers in solving production and process problems by providing products and services to meet their specific needs. Sales and marketing engineers use their technical knowledge to sell chemicals, equipment, and other products and provide follow-up services and training where needed.

*Some positions may require an advanced degree.*

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**Career Center**
cse.umn.edu/career

**Salary Information**
z.umn.edu/csesalary

**More Information on Undergraduate Majors**
cse.umn.edu/majors