Materials Science & Engineering

Freshman Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem 1061/65 Chem Princ I (placement into course, or 1015)</td>
<td>Chem 1062/66 Chem Princ II (1062/65)</td>
</tr>
<tr>
<td>Math 1371 Calculus I (placement into course, or pre-req)</td>
<td>Math 1372 Calculus II (1371)</td>
</tr>
<tr>
<td>ChEn/MatS 1001 (optional)</td>
<td>Phys 1302W Intro Physics II (1301, &amp;Math 1372)</td>
</tr>
<tr>
<td>Phys 1301W Intro Physics I (&amp;Math 1371)</td>
<td>Lib Ed or Writ 1301/1401</td>
</tr>
</tbody>
</table>

CSE 1001: 1st Yr Experience
Lib Ed or Writ 1301/1401

Junior Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
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<tbody>
<tr>
<td>MatS 3013 Electrical Maths (UD, 3011, Chem 4502 or Phys 2303)</td>
<td>MatS 3851W Mtls Prop. Lab (UD, 3801, 3013)</td>
</tr>
<tr>
<td>MatS 3012 Metals and Alloys (UD, 3011)</td>
<td>MatS 3002 Mass Tns &amp; Kinel (UD, 3001, Math 2373, CEGE 3010)</td>
</tr>
<tr>
<td>MatS 3801 Struct Char Lab (UD, 3011)</td>
<td>MatS 4214 Polymers (UD, 3011, 3001, Chem 2301)</td>
</tr>
<tr>
<td>Liberal Education course</td>
<td>Technical Elective I</td>
</tr>
</tbody>
</table>

Lib Ed or Writ 1301/1401

Sophomore Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
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</thead>
<tbody>
<tr>
<td>CEGE 3101 Computer Appl I (Physics 1301, Math 1372)</td>
<td>Math 2374 Multiw. Calculus (1372)</td>
</tr>
<tr>
<td>MatS 3011 Intro MatSci (Chem 1061/65, Math 1372, Phys 1302)</td>
<td>Math 2374 Lin Alg/Diff. Eq. (1372)</td>
</tr>
<tr>
<td>CSE 1001: 1st Yr Experience</td>
<td>Liberal Education course</td>
</tr>
</tbody>
</table>

Liberal Education course

Senior Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
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</thead>
<tbody>
<tr>
<td>MatS 4212 Ceramics (UD, 3011, 3001 or Chem 3101)</td>
<td>AEM 4511 Composite Matrl. (CSE UD or grad stdt, 3031)</td>
</tr>
<tr>
<td>MatS 4221 Mat. Performance (UD, 3012, AEM 3031)</td>
<td>MatS 4301W Mat. Processing (4212, &amp;4214)</td>
</tr>
<tr>
<td>Technical Elective II</td>
<td>Technical Elective III</td>
</tr>
<tr>
<td>Technical Elective IV</td>
<td>Technical Elective IV</td>
</tr>
</tbody>
</table>

 Liberal Education course

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. UD requires admission to the major prior to enrollment.
- Students can take either CSE-only or University-wide versions of Math courses (1371/1271, 1372/1272, 2373/2243, 2374/2263).
- Double-boxed courses, along with one of two courses with a dashed outline, are required for application to this major.
- Chemical Principles labs (1065/1066) must be taken concurrently with the lectures (1061/1062).
- Prior to fall 2015, CEGE courses were listed with a CE designator.
- Special requirements marked with an * are fulfilled by courses required for this major.
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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: cems.umn.edu/academics/mse/
- Main Phone: 612-625-1313
- Main Office: 151 Amundson Hall
- Director of Undergraduate Studies: Professor Chris Leighton
- Departmental Advisor: Sarah Swenson, sjswenso@umn.edu

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:

<table>
<thead>
<tr>
<th>CORES:</th>
<th>THEMES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bio</td>
<td>Civ</td>
</tr>
<tr>
<td>Phy*</td>
<td>DSJ</td>
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<tr>
<td>His</td>
<td>Env</td>
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<tr>
<td>SocS</td>
<td>GP</td>
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<tr>
<td>Ltr</td>
<td>TS</td>
</tr>
<tr>
<td>AH</td>
<td>Mth*</td>
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Total Credits Needed for Degree: 123-124
What can I do with a major in materials science and engineering?

Materials engineers are involved in the extraction, development, processing, and testing of the materials used to create a diversity of products, from computer chips and television screens to golf clubs and snow skis. They work with metals, ceramics, plastics, semiconductors, and composites to create new materials that meet certain mechanical, electrical, and chemical requirements. They also are involved in selecting materials for new applications. Materials engineers evaluate economic factors, and use their knowledge to develop new materials. For example, materials engineers have developed the ability to create and study materials at an atomic level using advanced processes, electrons, neutrons, or x-rays and then replicate the characteristics of materials and their components with computers. Materials scientists are largely responsible for the composite materials on stealth aircraft and other cutting-edge systems.

Many materials scientists are also involved in mining and the extraction of substances from natural ores. Mining engineers inspect and ensure the safety of miners in underground and open-pit mines. They also locate and appraise new ore deposits and supervise the construction of mine shafts. Mining Engineers often develop methods for extracting ores from the mine and monitor operating costs.

A bachelor’s degree is the minimum educational requirement, and many research jobs in materials science require a master’s or Ph.D.

Employers (sample listing)

- 3M
- Accenture
- Polar Semiconductor, LLC
- Boston Scientific
- General Mills
- ExxonMobil
- Ingersoll-Rand
- Ecolab
- Ford Motor Company
- Hormel Foods Corporation
- Seagate Technology
- Valspar
- Honeywell
- Boeing
- Applied Materials, Inc.
- Anderson Corporation
- Cargill
- U. S. Department of Energy
- Medtronic
- Pentair, Inc.
- The Dow Chemical Company

Industries (sample listing)

- Chemical products
- Consulting
- Electronics
- Packaging engineering
- Petroleum
- Polymer resins
- Paper making
- Consumer products
- Mining
- Pharmaceuticals
- Marketing
- Biomedical
- Healthcare
- Industrial gas
- Semiconductors
- Government
- Aerospace

Positions (sample listing)

- Mining Engineer: Plans mining operations, designs underground and surface mines, develops mining equipment, and supervises technicians and workers who use it.
- Materials Consultant: Serves as an expert in one area of materials and is familiar with past experiments and theories relating to the hiring firm’s proposed project.
- Project Engineer: Organizes and runs projects for engineering companies, 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 is to 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, environmental performance, and 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, and then sees the product through production.
- Sales and Marketing Engineer: Assists customers in solving production and process problems by providing products and services to meet specific needs.

Examples from: SloanCareerCornerstone.org and WhyNotChemEng.com

*Some positions may require an advanced degree.