## Bioproducts & Biosystems Engineering—Environmental & Ecological 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)
- BBE 1001 BBE Orientation
- Liberal Education course or 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, Math 1372)
- Chem 1062 Chem Princ II (placement into course or 1015, Math 1372)
- Math 1372 Calculus II Multi-variable Calc (1372)

### Sophomore Year

#### Fall Semester
- Math 2374 Multivariable Calc (1372)
- Biol 1009 General Biology
- BBE 2001 Mech & Struct Des (Math 1372, Phys 1301)
- BBE 2003 Comp App in BBE* (Math 1372, 2373 or 2374)
- Liberal Education course or Writ 1301

#### Spring Semester
- Math 2373 Lin Alg/Diff Eq (1372)
- Bioc 211 BioC Ag/Health Sci (1062/66, Math 2374, Phys 1302)
- BBE 3043 Biol/Environ Thermo (Math 1301, Phys 1302)
- BBE 3033 Material & Energy Balance in Biological Systems (Math 1372, Phys 1302/66)
- Liberal Education course

*Students admitted prior to Fall 2017 may use STAT 3021 to satisfy requirement.

### Junior Year

#### Fall Semester
- BBE 3013 Engr Cell Proc (Biol 1009, Math 1372, BioC 2011 or Chem 2301)
- BBE 3023 Ecological Engr Princ (Bio 1009, 3012 or 30132)
- BBE 3012 Transport Biol I (2001, 3013, Math 2373, 2374, Phys 1302)
- BBE 3002 Intro to Eng Design (Math 1371, Chem 1001/1065, Writ 1301)
- Liberal Education course

#### Spring Semester
- BBE 4013 Transport in Biol Sys (UD, 3013, 3043, 3012)
- BBE 4533 Sust Wast Mgmt Eng (UD, 3023)
- BBE 4303 Intro Bio-bsd Mat Sci (UD, 2001)
- BBE 4523 Ecol Eng Design (UD, 3012, Chem 1062/66)
- Technical Elective

### Senior Year

#### Fall Semester
- BBE 4023W Proc Cont & Instr (UD)
- BBE 5513 Watershed Eng (UD, 3023)
- BBE 4535 Assmt of Imp Water (UD)
- Emphasis Elective
- Emphasis Elective

#### Spring Semester
- BBE 4502W Capstone Design (UD, 3002)
- Emphasis Elective
- Emphasis Elective
- 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 & and &) 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).

### Applying to your Major
- Students who have completed the required courses for admission to this major (double-boxed and one with a dashed outline 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.

### Total Credits Needed for Degree: 125

### Department Contact Information
- Website: www.bbe.umn.edu
- Main Phone: 612-625-5200
- Main Office: 203 Kaufer Lab & 213 BioAgEng Bldg (St. Paul)
- Director of Undergraduate Studies: Professor Ulrike Tschirner
- Email: tschi007@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: 3xxx 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
<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>
</tr>
<tr>
<td>His</td>
<td>Env</td>
</tr>
<tr>
<td>SocS</td>
<td>GP</td>
</tr>
<tr>
<td>Ltr</td>
<td>TS</td>
</tr>
</tbody>
</table>

**: Technical Elective

*Students admitted prior to Fall 2017 may use STAT 3021 to satisfy requirement.
What can I do with a major in...

Bioproducts and biosystems engineering

**ACTIVITIES BIOPRODUCTS AND BIOSYSTEMS ENGINEERING MAJORS DO:**

Bioproducts and biosystems engineers apply knowledge of engineering, technology, chemistry, and biology to select the appropriate renewable resources – such as wood, agricultural residues, fiber crops, and other biomass – for producing a wide range of “green” materials, including wood products, paper, chemicals, industrial feedstocks, plastics, building materials, and energy. Bioproducts and biosystems engineers also develop energy-efficient, economical, and environmentally friendly processes, machinery, and equipment for manufacturing these products. They consider the ethical and safety issues surrounding bioproducts as well as their economic impact, and they design sustainable systems that protect the environment, humans, plants, and animals.

In addition to basic science and engineering, bioproducts and biosystems engineers focus on bioresources, biological/biochemical processes, bio-based products, and biological systems.

- Environmental and ecological engineers focus on engineering applications to land and water resources, air and soil quality, land-use management, ecosystem services, ecological restoration, and waste management.
- Bioproducts engineers design and develop engineering solutions for sustainable manufacturing and end-use applications of “green” products, including biofuels, bioenergy, biodegradable plastics, building materials, paper, and chemicals.
- Food engineers design and develop systems for production, processing, distributing, and storing food and agricultural materials.

**INDUSTRIES BIOPRODUCTS AND BIOSYSTEMS ENGINEERING MAJORS WORK IN (SAMPLE LISTING):**

<table>
<thead>
<tr>
<th>Alternative energy</th>
<th>Law</th>
<th>Pulp and paper products</th>
<th>Quality control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>Building products/materials</td>
<td>Food safety and security</td>
<td>Marketing</td>
</tr>
<tr>
<td>Public health</td>
<td>Wood products</td>
<td>University laboratories</td>
<td>Consulting</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Renewable plastics</td>
<td>Ecological restoration</td>
<td>Laboratories</td>
</tr>
<tr>
<td>Institutes</td>
<td>Food processing</td>
<td>Renewable plastics</td>
<td>Agriculture</td>
</tr>
<tr>
<td>Environmental consulting</td>
<td>Alternative energy</td>
<td>Ecology/environmental research</td>
<td>Government agencies</td>
</tr>
</tbody>
</table>

**EMPLOYERS WHO HIRE BIOPRODUCTS AND BIOSYSTEMS ENGINEERING MAJORS (SAMPLE LISTING):**

| Andersen Windows | MN Pollution Control Agency | General Mills | Avant Energy |
| Metropolian Council | Institute for Environmental Health | Cargill | Hormel |
| Barr Engineering | MEDTOX Laboratories | Genetech Inc. | Medtronic |
| Land O’Lakes Inc. | Monsanto Company | SSOE Group | Tetra Pak |
| MOM Brands | Syngenta | POET | Appvion |
| U.S. Department of Agriculture | Soil and Water Conservation District | Boise Paper | Virent Energy Systems |

**TYPES OF POSITIONS FOR BIOPRODUCTS AND BIOSYSTEMS ENGINEERING MAJORS (SAMPLE LISTING):**

- **Environmental engineer:** Addresses the many environmental and natural resource challenges that affect air, soil, and water quality.
- **Bioprocessing/food engineer:** Integrates biology and engineering to design sustainable systems that produce high quality food, renewable energy, and biomaterials for consumers while protecting the environment.
- **Bioproducts engineer:** Develops sustainable biomass conversion solutions to meet the world’s growing materials and energy demand.
- **Environmental consultant:** Offers expert advice to local, state, and federal government agencies and private sector clients who need to adopt environmentally sound practices or clean up contaminated sites.

**Some of these positions may require an advanced degree.**