## BBE—Environmental & Ecological Engineering

### Freshman Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>4</th>
<th>Spring Semester</th>
<th>4</th>
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</table>
| Math 1371 Calculus I  
(placement into course or pre-req) | 4 | Math 1372 Calculus II  
(1371) | 4 |
| Phys 1301W Intro Physics I  
(&Math 1371) | 4 | Phys 1302W Intro Physics II  
(1301, &Math 1372) | 4 |
| Chem 1065 Chem Princ I Lab  
(&1061) | 3 | Chem 1066 Chem Princ II Lab  
(1061/1065, &1062) | 3 |
| Chem 1061 Chem Princ I  
(placement into course or 1065, &1065) | 3 | Chem 1062 Chem Princ II  
(1061/1065, &1066) | 3 |
| BBE 1001 BBE Orientation | 1 | Liberal Education course or Writ 1301 | 3/4 |
| CSE 1001 1st Yr Experience | 1 | | |
| Liberal Education course or Writ 1301 | 3/4 |

### Sophomore Year

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<th>Fall Semester</th>
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| Math 2374 Multivariable Calc  
(1372) | 4 | Math 2373 Lin Alg/Diff Eq  
(1372) | 4 |
| Biol 1009 General Biology | 4 | BBE 2001 Mech & Struct Des  
(Math 1372, Phys 1301) | 4 |
| BBE 3043 Biol/Enviro Thermo  
(Math 1061/65, Phys 1302, Math 1372) | 3 | BBE 2003 Comp App in BBE*  
(Math 1372, &2373 or &2374) | 3 |
| BBE 3003 Material & Energy Balance in Biological Systems  
(Math 1372, Phys 1302, Chem 1062/66) | 3 | Liberal Education course | 3/4 |

### Junior Year

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<th>Fall Semester</th>
<th>3</th>
<th>Spring Semester</th>
<th>3</th>
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| BBE 3013 Engr Prin Cell Proc  
(Biol 1009, Math 1372, BioC 2011 or Chem 2201) | 3 | BBE 4013 Transport in Biol Sys  
(UO, 3013, 3045, 3012) | 3 |
| BBE 3023 Ecological Eng Princ  
(Bio 1009, 3012 or &3012) | 3 | BBE 4533 Sust Wast Mgmt Eng  
(UD, 3023) | 3 |
| BBE 3012 Transport Biol I  
(2001, 3033, Math 2373, 2374, Phys 1302) | 4 | BBE 4303 Intro Bio-bsd Mat Sci  
(UD, 2001) | 3 |
| BBE 3002 Intro to Engr Design  
(previously 2002 (Math 1371, Chem 1061/65, Writ 1301) | 3 | BBE 4523 Ecol Eng Design  
(UD, 3012, Chem 1062/66) | 3 |
| Liberal Education course | 3/4 | Technical Elective I | 3 |

### Senior Year

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<th>Fall Semester</th>
<th>3</th>
<th>Spring Semester</th>
<th>4</th>
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</table>
| BBE 4023W Proc Cont & Instru  
(UO) | 3 | BBE 4502W Capstone Design  
(UO, 2002) | 4 |
| BBE 5513 Watershed Eng  
(UO, 3023) | 3 | Engineering Elective III | 3 |
| BBE 4535 Asmt of Imp Water  
(UD) | 3 | Technical Elective II | 3/4 |
| Engineering Elective I | 3 | Technical Elective III | 3/4 |
| Engineering Elective II | 3 | Liberal Education course | 3/4 |
| Liberal Education course | 3 |

### 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.
- 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
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):**

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

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

- Andersen Windows
- MN Pollution Control Agency
- General Mills
- Avant Energy
- Metropolitan 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.**