### Physics - Biological Emphasis

#### Freshman Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 1371 Calculus I (placement into course, or pre-req)</td>
<td>Math 1372 Calculus II (1371)</td>
</tr>
<tr>
<td>Phys 1301W Intro Physics I (Math 1371)</td>
<td>Phys 1302W Intro Physics II (1301, &amp; Math 1372)</td>
</tr>
<tr>
<td>Biol 1009 General Biology</td>
<td>Chem 1065 Chem Princ I Lab (1061)</td>
</tr>
<tr>
<td>CSE 1001 1st Yr Experience</td>
<td>Chem 1061 Chem Princ I (placement into course or 1015, &amp;1065)</td>
</tr>
<tr>
<td>Liberal Education course or Writ 1301</td>
<td>Liberal Education course or Writ 1301</td>
</tr>
</tbody>
</table>

#### Sophomore Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 2373 Lin Alg/Diff Eq (1372)</td>
<td>Math 2374 Multivariable Calc (1372)</td>
</tr>
<tr>
<td>Chem 1062 Chem Princ II (1061/65, &amp;1066)</td>
<td>*Not required for students admitted prior to Fall 2017; recommend as a Tech Elective.</td>
</tr>
</tbody>
</table>

#### Junior Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phys 4001 Analytical Mech (2503 or 2601, 3041, Math 2374)</td>
<td>Phys 4101 Quantum Mech (2503 or 2601 or Chem 4501 or 4502)</td>
</tr>
<tr>
<td>Phys 4051 Experimental Phys I (3605 or equiv lab exp or instr consent)</td>
<td>Phys 4052W Experimental Phys II (4051)</td>
</tr>
<tr>
<td>Liberal Education course</td>
<td>Liberal Education course</td>
</tr>
</tbody>
</table>

#### Senior Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phys 4002 Elect &amp; Magnetism (2503 or 2601, 3041, Math 2374)</td>
<td>Technical Elective I</td>
</tr>
<tr>
<td>Phys 4201 Stat Therm Phys (2601)</td>
<td>Technical Elective II (3/4)</td>
</tr>
<tr>
<td>Liberal Education course</td>
<td>Open Elective (If needed to reach 120 credits)</td>
</tr>
<tr>
<td>Open Elective (If needed to reach 120 credits)</td>
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</tbody>
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### 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.
- Students may take either the CSE-only or University-wide versions of math courses (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.

### Total Credits Needed for Degree: 120

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### Department Contact Information
- Website: www.physics.umn.edu/undergrad/
- Main Phone: 612-624-7375
- Main Office: 130 Tate Hall
- Director of Undergraduate Studies: Jeremy Mans
- Departmental Contact: physics@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:
- **Freshman 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.)*

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>4 of 5:</td>
</tr>
<tr>
<td>Phy*</td>
<td>CIV</td>
</tr>
<tr>
<td>His</td>
<td>DSJ</td>
</tr>
<tr>
<td>SocS</td>
<td>Env</td>
</tr>
<tr>
<td>Ltr</td>
<td>GP</td>
</tr>
<tr>
<td>AH</td>
<td>TS</td>
</tr>
<tr>
<td>Mth*</td>
<td></td>
</tr>
</tbody>
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*Not required for students admitted prior to Fall 2017; recommend as a Tech Elective.
Physics

POSSIBLE POSITIONS

- **Data analyst**: Analyzes problems and comes up with creative solutions.
- **Field test engineer**: Performs electro-optical (EO) or infrared (IR) measurements, both on site and at field test sites as part of a small team. Develop/upgrade instrumentation and software for control and analysis, document test procedures and experimental setups, and analyze and document the results of the tests.
- **Lab analyst**: Conducts experiments, runs laboratory tests and analyzes results.
- **Physicist**: Conducts research into the phases of physical phenomena, develops theories/laws on the basis of observation and experiments, and devises methods to apply laws/theories to industry and other fields.
- **Professor/teacher**: Develops and teaches physics curriculum, which includes scientific experiments.
- **Researcher**: Conducts experiments, analyzes findings, operates necessary equipment, develops and tests theories.
- **Thin film deposition engineer**: Conducts product development on thin film deposition using vacuum systems, including operation/maintenance of a vacuum system; designing and constructing part of the system as needed; analysis of the deposited thin film; and designing of experiments, analyzing results, and reporting.

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

CSE Career Outcomes

Average Starting Salary: $**

Post-graduation Outcomes:*

**cohort size too small to report data due to privacy regulations

**Post-graduation outcomes reflect the percentage of students who were employed full-time in their field or were enrolled in a graduate program.

INDUSTRIES

- Aerospace/aeronautical
- Automotive
- Biomedical
- Consulting
- Educational institutions
- Engineering consulting
- Government agencies
- Information technology
- Materials supply
- Nuclear plants
- Observatories
- Optics/electronics
- Petroleum/mining
- Research and development
- Telecommunications

EMPLOYERS

- 3M
- Accenture
- Amazon
- Boom Lab
- Carl Zeiss Industrial Metrology
- Deloitte
- Epic Systems
- General Mills
- Google
- Intel Corporation
- Meditech
- Micron Technology, Inc
- Minco Products
- Orbital ATK
- Proto Labs Inc
- RFA Engineering
- Seagate Technology
- Siemens
- Thomson Reuters
- Vascular Solutions

More Information

Career Center: cse.umn.edu/career
Salary Information: z.umn.edu/csesalary
More Information on Undergraduate Majors: cse.umn.edu/majors

Please visit the Career Center to continue exploring this major.

*Salary and Career Outcomes gathered from the 2016-2017 CSE Graduation Survey
Post-graduation outcomes reflect the percentage of students who were employed full-time in their field or were enrolled in a graduate program.