# Physics - Biological Emphasis

## Freshman Year

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

## Sophomore Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
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</table>
| Math 2373 Lin Alg/Diff Eq  
(1372) | Math 2374 Multivariable Calc  
(1372) |
| Phys 2503 Phys III: Waves, Optics  
(1302, Math 1372) | Phys 2601 Quantum Physics  
(2503, &3605, &Math 2373) |
| Phys 2201 Thermo & Stat Phys  
(1302, Math 1372) | Phys 3041 Math for Physics*  
(1302, Math 2373) |
| Chem 1066 Chem Princ II Lab  
(1061/65, &1062) | Chem 1062 Chem Princ II  
(1061/65, &1066) |

*Not required for students admitted prior to Fall 2017; recommend as a Tech Elective.

## Junior Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
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</table>
| Phys 4001 Analytical Mech  
(2503 or 2601, 3041, Math 2374) | Phys 4101 Quantum Mech  
(2503 or 2601 or Chem 4501 or 4502) |
| Phys 4051 Experimental Phys I  
(3605 or equiv lab exp or instr consent) | Phys 4052W Experimental Phys II  
(4051) |
| Chem 2301 Organic Chem I  
(1062/66) | BioC 3021 Biochemistry  
(Chem 2301, Biol 1009) |
| Liberal Education course | Liberal Education course |

## Senior Year

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
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</thead>
</table>
| Phys 4002 Elect & Magnetism  
(2503 or 2601, 3041, Math 2374) | Technical Elective I |
| Phys 4201 Stat Therm Phys  
(2601) | Technical Elective II  
(3/4) |
| Liberal Education course | Open Elective  
(If needed to reach 120 credits) |
| Open Elective  
(If needed to reach 120 credits) | Open Elective  
(If needed to reach 120 credits) |

## 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

## University Degree Requirements

All students must complete the following Writing & Liberal Education requirements, as noted on their APAS report.

### Writing Requirements:

**Freshman Writing:**  
Wrt 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>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>
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<tr>
<td>AH</td>
<td></td>
</tr>
<tr>
<td>Mth*</td>
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**Rev. Date: 5/2018**
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. Develops 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.**

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

CSE Career Outcomes

Post-graduation Outcomes:*  

- Employed: 60.6%
- Grad School: 33.4%
- Other: 6%

**Salary Information:** [z.umn.edu/csesalary](http://z.umn.edu/csesalary)

**More Information:**

Career Center: [cse.umn.edu/career](http://cse.umn.edu/career)

Salary Information: [z.umn.edu/csesalary](http://z.umn.edu/csesalary)

More Information on Undergraduate Majors: [cse.umn.edu/majors](http://cse.umn.edu/majors)

*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.*