# Physics—Engineering Emphasis

<table>
<thead>
<tr>
<th>Freshman Year</th>
<th>Sophomore Year</th>
<th>Junior Year</th>
<th>Senior Year</th>
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<tbody>
<tr>
<td><strong>Fall Semester</strong></td>
<td><strong>Spring Semester</strong></td>
<td><strong>Fall Semester</strong></td>
<td><strong>Spring Semester</strong></td>
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<tr>
<td>Math 1371 Calculus I (placement into course, or pre-req)</td>
<td>Math 1372 Calculus II (1371)</td>
<td>Math 2373 Lin Alg/Diff Eq (1372)</td>
<td>Math 2374 Multivariable Calc (1372)</td>
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<td>CSE 1001 1st Yr Experience</td>
<td>Liberal Education course or Writ 1301</td>
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<tr>
<td><strong>Total Credits Needed for Degree: 120</strong></td>
<td><strong>Department Contact Information</strong></td>
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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).
- Students applying to the major prior to Fall 2018 are eligible based on completion of either Math 2373 or Math 2374 (or equivalent).

**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. 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**
- **CORES:**
  - Bio
  - Phy*
  - His
  - SocS
  - Ltr
  - AH
  - Mth*
- **THEMES:**
  - 4 of 5:
    - Civ
    - DSI
    - Env
    - GP
    - TS

*Not required for students admitted prior to Fall 2017; recommend as a Tech Elective.
What can I do with a major in...

Physics

ACTIVITIES PHYSICS MAJORS DO:

Physicists explore and identify the basic principles governing the structure and behavior of matter, the generation and transfer of energy, and the interaction of matter and energy. Some physicists use these principles in theoretical areas such as the nature of time and the origin of the universe. Others work in more practical areas such as the development of materials, electronic or optical devices, and medical equipment. Physicists design and perform experiments with lasers, cyclotrons, telescopes, mass spectrometers, and other equipment. For instance, lasers are used in surgery, microwave devices function in ovens, and measuring instruments can analyze blood or the chemical content of foods. Physicists also find ways to apply mathematics and physical laws and theories to problems in nuclear energy, electronics, optics, materials, communications, aerospace technology, navigation equipment, and medical instrumentation. Many physicists work in research and development. Some do basic research to increase scientific knowledge or applied research to build on basic knowledge. For example, knowledge gained through basic research in solid-state physics led to the development of transistors and then integrated circuits used in computers. A small number of physicists work in inspection, testing, quality control, and other production-related jobs in industry. Physicists generally specialize in one of the following areas: acoustics, astronomy, astrophysics, atmospheric physics, biophysics, chemical physics, cryogenics, electromagnetism, energy, environmental physics, fluid mechanics, geophysics, medical physics, metallurgy, nuclear physics, optical physics, plasma physics, theology, solid state physics, or vacuum physics. Research in physics often requires a Ph.D.

INDUSTRIES PHYSICS MAJORS WORK IN (SAMPLE LISTING):

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

EMPLOYERS WHO HIRE PHYSICS MAJORS (SAMPLE LISTING):

3M
Bose Corporation
Graco Inc.
NASA
IBM
Polar Semiconductor, LLC
Alliant Techsystems
Epic
Intel Corporation
Black River Systems Co.
Microsoft Corporation
LasX Industries Inc.
Applied Materials
ExxonMobil
General Electric
Seagate Technology
Schlumberger
John Hopkins Applied Phys. Lab
D.E. Shaw Research
Starkey Hearing Technologies
NAVAIR Weapons Division
MIT Lincoln Laboratory
Garmin International

TYPES OF POSITIONS FOR PHYSICS MAJORS (SAMPLE LISTING):

- **Physical scientist**: Conducts research, testing, evaluation, and analysis related to the identification and evaluation of products and features such as counterfeit deterrent security features for Federal Reserve Notes. Specifically, physical scientists advise on and administer scientific work in the investigation and application of optical/light principles.

- **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. Field test engineers develop/upgrade instrumentation and software for control and analysis, document test procedures and experimental setups, and analyze and document the results of the tests and measurements.

- **Thin film deposition engineer**: Conducts product development on thin film deposition using vacuum systems. Duties include operation and 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.

- **Rheologists**: Applies physics to the study of the deformation and flow of matter. For instance, rheologists apply the principles behind the observation in the differences in the flow of ketchup from a bottle before and after shaking the bottle.

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