Applied Physics, B.S.

Requirements

The Bachelor of Science with a major in applied physics requires a minimum of 120 s.h., including at least 59-83 s.h. of work for the major. Total credit required for the major depends on the student’s choice of concentration. Students must maintain a g.p.a. of at least 2.00 in all courses for the major and in all UI courses for the major. They also must complete the College of Liberal Arts and Sciences General Education Program.

The major in applied physics is intended primarily for students interested in a broad program of study in physics combined with a significant concentration of courses in a field that has immediate application to industry. The degree provides a foundation for a wide range of employment opportunities in high-technology industries, including research and development, product design and testing, sales, and quality control. It also is designed to include exposure to physics sufficient to allow students to continue with graduate studies in either physics or astronomy.

The major offers four areas of concentration: optics, solid-state electronics, computer science, and medical physics. Students also may design customized concentration areas in close consultation with their advisors and with departmental approval.

An essential component of each concentration is successful completion of a related one-semester internship or practicum experience in a research laboratory (an applied physics thesis is required for the latter option). Well-prepared students will be able to complete the degree in four years. Students should work closely with their advisors on a graduation plan.

Students who wish to earn a double major in physics and astronomy must choose their course work carefully; see “B.S.: Double Major in Physics and Astronomy” below.

All applied physics students complete a common set of courses that includes calculus, linear algebra, physics, and an experiential learning course. They also complete the courses required for their chosen concentration. The department encourages students to take additional course work; advisors can suggest electives that will enrich programs and help students prepare for graduate work.

The B.S. with a major in applied physics requires the following courses. Many upper-level physics courses have prerequisites; students should consult their advisors when choosing courses numbered 3000 or above.

<table>
<thead>
<tr>
<th>Common Requirements</th>
<th>Concentration Area Courses</th>
<th>Total Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>37-41</td>
<td>22-46</td>
<td>59-87</td>
</tr>
</tbody>
</table>

Common Requirements

Students in all concentrations must successfully complete the following courses or their equivalents.

Mathematics

All of these:

- MATH:1850 & MATH:1860
- MATH:2700

Mathematics

All of these:

- MATH:2850

Calculus III

4

Physics

One of these sequences:

- PHYS:1611-
  - PHYS:1612
- PHYS:1701 &
  - PHYS:1702 &
  - PHYS:2703

Introductory Physics I-II

Physics I-II - Physics III

(Strongly preferred)

All of these:

- PHYS:2704
- PHYS:3710
- PHYS:3741
- PHYS:3811

Physics IV

Intermediate Mechanics

Introduction to Quantum Mechanics I

Electricity and Magnetism I

Experiential Learning

One of these:

- A one-semester industrial internship
- A one-semester practicum in a research laboratory (requires an applied physics thesis)

Computer Science Concentration

All of these:

- PHYS:3730
- PHYS:3756
- PHYS:3812
- PHYS:3850
- CS:1210
- CS:2210
- CS:2230
- CS:2630
- CS:2820
- CS:3330

Statistical Physics

Intermediate Laboratory

Electricity and Magnetism II

Electronics

Computer Science I: Fundamentals

Discrete Structures

Computer Science II: Data Structures

Computer Organization

Object-Oriented Software Development

Algorithms

One additional computer science course numbered 3000 or above

Two of these:

- CS:2630
- CS:2820
- CS:3330

Optics Concentration

All of these:

- PHYS:3730
- PHYS:3756
- PHYS:3812
- PHYS:3850
- PHYS:4720
- PHYS:4726
- PHYS:4728
- PHYS:4820

Statistical Physics

Intermediate Laboratory

Electricity and Magnetism II

Electronics

Introductory Optics

Electro Optics

Introductory Solid State Physics

Optical Signal Processing

Two of these:

- PHYS:4726
- PHYS:4728
- PHYS:4820

Solid-State Electronics Concentration

All of these:

- PHYS:3730
- PHYS:4728

Statistical Physics

Introductory Solid State Physics
ECE:2400 Linear Systems I 3
ECE:2410 Principles of Electronic Instrumentation 4
ECE:3320 Introduction to Digital Design 3
ECE:3410 Electronic Circuits 4
ENGR:1300 Introduction to Engineering Computing 3
ENGR:2120 Engineering Fundamentals II: Electrical Circuits 3
ENGR:2730 Computers in Engineering 3
One of these:
PHYS:3742 Introduction to Quantum Mechanics II 3
PHYS:3812 Electricity and Magnetism II 3

Medical Physics Concentration

All of these:
PHYS:3756 Intermediate Laboratory 3
PHYS:3850 Electronics 4
BIOL:1411-1412 Foundations of Biology and Diversity of Form and Function 8
CHEM:1110 & CHEM:1120 Principles of Chemistry I-II 8
CHEM:2210 & CHEM:2220 Organic Chemistry I-II 6
CHEM:2410 Organic Chemistry Laboratory 3
Two additional biology courses numbered 2000 or above 6-8
One of these:
BIOS:4120 Introduction to Biostatistics 3
STAT:3510 Biostatistics 3
One of these:
PHYS:3730 Statistical Physics 3
PHYS:3742 Introduction to Quantum Mechanics II 3
PHYS:3812 Electricity and Magnetism II 3
PHYS:4750 Advanced Laboratory 3
PHYS:4905 Special Topics in Physics (physics of the body) 3

Honors

Honors in the Major

Students majoring in applied physics have the opportunity to graduate with honors in their major. Departmental honors students must maintain a University of Iowa g.p.a. of at least 3.33. To graduate with honors in the major, they must earn 6-8 s.h. in PHYS:4999 Undergraduate Research during their junior and senior years and conduct an investigation under the guidance of a faculty member. They must present a written report of their research (honors thesis) and describe their research results at a departmental seminar.

University of Honors Program

In addition to honors in the major, students have opportunities for honors study and activities through membership in the University of Iowa Honors Program. Visit Honors at Iowa to learn about the University's honors program.

Membership in the UI Honors Program is not required to earn honors in the applied physics major.

Academic Plans

Four-Year Graduation Plan

The following checkpoints list the minimum requirements students must complete by certain semesters in order to stay on the University's Four-Year Graduation Plan. Courses in the major are those required to complete the major; they may be offered by departments other than the major department.

Before the third semester begins: calculus II and physics II

Before the fifth semester begins: physics III-IV, introduction to linear algebra, calculus III, one more course in the major, and up to four courses in another science or engineering department

Before the seventh semester begins: two to four more courses in the major, up to three other science or engineering courses, and at least 90 s.h. earned toward the degree

Before the eighth semester begins: two or three more courses in the major or other science or engineering courses and all or part of an academic year research experience or a summer research experience or internship as approved by the applied physics coordinator

During the eighth semester: enrollment in all remaining course work in the major, all remaining General Education courses, and a sufficient number of semester hours to graduate

Sample Plan of Study

Applied Physics (B.S.)

Medical Physics Concentration

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS:1701</td>
<td>Physics I</td>
<td>4</td>
</tr>
<tr>
<td>CHEM:1110</td>
<td>Principles of Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>MATH:1850</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>GE: Diversity and Inclusion</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Hours</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>CSI:1600</td>
<td>Success at Iowa</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Hours</td>
<td>17</td>
</tr>
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</table>

**Spring**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS:1702</td>
<td>Physics II</td>
<td>4</td>
</tr>
<tr>
<td>CHEM:1120</td>
<td>Principles of Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>MATH:1860</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>RHET:1030</td>
<td>Rhetoric (GE: Rhetoric or other General Education course)</td>
<td>4</td>
</tr>
</tbody>
</table>

**Second Year**

**Fall**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS:2703</td>
<td>Physics III</td>
<td>4</td>
</tr>
<tr>
<td>BIOL:1411</td>
<td>Foundations of Biology</td>
<td>4</td>
</tr>
<tr>
<td>MATH:2700</td>
<td>Introduction to Linear Algebra</td>
<td>4</td>
</tr>
<tr>
<td>GE: World Languages or elective course</td>
<td>3-5</td>
<td></td>
</tr>
</tbody>
</table>

|             | Hours                                            | 16    |

**Spring**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS:2704</td>
<td>Physics IV</td>
<td>3-4</td>
</tr>
<tr>
<td>BIOL:1412</td>
<td>Diversity of Form and Function</td>
<td>4</td>
</tr>
<tr>
<td>MATH:2850</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>GE: World Languages or elective course</td>
<td>3-5</td>
<td></td>
</tr>
<tr>
<td>Elective course</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

|             | Hours                                            | 15-17 |

**Third Year**

**Fall**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS:3741</td>
<td>Introduction to Quantum Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS:3811</td>
<td>Electricity and Magnetism I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:2210</td>
<td>Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>ENGL:1200</td>
<td>The Interpretation of Literature (GE: Interpretation of Literature )</td>
<td>3</td>
</tr>
<tr>
<td>GE: World Languages or elective course</td>
<td>3-5</td>
<td></td>
</tr>
</tbody>
</table>

|             | Hours                                            | 15-17 |

**Spring**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS:3710</td>
<td>Intermediate Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS:3850</td>
<td>Electronics</td>
<td>4</td>
</tr>
<tr>
<td>CHEM:2220</td>
<td>Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>GE: Social Sciences</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>GE: World Languages or elective course</td>
<td>3-5</td>
<td></td>
</tr>
</tbody>
</table>

|             | Hours                                            | 16-18 |

**Summer**

Major: industrial internship | 3 |

|             | Hours                                            | 3     |

**Fourth Year**

**Fall**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS:3730</td>
<td>Statistical Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS:3756</td>
<td>Intermediate Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>BIOL:3233</td>
<td>Introduction to Developmental Biology</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:2410</td>
<td>Organic Chemistry Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>GE: Literary, Visual, and Performing Arts</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

|             | Hours                                            | 15    |

**Spring**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL:2512</td>
<td>Fundamental Genetics</td>
<td>4</td>
</tr>
<tr>
<td>STAT:3510</td>
<td>Biostatistics</td>
<td>3</td>
</tr>
<tr>
<td>GE: Historical Perspectives</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>GE: Values and Culture</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

|             | Hours                                            | 15    |

**Career Advancement**

Physics and astronomy graduates have mastered skills that are readily transferable to a number of fields. They might choose to work in research, engineering, software development, teaching, finance, biomedical research, or consulting.

About 70 percent of physics and astronomy graduates go on to graduate school. With help from the department’s in-house recruiting office, they win acceptance to some of the best graduate programs in the country.

The Pomerantz Career Center offers multiple resources to help students find internships and jobs.