Physics

Physics is the scientific study of the fundamental principles governing the behavior of matter and the interaction of matter and energy. Mathematics is used to describe fundamental physical principles, the behavior of matter, and the interactions of matter and energy. As the most fundamental of sciences, physics provides a foundation for other scientific fields as well as the underpinnings of modern technology. The Physics department is unique because of the breadth of its faculty expertise and research, and the relatively intimate size of its classes above the introductory level. Physics concentrators may choose to pursue either the A.B. or the more intensive Sc.B. degree. Course work on either path covers a broad base and the relatively intimate size of its classes above the introductory level.

The Sc.B. degree is unique because of the breadth of its faculty expertise and research, as the underpinnings of modern technology. The Physics department sciences, physics provides a foundation for other scientific fields as well and the interactions of matter and energy. As the most fundamental of sciences, physics is used to describe fundamental physical principles, the behavior of matter, and the interaction of matter and energy. Mathematics is used to describe fundamental physical principles, the behavior of matter, and the interactions of matter and energy. Mathematics is used to describe fundamental physical principles, the behavior of matter, and the interactions of matter and energy.

**Standard program for the Sc.B. degree**

Prerequisites:
Select one of the following series:

- PHYS 0070 & PHYS 0160 Analytical Mechanics and Introduction to Relativity and Quantum Physics
- PHYS 0030 & PHYS 0040 Basic Physics and Basic Physics
- PHYS 0050 & PHYS 0060 Foundations of Mechanics and Foundations of Electromagnetism and Modern Physics

Select one of the following:

- MATH 0190 Advanced Placement Calculus (Physics/Engineering)
- MATH 0090, MATH 0100

Program:

- PHYS 0470 Electricity and Magnetism
- PHYS 0500 Advanced Classical Mechanics
- PHYS 0560 Experiments in Modern Physics
- PHYS 1410 Quantum Mechanics A
- PHYS 1530 Thermodynamics and Statistical Mechanics

One additional 1000-level course or a mathematics course beyond the introductory level.

Total Credits: 8

**Astrophysics Track for the Sc.B. degree**

Prerequisites:

Select one of the following series:

- PHYS 0070 & PHYS 0160 Analytical Mechanics and Introduction to Relativity and Quantum Physics
- PHYS 0050 & PHYS 0060 Foundations of Mechanics and Foundations of Electromagnetism and Modern Physics

Select one of the following:

- MATH 0170 Advanced Placement Calculus & MATH 0180 and Intermediate Calculus
- MATH 0190 Advanced Placement Calculus (Physics/Engineering) & MATH 0200 and Intermediate Calculus (Physics/Engineering)
- MATH 0350 Honors Calculus (or equivalent)

Program:

- PHYS 0470 Electricity and Magnetism
- PHYS 0500 Advanced Classical Mechanics
- PHYS 0560 Experiments in Modern Physics
- PHYS 1410 Quantum Mechanics A
- PHYS 1530 Thermodynamics and Statistical Mechanics

Three of the following:

- PHYS 1100 Introduction to General Relativity
- PHYS 1250 Stellar Structure and the Interstellar Medium
- PHYS 1270 Extragalactic Astronomy and High-Energy Astrophysics
- PHYS 1280 Introduction to Cosmology

Total Credits: 18

1 In addition, courses in computer programming are recommended.

2 A senior thesis is required. This is to be prepared in connection with PHYS 1990 under the direction of a faculty supervisor. The topic may be in a related department or of interdisciplinary nature. In any event, a dissertation must be submitted.

**Honors**

Candidates for honors in physics will be expected to pursue a more rigorous and extensive program than those merely concentrating in the subject. In addition they will be required to begin an honors thesis during the seventh semester and to complete it (as part of PHYS 1990) during the eighth semester. Honors candidates are also expected to take a special oral examination on the thesis at the end of the eighth semester. Further details about the program may be obtained from the chair of the department or the departmental honors advisor.

**Standard concentration for the A.B. degree**

Select one of the following Series:

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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tr>
<td>PHYS 0070</td>
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<td>PHYS 0030</td>
<td>Basic Physics &amp; PHYS 0040 &amp; Basic Physics</td>
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<tr>
<td>PHYS 0050</td>
<td>Foundations of Mechanics &amp; PHYS 0060 &amp; Foundations of Electromagnetism and Modern Physics</td>
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<td>PHYS 0470</td>
<td>Electricity and Magnetism</td>
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<tr>
<td>PHYS 0500</td>
<td>Advanced Classical Mechanics</td>
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<td>PHYS 0560</td>
<td>Experiments in Modern Physics</td>
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<tr>
<td>PHYS 1410</td>
<td>Quantum Mechanics A</td>
</tr>
<tr>
<td>PHYS 1530</td>
<td>Thermodynamics and Statistical Mechanics</td>
</tr>
</tbody>
</table>

One additional 1000-level course or a mathematics course beyond the introductory level.

Total Credits: 2

**Astrophysics Program**

Select one of the following Series:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
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<tr>
<td>PHYS 0070</td>
<td>Analytical Mechanics &amp; PHYS 0160 &amp; Introduction to Relativity and Quantum Physics</td>
</tr>
<tr>
<td>PHYS 0050</td>
<td>Foundations of Mechanics &amp; PHYS 0060 &amp; Foundations of Electromagnetism and Modern Physics</td>
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<td>PHYS 0470</td>
<td>Electricity and Magnetism</td>
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<td>Advanced Classical Mechanics</td>
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</table>

Three of the following:

- PHYS 1100 Introduction to General Relativity
- PHYS 1250 Stellar Structure and the Interstellar Medium
- PHYS 1270 Extragalactic Astronomy and High-Energy Astrophysics
- PHYS 1280 Introduction to Cosmology

Total Credits: 18

1 In addition, courses in computer programming are recommended.

2 A senior thesis is required. This is to be prepared in connection with PHYS 1990 under the direction of a faculty supervisor. The topic may be in a related department or of interdisciplinary nature. In any event, a dissertation must be submitted.

**Honors**

Candidates for honors in physics will be expected to pursue a more rigorous and extensive program than those merely concentrating in the subject. In addition they will be required to begin an honors thesis during the seventh semester and to complete it (as part of PHYS 1990) during the eighth semester. Honors candidates are also expected to take a special oral examination on the thesis at the end of the eighth semester. Further details about the program may be obtained from the chair of the department or the departmental honors advisor.
A senior thesis is required. This is to be prepared in connection with under the direction of a faculty supervisor. The topic may be in a related department or of interdisciplinary nature. In any event, a dissertation must be submitted.

**Biological Physics Track for the Sc.B. degree**

**Foundations of Physics**
- PHYS 0070 Analytical Mechanics
- PHYS 0050 Foundations of Mechanics
- ENGN 0040 Dynamics and Vibrations
- PHYS 0160 Introduction to Relativity and Quantum Physics
- PHYS 0060 Foundations of Electromagnetism and Modern Physics
- PHYS 0470 Electricity and Magnetism
- PHYS 0500 Advanced Classical Mechanics
- PHYS 1410 Quantum Mechanics A
- PHYS 1530 Thermodynamics and Statistical Mechanics

Select one of the following Series:¹

**Series A**
- PHYS 0720 Methods of Mathematical Physics

**Series B**
- Select one of the following:
  - APMA 0330 Methods of Applied Mathematics I, II
  - APMA 0350 Applied Ordinary Differential Equations
  - MATH 1110 Ordinary Differential Equations

And select one of the following:
- MATH 0180 Intermediate Calculus
- MATH 0200 Intermediate Calculus (Physics/Engineering)
- MATH 0350 Honors Calculus
- MATH 0520 Linear Algebra
- MATH 0540 Honors Linear Algebra

**Basic Biology and Chemistry**
- BIOL 0200 The Foundation of Living Systems (or placement out of BIOL 0200)
- BIOL 0500 Cell and Molecular Biology
- CHEM 0330 Equilibrium, Rate, and Structure

**Advanced Biophysical Topics and Techniques**
- PHYS 1610 Biological Physics
- PHYS 1990 Senior Conference Course

**Elective Courses (four chosen from the following list, with at least two 1000-level courses, or additional courses approved by the concentration advisor):**
- APMA 0360 Applied Partial Differential Equations I
- APMA 0410 Mathematical Methods in the Brain Sciences
- APMA 0650 Essential Statistics
- APMA 1070 Quantitative Models of Biological Systems
- APMA 1080 Inference in Genomics and Molecular Biology
- BIOL 0280 Introductory Biochemistry
- BIOL 0470 Genetics
- BIOL 1050 Biology of the Eukaryotic Cell
- BIOL 1200 Protein Biophysics and Structure
- BIOL 1270 Advanced Biochemistry
- BIOL 1870 Techniques in Pathobiology
- CHEM 0350 Organic Chemistry
- CHEM 0360 Organic Chemistry
- MATH 0090 Introductory Calculus, Part I
- MATH 0170 Advanced Placement Calculus
- MATH 0190 Advanced Placement Calculus (Physics/Engineering)
- MATH 1610 Probability
- MATH 1620 Mathematical Statistics

**Mathematical Physics Track for the A.B. degree**

**Prerequisites:**
- MATH 0090 Introductory Calculus, Part I
- or MATH 0100 Introductory Calculus, Part II
- or MATH 0190 Advanced Placement Calculus (Physics/Engineering)
- PHYS 0050 Foundations of Mechanics
- or PHYS 0070 Analytical Mechanics

**Mathematics Courses**¹
- MATH 0180 Intermediate Calculus
- or MATH 0200 Intermediate Calculus (Physics/Engineering)
- or MATH 0350 Honors Calculus
- MATH 0520 Linear Algebra
- or MATH 0540 Honors Linear Algebra
- MATH 1110 Ordinary Differential Equations

Select at least one of the following:
- MATH 1060 Differential Geometry
- MATH 1120 Partial Differential Equations
- MATH 1610 Probability

**Physics Courses**¹
- PHYS 0060 Foundations of Electromagnetism and Modern Physics
- or PHYS 0160 Introduction to Relativity and Quantum Physics
- PHYS 0470 Electricity and Magnetism
- PHYS 0500 Advanced Classical Mechanics
- PHYS 0560 Experiments in Modern Physics

Select at least two of the following:
- PHYS 1410 Quantum Mechanics A
- PHYS 1420 Quantum Mechanics B
- PHYS 1510 Advanced Electromagnetic Theory
- PHYS 1530 Thermodynamics and Statistical Mechanics
- PHYS 1560 Modern Physics Laboratory

**Total Credits** 17-18

¹ Concentrators are required to take at least one course in mathematics and one in physics in each of their last two semesters.

**Mathematical Physics Track for the Sc.B. degree**

**Prerequisites:**
- Select one of the following series:
  - PHYS 0070 Analytical Mechanics
  - & PHYS 0160 and Introduction to Relativity and Quantum Physics
  - PHYS 0050 Foundations of Mechanics
  - & PHYS 0060 and Foundations of Electromagnetism and Modern Physics

Select one of the following:
- PHYS 1410 Quantum Mechanics A
- PHYS 1420 Quantum Mechanics B
- PHYS 1510 Advanced Electromagnetic Theory
- PHYS 1530 Thermodynamics and Statistical Mechanics
- PHYS 1560 Modern Physics Laboratory

**Total Credits** 12

¹ Select Series A alone or two from Series B as indicated.
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<th>Course Code</th>
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<td>Advanced Placement Calculus (Physics/Engineering)</td>
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<td>MATH 0090</td>
<td>Introductory Calculus, Part I</td>
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<tr>
<td>&amp; MATH 0100</td>
<td>and Introductory Calculus, Part II</td>
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<td><strong>Required courses:</strong></td>
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<td>Intermediate Calculus</td>
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<tr>
<td>&amp; MATH 0200</td>
<td>and Intermediate Calculus (Physics/Engineering)</td>
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<tr>
<td>or MATH 0350</td>
<td>Honors Calculus</td>
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<tr>
<td>MATH 0520</td>
<td>Linear Algebra</td>
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<td>or MATH 0540</td>
<td>Honors Linear Algebra</td>
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<tr>
<td>MATH 1530</td>
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<td>Four additional 1000 or 2000 level Physics courses</td>
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<td>Two additional 1000 or 2000 level Math courses</td>
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<tr>
<td>PHYS 1990</td>
<td>Senior Conference Course</td>
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</tbody>
</table>

**Total Credits**: 18-20

1. A senior thesis is required. This is to be prepared in connection with under the direction of a faculty supervisor.
Font Notice

This document should contain certain fonts with restrictive licenses. For this draft, substitutions were made using less legally restrictive fonts. Specifically:

Helvetica was used instead of Arial.

The editor may contact Leepfrog for a draft with the correct fonts in place.