PHYSICS MAJOR

Learning Goals and Objectives

Goal 1: The student will develop the skills to be able to analyze phenomena quantitatively, be able to build scientific models, and use the scientific method to test those models, and as such, experimentation will be a central part of the student’s curriculum.

Students will be able to:

Objective 1.1: Be conversant with fundamental laboratory methods including developing skills in experimental design, the use of electronic equipment, and analysis of data including computational methods of processing and analyzing data.

Objective 1.2: Be able to translate problems in the natural sciences, especially those related to the physical world, into mathematical formulations utilizing calculus, differential equations, and linear algebra.

Goal 2: The student will gain an appreciation and understanding, and pursue a mastery of the foundations of physics including Newtonian mechanics, classical electricity and magnetism, thermodynamics, and quantum theory.

Students will be able to:

Objective 2.1: Solve problems using classical Newtonian mechanics

Objective 2.2: Solve problems in classical electricity and magnetism including wave phenomena and optics.

Objective 2.3: Understand the development of quantum mechanics from the failure of classical mechanics under certain conditions and be able to solve paradigmatic problems using fundamental quantum theory.

Objective 2.4: Understand the development of classical thermodynamics and in conjunction with quantum theory, appreciate the need for a statistical approach to thermodynamics.

Goal 3: The student will gain an appreciation for, and integrate the contributions of physics within an historical and sociological context and be able to articulate the development of physical thought in both oral and written form.

Students will be able to:

Objective 3.1: Competent in articulating ideas and laboratory research using oral and written forms of communication, especially as they pertain to disseminating these to the general public.

Objective 3.2: Able to integrate the discipline of physics into a broader worldview, one that is able to see the developments in physics as useful to humankind.

Goal 4: The student will gain an appreciation for the central themes of physical thought as they apply to other areas of the natural sciences, the applied sciences, and technology.

Objective 4.1: Through the General Education Program and, in particular, the Integrated Learning Courses, students in physics will develop their knowledge of the other areas of the natural sciences.

Signature Courses, Variable Courses, and an Integrative Learning requirement; a Major and Divisional component; and Free Electives. In addition to course requirements as specified in each area, students must complete one certified course in each of the following overlay areas:

1. Diversity, Globalization or Non-western Area Studies,
2. Ethics Intensive, and
3. Writing Intensive. Overlay requirements are part of the forty-course requirement.

General Education Signature Courses

See this page about Signature courses (https://academiccatalog.sju.edu/curricula/#signature). Six courses

General Education Variable Courses

See this page about Variable courses (https://academiccatalog.sju.edu/curricula/#variable). Six to Nine courses

General Education Overlays

See this page about Overlays (https://academiccatalog.sju.edu/curricula/#overlay).

General Education Integrative Learning Component

See this page about Integrative Learning Component (https://academiccatalog.sju.edu/curricula/#integrative-learning). Three courses:

Students are encouraged, but not required, to take the associated Chemistry labs.

GEP Electives

Six courses

Major Requirements

Sixteen courses

The traditional undergraduate programs include 40 courses distributed across three components: A General Education component divided into
Below is the recommended program for students who will be eligible for a PA Level I teaching certificate:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDU 150/150F</td>
<td>Schools in Society-Fr Seminar</td>
<td>3</td>
</tr>
<tr>
<td>EDU 160/160F</td>
<td>Schools in Society</td>
<td>3</td>
</tr>
<tr>
<td>EDU 157</td>
<td>Adolescent Development (may fulfill the GEP Social Science requirement)</td>
<td>3</td>
</tr>
<tr>
<td>EDU 247</td>
<td>Literacy in the Content Areas</td>
<td>3</td>
</tr>
<tr>
<td>SPE 160/160F</td>
<td>Intro to Special Education</td>
<td>3</td>
</tr>
<tr>
<td>SPE 203/203F</td>
<td>Tchng Adolescents Inclus Envir</td>
<td>3</td>
</tr>
<tr>
<td>SPE 310/310F</td>
<td>Assessment &amp; Progress Monitor</td>
<td>3</td>
</tr>
<tr>
<td>EDU 246</td>
<td>Literacy, Language and Culture (ELL)</td>
<td>3</td>
</tr>
<tr>
<td>EDU 418/418F</td>
<td>Instructional Tech: Science</td>
<td>3</td>
</tr>
<tr>
<td>EDU 497</td>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>

1 You must register for the field experience with any "F" course.

Note: Students may or may not be able to complete the requirements for certification within the normal 8 semesters. This will be largely controlled by the number of GEP variable core courses the student has to take, AP credit received and other factors. Given the complexity of the requirements it is essential that students interested in pursuing secondary education certification speak with their academic advisor about this early in their program of study.

**Advisory Option—Physics Pre-Medical, Pre-Dental**

Physics majors may elect an advisory course sequence designed to meet medical/dental school admission requirements. With the explicit permission of the Chair of the Physics Department, students choosing this option may substitute CHM 210/CHM 210L and CHM 215/CHM 215L for two of the required physics electives.

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**Track in Materials Physics**

A student may elect to pursue a course of study leading to expertise in the area of the physics of materials, nanotechnology, or biophysics.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
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<tbody>
<tr>
<td>PHY 253</td>
<td>Survey of Nanotechnology</td>
<td>3</td>
</tr>
<tr>
<td>PHY 261</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>PHY 407</td>
<td>Soft Condensed Matter Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHY 405</td>
<td>Solid State Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHY 413</td>
<td>Materials of Electronics</td>
<td>3</td>
</tr>
<tr>
<td>PHY 419</td>
<td>Biophysics</td>
<td>3</td>
</tr>
<tr>
<td>PHY 421</td>
<td>Physics of Fluids</td>
<td>3</td>
</tr>
</tbody>
</table>

These courses will prepare the student for either entry into various areas of the electronics and nanotechnology industries or for entry into graduate programs in various areas of physics, materials science engineering, medical physics, and biophysics.

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**Advisory Option—Computer Science**

Physics majors may elect an advisory course sequence designed to prepare the student for an entry level position or graduate work in Computer Science.

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**Advisory Option—Teacher Certification in Physics**

Pennsylvania’s Secondary (referred to as "secondary" or "7-12") preparation program guidelines require a Professional Core of courses, early and varied field experiences, and student teaching. In addition to the subject-specific content requirements for secondary programs that are met by the student’s major, candidates for the 7-12 teaching certificate in Pennsylvania must complete a prescribed sequence of coursework which includes the specific requirements for Accommodations and Adaptations for Diverse Learners in Inclusive Settings and Meeting the Needs of English Language Learners under §49.13(4)(i)).