MAJOR IN PHYSICS - SECONDARY EDUCATION CONCENTRATION

Physics majors in the Secondary Education Concentration are eligible, upon graduation, to apply for certification to teach physics for grades 7-12 in the state of Maryland.

The Physics Secondary Education Concentration requires 128-129 units for completion. Students in this concentration must complete 101-102 required units in content and Towson UTeach courses, and 27 units in Core Curriculum courses not satisfied by the major, earning a grade equivalent of 2.00 or higher in each course.

Formal Admission to Towson UTeach

Students should apply to Towson UTeach when they have met the following criteria:

1. completion of a written application available at www.towson.edu/uteach
2. completion of at least 45 college units
3. a minimum cumulative 2.75 overall GPA
4. presentation of either a passing score on Praxis Core (Pre-Professional Skills Test: Reading, Writing, and Mathematics) OR an acceptable score on the Score Reporting Form for either the SAT, ACT, or GRE. Please refer to www.towson.edu/uteach for information on these assessments, including acceptable minimum passing scores.
5. completion of a Criminal History Disclosure Form. This form is to be notarized and submitted to the Towson UTeach Office. It will be forwarded and kept on file with the Center for Professional Practice.

Full Time Internship in Towson UTeach

Students in this concentration should be prepared to do their capstone internship in their senior year. Students who wish to deviate from this policy must obtain permission from the Department of Physics, Astronomy, and Geosciences prior to the beginning of their junior year. The following requirements must be met for the capstone internship:

- a minimum cumulative GPA of 2.75 in content courses required for the major;
- a minimum cumulative GPA of 3.00 in professional education courses;
- a minimum cumulative overall GPA of 2.75.

GPA calculations based on transcripts from all institutions of higher learning attended, including Towson University

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Required Physics Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 185</td>
<td>INTRODUCTORY HONORS SEMINAR IN PHYSICS</td>
<td>1</td>
</tr>
</tbody>
</table>

Select one of the following:

- PHYS 241 & PHYS 242: GENERAL PHYSICS I CALCULUS-BASED and GENERAL PHYSICS II CALCULUS-BASED
- PHYS 251 & PHYS 252: HONORS GENERAL PHYSICS I CALCULUS-BASED and HONOR GENERAL PHYSICS II CALCULUS-BASED
- PHYS 243: GENERAL PHYSICS III
- PHYS 270: COMPUTERS IN PHYSICS
- PHYS 307: INTRODUCTORY MATHEMATICAL PHYSICS
- PHYS 311: MODERN PHYSICS I
- PHYS 341: INTERMEDIATE PHYSICS LABORATORY I
- PHYS 351: MECHANICS
- PHYS 354: ELECTRICITY & MAGNETISM

Non-Physics Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 273</td>
<td>CALCULUS I</td>
<td>8</td>
</tr>
<tr>
<td>MATH 274</td>
<td>and CALCULUS II</td>
<td></td>
</tr>
</tbody>
</table>

Total Units: 42

Required Content Courses for the Secondary Education Concentration

In addition to the 34 units of common physics requirements and 8 units of common non-physics requirements for a physics major, the following content courses are required:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 385</td>
<td>PHYSICS SEMINAR</td>
<td>1</td>
</tr>
</tbody>
</table>

Select one upper-level physics elective from the following: 3-4

- PHYS 312: MODERN PHYSICS II
- PHYS 335: BASIC ELECTRONICS
- PHYS 337: DIGITAL ELECTRONICS
- PHYS 337: DIGITAL ELECTRONICS
- PHYS 342: INTERMEDIATE PHYSICS LABORATORY II
- PHYS 352: THERMODYNAMICS AND KINETIC THEORY
- PHYS 361: OPTICS FUNDAMENTALS
- PHYS 455: INTRODUCTORY QUANTUM MECHANICS
- PHYS 457: SOLID STATE PHYSICS
- PHYS 459: NUCLEAR AND PARTICLE PHYSICS
- PHYS 495: CAPSTONE PROJECT IN PHYSICS

Additional Non-Physics Content Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTR 161</td>
<td>THE SKY AND THE SOLAR SYSTEM</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 201</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>SCIE 380</td>
<td>TEACHING SCIENCE IN THE SECONDARY SCHOOLS</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Units: 15-16

Towson UTeach Course Requirements (40 Units)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMS 110</td>
<td>INTRODUCTION TO STEM TEACHING I: INQUIRY APPROACHES TO TEACHING</td>
<td>2</td>
</tr>
<tr>
<td>SEMS 120</td>
<td>and INTRODUCTION TO STEM TEACHING II: INQUIRY-BASED LESSON DESIGN</td>
<td></td>
</tr>
</tbody>
</table>
or SEMS 130

*Permission of Towson UTeach Department required to take SEMS 130.

**Core Courses**

- SEMS 230 KNOWING AND LEARNING 3
- SEMS 240 CLASSROOMS INTERACTIONS 3
- SEMS 250 PERSPECTIVES IN SCIENCE AND MATHEMATICS 3
- SEMS 360 RESEARCH METHODS 3
- SEMS 370 PROJECT-BASED INSTRUCTION 3
- SEMS 498 INTERNSHIP IN MATHEMATICS AND SCIENCE SECONDARY EDUCATION 3
- SEMS 498 INTERNSHIP IN SECONDARY EDUCATION-SCIENCE 12
- SCED 460 USING READING AND WRITING IN THE SECONDARY SCHOOLS 4
- SCED 461 TEACHING READING IN THE SECONDARY CONTENT AREAS 3

**Science Courses**

- SCIE 393 INTERNSHIP IN SECONDARY EDUCATION-SCIENCE 12
- SCIE 430 SEMINAR IN STUDENT TEACHING - SCIENCE 3

**Suggested Four-Year Plan**

Based on course availability and student needs and preferences, the selected sequences will probably vary from those presented below. Students should consult with their adviser to make the most appropriate elective choices.

**Freshman**

<table>
<thead>
<tr>
<th>Term 1 Term 2</th>
<th>Units</th>
<th>Term 2</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMS 110</td>
<td>1</td>
<td>SEMS 120</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 131</td>
<td>4</td>
<td>PHYS 241 or 251</td>
<td>4</td>
</tr>
<tr>
<td>MATH 273</td>
<td>4</td>
<td>MATH 274 (Core 3)</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 185</td>
<td>1</td>
<td>TSEM 102 (Core 1)</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 102 (Core 2)</td>
<td>3 Core</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Core</td>
<td>3</td>
<td>16</td>
<td>15</td>
</tr>
</tbody>
</table>

**Sophomore**

<table>
<thead>
<tr>
<th>Term 1 Term 2</th>
<th>Units</th>
<th>Term 2</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMS 230</td>
<td>3</td>
<td>SEMS 240</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 242 or 252</td>
<td>4 PHYS 243</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>ASTR 161</td>
<td>4</td>
<td>PHYS 270</td>
<td>4</td>
</tr>
<tr>
<td>Core</td>
<td>3</td>
<td>PHYS 307</td>
<td>3</td>
</tr>
<tr>
<td>Core</td>
<td>3</td>
<td>17</td>
<td>17</td>
</tr>
</tbody>
</table>

**Junior**

<table>
<thead>
<tr>
<th>Term 1 Term 2</th>
<th>Units</th>
<th>Term 2</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 200 &amp; 200L</td>
<td>4 SEMS 370</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>PHYS 311</td>
<td>3</td>
<td>PHYS 354</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 341</td>
<td>3</td>
<td>PHYS 385</td>
<td>1</td>
</tr>
<tr>
<td>SEMS 250</td>
<td>3</td>
<td>SCED 461</td>
<td>3</td>
</tr>
<tr>
<td>SCED 460</td>
<td>4 Core</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**NSTA Standard 1: Content Knowledge**

Effective teachers of science understand and articulate the knowledge and practices of contemporary science. They interrelate and interpret important concepts, ideas, and applications in their fields of licensure. Below are the elements of the standard.

Pre-service teachers will:

1a) Understand the major concepts, principles, theories, laws, and interrelationships of their fields of licensure and supporting fields as recommended by the National Science Teachers association.

1b) Understand the central concepts of the supporting disciplines and the supporting role of science-specific technology.

1c) Show an understanding of state and national curriculum standards and their impact on the content knowledge necessary for teaching P-12 students.

Assessment: Praxis II scores

**NSTA Standard 2: Content Pedagogy**

Effective teachers of science understand how students learn and develop scientific knowledge. Pre-service teachers use scientific inquiry to develop this knowledge for all students. Below are the elements of the standard.

Pre-service teachers will:

2a) Plan multiple lessons using a variety of inquiry approaches that demonstrate their knowledge and understanding of how all students learn science.

2b) Include active inquiry lessons where students collect and interpret data in order to develop and communicate concepts and understand scientific processes, relationships and natural patterns from empirical experiences. Applications of science-specific technology are included in the lessons when appropriate.

2c) Design instruction and assessment strategies that confront and address naive concepts/preconceptions.

Assessment: This Standard is usually met using Assessment 3 - Unit Plan. GPA required in content coursework.

**NSTA Standard 3: Learning Environments**

Effective teachers of science are able to plan for engaging all students in science learning by setting appropriate goals that are consistent with knowledge of how students learn science and are aligned with state and national standards. The plans reflect the nature and social context of science, inquiry, and appropriate safety considerations. Candidates design and select learning activities, instructional settings, and resources—including science-specific technology, to achieve those goals; and they plan fair and equitable assessment strategies to evaluate if the learning goals are met. Below are the elements of the standard.

Pre-service teachers will:
3a) Use a variety of strategies that demonstrate the candidates' knowledge and understanding of how to select the appropriate teaching and learning activities, including laboratory or field settings and applicable instruments and/or technology, to allow access so that all students learn. These strategies are inclusive and motivating for all students.

3b) Develop lesson plans that include active inquiry lessons where students collect and interpret data using applicable science-specific technology in order to develop concepts, understand scientific processes, relationships, and natural patterns from empirical experiences. These plans provide for equitable achievement of science literacy for all students.

3c) Plan fair and equitable assessment strategies to analyze student learning and to evaluate if the learning goals are met. Assessment strategies are designed to continuously evaluate preconceptions and ideas that students hold and the understandings that students have formulated.

3d) Plan a learning environment and learning experiences for all students that demonstrate chemical safety, safety procedures, and the ethical treatment of living organisms within their licensure area.

Assessment: Curriculum Development Project (CDP) score

NSTA Standard 4: Safety

Effective teachers of science can, in a P-12 classroom setting, demonstrate and maintain chemical safety, safety procedures, and the ethical treatment of living organisms needed in the P-12 science classroom appropriate to their area of licensure. Below are the elements of the standard.

Pre-service teachers will:

4a) Design activities in a P-12 classroom that demonstrate the safe and proper techniques for the preparation, storage, dispensing, supervision, and disposal of all materials used within their subject area science instruction.

4b) Design and demonstrate activities in a P-12 classroom that demonstrate an ability to implement emergency procedures and the maintenance of safety equipment, policies and procedures that comply with established state and/or national guidelines. Candidates ensure safe science activities appropriate for the abilities of all students.

4c) Design and demonstrate activities in a P-12 classroom that demonstrate ethical decision-making with respect to the treatment of all living organisms in and out of the classroom. They emphasize safe, humane, and ethical treatment of animals and comply with the legal restrictions on the collection, keeping, and use of living organisms.

Assessment: Internship Evaluations

NSTA Standard 5: Impact on Student Learning

Effective teachers of science provide evidence to show that P-12 students' understanding of major science concepts, principles, theories, and laws have changed as a result of instruction by the candidate and that student knowledge is at a level of understanding beyond memorization. Candidates provide evidence for the diversity of students they teach. Below are the elements of the standard.

Pre-service teachers will:

5a) Collect, organize, analyze, and reflect on diagnostic, formative and summative evidence of a change in mental functioning demonstrating that scientific knowledge is gained and/or corrected.

5b) Provide data to show that P-12 students are able to distinguish science from non-science, understand the evolution and practice of science as a human endeavor, and critically analyze assertions made in the name of science.

5c) Engage students in developmentally appropriate inquiries that require them to develop concepts and relationships from their observations, data, and inferences in a scientific manner.

Assessment: Portfolio scores

Standard 6: Professional Knowledge and Skills

Effective teachers of science strive continuously to improve their knowledge and understanding of the ever changing knowledge base of both content, and science pedagogy, including approaches for addressing inequities and inclusion for all students in science. They identify with and conduct themselves as part of the science education community. Below are the elements of the standard.

Pre-service teachers will:

6a) Engage in professional development opportunities in their content field such as talks, symposiums, research opportunities, or projects within their community.

6b) Engage in professional development opportunities such as conferences, research opportunities, or projects within their community.

Assessment: Flinn Science Safety Course completion