## Bachelor of Science

# Physics with a Major in Physics-Professional (BS)

The Physics-Professional major is designed for students who wish to create a specialized program of study that combines a strong foundation in physics with strong preparation in another field. Such other fields include engineering, medicine, computer science, business, and communications, to name a few.

## Requirements

### Lower-Division General Education

| | |
|---|---|
| Written Communication (http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#written) | 6 |
| Oral Communication (http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#oral) | 3 |
| Mathematics (http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#math) | 3 |
| Language and Culture (http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#language) | 0-6 |
| Information Literacy and Research (http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#information) | 3 |
| Human Behavior (http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#behavior) | 3 |
| Human Creativity (http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#creativity) | 3 |
| Interpreting the Past (http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#interpret) | 3 |
| Literature (http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#literature) | 3 |
| Philosophy and Ethics (http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#philosophy) | 3 |
| The Nature of Science (http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#nature) | 8 |
| Impact of Technology (http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#impact) | 3 |

Mathematics: Satisfied by the major

Information Literacy and Research: CS 120G or CS 121G or OEAS 130G

Nature of Science: satisfied by the major

### Upper-Division General Education

- Option A. Approved Disciplinary Minor (a minimum of 12 hours determined by the department), or second degree or second major.
- Option B: Interdisciplinary Minor (specifically 12 hours, 3 of which may be in the major)
- Option C. An approved Certification Program such as teaching licensure
- Option D. Two Upper-Division Courses from outside the College of Sciences and not required by the major (6 hours)

### Requirements for Graduation

All majors for the BS degree in physics require completion of a minimum of 120 credit hours (150 credit hours for the dual degree in physics and electrical engineering and the dual degree in physics and the Master of Business Administration), which must include both a minimum of 30 credit hours overall and 12 credit hours in upper-level courses in the major program from Old Dominion University, completion of ENGL 110C, ENGL 211C or ENGL 231C, and the writing intensive (W) course in the major with a grade of C or better, and Senior Assessment. Additionally, physics majors require completion of the Physics Exit Exam with a minimum score of 20$^{th}$ percentile, and the astrophysics major requires completion of the Astrophysics Exit Exam with a minimum score of 20$^{th}$ percentile. Additional hours may be required to meet the foreign language requirement. All majors require a minimum grade of C in PHYS 261N-PHYS 262N, PHYS 231N-PHYS 232N, or PHYS 226N-PHYS 227N. Except for the secondary physics education major, physics majors require a minimum cumulative grade point average of 2.00 overall and in the major. The secondary physics education major requires a minimum 2.75 grade point average overall, in the major, and in the professional education core, with no grade less than a C- in the major and professional education core. The professional education core satisfies the upper-level general education requirement.

### Math Minor

Physics-Professional majors wishing to complete a minor in applied mathematics can do so with just two additional math courses. Please consult the Department of Mathematics section of the Catalog for details.

## Physics-Professional Major

| | | |
|---|---|---|
| **General Education** | | |
| Complete lower-division requirements | | 30-36 |
| Complete upper-division requirements (minimum of 6 credit hours) | | 6 |
| **Physics-Professional Major** | | |
| MATH 211 | Calculus I | 4 |
| MATH 212 | Calculus II | 4 |
| MATH 312 | Calculus III | 4 |
| or MATH 285 | Transfer Credit for Calculus III | |
| MATH 307 | Ordinary Differential Equations | 3 |
| or MATH 280 | Transfer Credit for Ordinary Differential Equations | |
| Select one of the following: | | 3 |
| MATH 316 | Introductory Linear Algebra | |
| MATH 401 | Partial Differential Equations | |
| MATH 421 | Applied Mathematics II: Mathematical Modeling | |
| MATH 422 | Applied Complex Variables | |
| CHEM 121N & CHEM 122N | Foundations of Chemistry I Lecture and Foundations of Chemistry I Laboratory | 4 |
| CHEM 123N & CHEM 124N | Foundations of Chemistry II Lecture and Foundations of Chemistry II Laboratory | 4 |
| PHYS 261N | Advanced University Physics I | 4 |
| or PHYS 231N | University Physics I | |
| or PHYS 226N | Honors: University Physics I | |
| CS 151 | Introduction to Programming with Java | 4 |
| or CS 153 | Introduction to Programming with Python | |
| PHYS 262N | Advanced University Physics II | 4 |
| or PHYS 232N | University Physics II | |
| or PHYS 227N | Honors: University Physics II | |
| PHYS 323 | Modern Physics | 3 |
| PHYS 319 | Analytical Mechanics | 3 |
| PHYS 303 | Intermediate Experimental Physics | 3 |
| PHYS 355 | Mathematical Methods of Physics | 3 |
| PHYS 413 | Methods of Experimental Physics | 3 |
| PHYS 425 | Electromagnetism I | 3 |
| PHYS 452 | Introduction to Quantum Mechanics | 3 |
| PHYS 454 | Thermal and Statistical Physics | 3 |
| Select one of the following: | | 3 |
| PHYS 420 | Introductory Computational Physics | |
| PHYS 453 | Electromagnetism II | |
| PHYS 456 | Intermediate Quantum Mechanics | |
| PHYS 499W | Senior Thesis * | 3 |
| or PHYS 489W & PHYS 490W | Senior Thesis I and Senior Thesis II | |
| PHYS 120 | Physics in the 21st Century | 1 |

| | | |
|---|---|---|
| or PHYS 309 | Physics on the Back of an Envelope | |
| Select two of the following: ** | | 6 |
| ASTP 313 | Elements of Astrophysics | |
| ASTP 414 | Relativity and Cosmology | |
| ASTP 495 | Special Topics in Astrophysics | |
| PHYS 411 | Introduction to Atomic Physics | |
| PHYS 415 | Introduction to Nuclear and Particle Physics | |
| PHYS 416 | Introduction to Solid State Physics | |
| PHYS 417 | Introduction to Particle Accelerator Physics | |
| **Total Credit Hours** | | **111-117** |

* Grade of C or better required in PHYS 499W or both PHYS 489W and PHYS 490W

** At least one three credit course must be at the 400-level.

## Elective Credit

Elective credit may be needed to meet the minimum requirement of 120 credit hours.

# BS Degree with Honors

Qualified students may receive the BS degree with honors (to be noted on their diplomas) by completing specified additional requirements. At the time of application for this designation, a student must have a GPA of 3.50 or higher in physics, a GPA of 3.25 or higher overall, must have completed two contract honors courses, and must have completed 60 credit hours (of which at least 54 must be in grade-point graded courses) at Old Dominion University. (Contract honors courses are specialized courses of individual study under the direct supervision of a professor. Permission to take these courses is granted jointly by the Department of Physics and the Honors College.)

# Degree Program Guide

The Degree Program Guide is a suggested curriculum to complete this degree program in four years. It is just one of several plans that will work and is presented only as broad guidance to students. Each student is strongly encouraged to develop a customized plan in consultation with their academic advisor. Additional information can also be found in Degree Works.

| Course | Title | Credit Hours |
|---|---|---|
| **Freshman** | | |
| **Fall** | | |
| ENGL 110C | English Composition (Grade of C or better required) | 3 |
| MATH 211 | Calculus I | 4 |
| PHYS 120<br>or PHYS 309 | Physics in the 21st Century *<br>or Physics on the Back of an Envelope | 1 |
| CS 151<br>or CS 153 | Introduction to Programming with Java<br>or Introduction to Programming with Python | 4 |
| Language & Culture I (May be waived; See requirement details) | | 0-3 |
| | **Credit Hours** | **12-15** |
| **Spring** | | |
| ENGL 211C or ENGL 231C (Grade of C or better required) | | 3 |
| MATH 212 | Calculus II | 4 |
| Select one of the following: | | 4 |
| PHYS 261N | Advanced University Physics I | |
| PHYS 231N | University Physics I | |
| PHYS 226N | Honors: University Physics I | |
| Human Behavior | | 3 |
| Language & Culture II (May be waived; See requirement details) | | 0-3 |
| | **Credit Hours** | **14-17** |
| **Sophomore** | | |
| **Fall** | | |
| CHEM 121N and CHEM 122N | | 4 |
| Select one of the following: | | 4 |
| PHYS 262N | Advanced University Physics II | |
| PHYS 232N | University Physics II | |
| PHYS 227N | Honors: University Physics II | |
| MATH 312 or MATH 285 | | 4 |
| Select one of the following: | | 3 |
| CS 120G | Introduction to Information Literacy and Research | |
| CS 121G | Introduction to Information Literacy and Research for Scientists | |
| OEAS 130G | Research Skills and Information Literacy for the Natural Sciences | |
| | **Credit Hours** | **15** |
| **Spring** | | |
| CHEM 123N and CHEM 124N | | 4 |
| MATH 307 or MATH 280 | | 3 |
| PHYS 319 | Analytical Mechanics | 3 |
| Interpreting the Past | | 3 |
| Oral Communication | | 3 |
| | **Credit Hours** | **16** |
| **Junior** | | |
| **Fall** | | |
| PHYS 303 | Intermediate Experimental Physics | 3 |
| PHYS 323 | Modern Physics | 3 |
| PHYS 355 | Mathematical Methods of Physics | 3 |
| Select one of the following: | | 3 |
| PHYS 420 | Introductory Computational Physics * | |
| PHYS 453 | Electromagnetism II * | |
| PHYS 456 | Intermediate Quantum Mechanics * | |
| Philosophy and Ethics | | 3 |
| | **Credit Hours** | **15** |
| **Spring** | | |
| PHYS 413 | Methods of Experimental Physics | 3 |
| Select one of the following: | | 3 |
| MATH 316 | Introductory Linear Algebra | |
| MATH 401 | Partial Differential Equations | |
| MATH 421 | Applied Mathematics II: Mathematical Modeling | |
| MATH 422 | Applied Complex Variables | |
| Select one of the following: | | 3 |
| ASTP 313 | Elements of Astrophysics * | |
| ASTP 414 | Relativity and Cosmology | |
| ASTP 495 | Special Topics in Astrophysics | |

| | | |
|---|---|---|
| PHYS 411 | Introduction to Atomic Physics | |
| PHYS 415 | Introduction to Nuclear and Particle Physics | |
| PHYS 416 | Introduction to Solid State Physics | |
| PHYS 417 | Introduction to Particle Accelerator Physics | |
| Upper-Division General Education Course or Course for Minor | | 3 |
| Human Creativity | | 3 |
| | **Credit Hours** | **15** |
| **Senior** | | |
| **Fall** | | |
| PHYS 425 | Electromagnetism I | 3 |
| PHYS 452 | Introduction to Quantum Mechanics | 3 |
| Select one of the following: (C or better required) | | 3 |
| PHYS 499W | Senior Thesis | |
| PHYS 489W & PHYS 490W | Senior Thesis I and Senior Thesis II | |
| Upper-Division General Education Course or Course for Minor | | 3 |
| Impact of Technology | | 3 |
| Elective (if needed) | | 3 |
| | **Credit Hours** | **18** |
| **Spring** | | |
| Select one of the following: | | 3 |
| ASTP 313 | Elements of Astrophysics * | |
| ASTP 414 | Relativity and Cosmology | |
| ASTP 495 | Special Topics in Astrophysics | |
| PHYS 411 | Introduction to Atomic Physics | |
| PHYS 415 | Introduction to Nuclear and Particle Physics | |
| PHYS 416 | Introduction to Solid State Physics | |
| PHYS 417 | Introduction to Particle Accelerator Physics | |
| Literature | | 3 |
| Course for Minor or Elective | | 3 |
| Course for Minor or Elective | | 3 |
| PHYS 454 | Thermal and Statistical Physics | 3 |
| | **Credit Hours** | **15** |
| | **Total Credit Hours** | **120-126** |

*PHYS 120 and PHYS 420 are offered fall semester only. ASTP 313, PHYS 309, PHYS 453, and PHYS 456 are offered spring semester only.