

# ENGINEERING PHYSICS MAJOR (B.S.)

<https://ceps.unh.edu/physics-astronomy/program/bs/engineering-physics-major>

## Description

The goal of the UNH BSEP program is to produce broadly-trained engineers who can provide solutions to today's challenging problems in support of a technologically evolving society. The core of the program is based on interdisciplinary training, complemented with a deeper understanding of the physical principles needed to support careers in engineering, engineering research or, perhaps, further training in systems engineering. The program balances depth and breadth in skill development; flexibility and functionality are what drive the program in the sense that 1) the particular focus is based on the student's interests, and 2) the breadth of the course selection is guided by the post-graduation goals of the student (e.g., employment versus graduate school).

## Requirements

### Degree Requirements

**Minimum Credit Requirement:** 128 credits

**Minimum Residency Requirement:** 32 credits must be taken at UNH

**Minimum GPA:** 2.0 required for conferral\*

**Core Curriculum Required:** Discovery & Writing Program Requirements

**Foreign Language Requirement:** No

All Major, Option and Elective Requirements as indicated.

\*Major GPA requirements as indicated.

### Major Requirements

A student must have a minimum grade of C in each 400- or 500-level courses that are part of the core requirements and an overall grade-point average of 2.33 in these courses in order to continue in the program.

Code	Title	Credits
<b>Core Requirements (all tracks)</b>		
CHEM 403	General Chemistry I	4
or CHEM 405	Chemical Principles for Engineers	
IAM 550	Introduction to Engineering Computing	4
or CS 410C	Introduction to Scientific Programming/C	
or CS 410P	Introduction to Scientific Programming/Python	
MATH 425	Calculus I	4
MATH 426	Calculus II	4
MATH 527 & MATH 528	Differential Equations with Linear Algebra and Multidimensional Calculus	8-12
or MATH 525 & MATH 526	Linearity I and Linearity II	
PHYS 400	Physics Seminar I	1
PHYS 407	General Physics I	4
PHYS 408	General Physics II	4
PHYS 505	General Physics III	3
PHYS 506	General Physics III Laboratory	1
PHYS 508	Thermodynamics and Statistical Mechanics	4

PHYS 615	Classical Mechanics and Mathematical Physics I	4
PHYS 616	Classical Mechanics and Mathematical Physics II	4
PHYS 703	Electricity and Magnetism I	4
<b>Capstone</b>		4
PHYS 797	Senior Design Project	4
<b>Additional courses for Aerospace Track</b>		
ECE 541	Electric Circuits	4
ECE 548	Electronic Design I	4
ME 608	Fluid Dynamics	3
ME 743	Satellite Systems, Dynamics, and Control	3-4
or PHYS 712	Space Plasma Physics	
<b>Aerospace track electives in major:</b>		
Select four courses from the following:		
CS 417	From Programs to Computer Science	4
CS 419	Computer Science for Engineers and Scientists	4
ME 441	Introduction to Engineering Design and Solid Modeling	4
CS 501	Professional Ethics and Communication in Technology-related Fields	4
or PHIL 424	The Future of Humanity: Science, Technology, and Society	
or PHIL 447	A.I., Robots, and People	
MATH 539	Introduction to Statistical Analysis	4
or MATH 644	Statistics for Engineers and Scientists	
ECE 543	Introduction to Digital Systems	4
ECE 562	Computer Organization	4
ECE 583	Designing with Programmable Logic	6
ME 603	Heat Transfer	3
PHYS 605	Experimental Physics I	5
ECE 633	Signals and Systems I	3
ECE 634	Signals and Systems II	3
ME 646	Experimental Measurement and Data Analysis	4
MATH 647	Complex Analysis for Applications	4
or MATH 788	Complex Analysis	
ECE 649	Embedded Microcomputer Based Design	6
ECE 652	Electronic Design II	6
CS 659	Introduction to the Theory of Computation	4
ME 670	Systems Modeling, Simulation, and Control	4
PHYS 701	Quantum Mechanics I	4
PHYS 702	Quantum Mechanics II	4
PHYS 704	Electricity and Magnetism II	4
PHYS 705	Experimental Physics II	4
ME 705	Thermal System Analysis and Design	4
ME 706	Renewable Energy: Physical and Engineering Principles	3
ME 707	Analytical Fluid Dynamics	4
PHYS 708	Optics	4
PHYS 710	Astrophysics I	4
PHYS 711	Astrophysics II	4
ME 712	Waves in Fluids	3
PHYS 712	Space Plasma Physics	4
PHYS 718	Condensed Matter Physics	4
PHYS 720	Nuclear Physics	4
ME 743	Satellite Systems, Dynamics, and Control	3
ME 747	Experimental Measurement and Modeling of Complex Systems	4
PHYS 764	General Relativity and Cosmology	4
ME 786	Introduction to Finite Element Analysis	4
<b>Additional Courses for the Engineering Research track</b>		
ECE 541	Electric Circuits	4
ECE 543	Introduction to Digital Systems	4
ECE 548	Electronic Design I	4
PHYS 704	Electricity and Magnetism II	4
or PHYS 708	Optics	
<b>Engineering Research track electives in major:</b>		
Select four courses from the following:		
ME 441	Introduction to Engineering Design and Solid Modeling	4
CS 417	From Programs to Computer Science	0
CS 419	Computer Science for Engineers and Scientists	4
CS 501	Professional Ethics and Communication in Technology-related Fields	4
or PHIL 424	The Future of Humanity: Science, Technology, and Society	
or PHIL 447	A.I., Robots, and People	
MATH 539	Introduction to Statistical Analysis	4

or MATH 644	Statistics for Engineers and Scientists	
ME 561	Introduction to Materials Science	4
ECE 562	Computer Organization	4
ECE 583	Designing with Programmable Logic	6
PHYS 605	Experimental Physics I	5
ME 608	Fluid Dynamics	4
ECE 633	Signals and Systems I	3
ECE 634	Signals and Systems II	3
MATH 647	Complex Analysis for Applications	4
or MATH 788	Complex Analysis	
ECE 647	Random Processes and Signals in Engineering	3
ECE 649	Embedded Microcomputer Based Design	6
ECE 652	Electronic Design II	6
ECE 653	Electronic Design III	6
ME 670	Systems Modeling, Simulation, and Control	4
PHYS 701	Quantum Mechanics I	4
PHYS 702	Quantum Mechanics II	4
PHYS 704	Electricity and Magnetism II	4
PHYS 705	Experimental Physics II	4
ME 706	Renewable Energy: Physical and Engineering Principles	3
PHYS 708	Optics	4
PHYS 710	Astrophysics I	4
PHYS 711	Astrophysics II	4
ME 712	Waves in Fluids	3
PHYS 718	Condensed Matter Physics	4
PHYS 720	Nuclear Physics	4
CS 750	Machine Learning	4
PHYS 764	General Relativity and Cosmology	4
ME 743	Satellite Systems, Dynamics, and Control	3

## Degree Plan

### Sample Degree Plan

*This sample degree plan serves as a general guide; students collaborate with their academic advisor to develop a personalized degree plan to meet their academic goals and program requirements.*

Students are recommended (but not required) to take MATH 425H Honors/Calculus I and PHYS 407H Honors/General Physics I in their first semester and MATH 426H Honors/Calculus II and PHYS 408H Honors/General Physics II in their second semester, if eligible to take calculus first semester. Non-Honors versions of these courses will also satisfy the requirements for either Engineering Physics option.

### Aerospace Track

#### First Year

Fall		Credits
PHYS 407H	Honors/General Physics I	4
MATH 425H	Honors/Calculus I	4
PHYS 400	Physics Seminar I	1
ENGL 401	First-Year Writing	4
Discovery Course		4
<b>Credits</b>		<b>17</b>

#### Spring

PHYS 408H	Honors/General Physics II	4
MATH 426H	Honors/Calculus II	4
CHEM 405	Chemical Principles for Engineers	4
IAM 550	Introduction to Engineering Computing	4
<b>Credits</b>		<b>16</b>

#### Second Year

##### Fall

PHYS 505	General Physics III	3
PHYS 506	General Physics III Laboratory	1
PHYS 508	Thermodynamics and Statistical Mechanics	4
MATH 528	Multidimensional Calculus	4
Discovery Course		4
<b>Credits</b>		<b>16</b>

##### Spring

PHYS 615	Classical Mechanics and Mathematical Physics I	4
MATH 527	Differential Equations with Linear Algebra	4
Elective in Major		4
Discovery Course		4
<b>Credits</b>		<b>16</b>

#### Third Year

##### Fall

PHYS 616	Classical Mechanics and Mathematical Physics II	4
ME 608	Fluid Dynamics	3
ECE 541	Electric Circuits	4
Discovery Course		4
<b>Credits</b>		<b>15</b>

##### Spring

PHYS 703	Electricity and Magnetism I	4
ECE 548	Electronic Design I	4
Elective in Major		3-4
Discovery Course		4
<b>Credits</b>		<b>15-16</b>

#### Fourth Year

##### Fall

PHYS 797	Senior Design Project	2
ECE 651	Electronic Design II	4
Elective in Major		3-4
Discovery Course		4
Free Elective		4
<b>Credits</b>		<b>17-18</b>

##### Spring

PHYS 797	Senior Design Project	2
ME 743	Satellite Systems, Dynamics, and Control	3-4
or PHYS 712	or Space Plasma Physics	
Elective in Major		4
Discovery Course		4
Free Elective		4
<b>Credits</b>		<b>17-18</b>
<b>Total Credits</b>		<b>129-132</b>

## Engineering Research Track

### First Year

Fall		Credits
PHYS 407H	Honors/General Physics I	4
MATH 425H	Honors/Calculus I	4
CHEM 405	Chemical Principles for Engineers	4
PHYS 400	Physics Seminar I	1
Discovery Course		4
<b>Credits</b>		<b>17</b>

### Spring

PHYS 408H	Honors/General Physics II	4
MATH 426H	Honors/Calculus II	4
IAM 550	Introduction to Engineering Computing	4
ENGL 401	First-Year Writing	4
<b>Credits</b>		<b>16</b>

### Second Year

#### Fall

PHYS 505	General Physics III	3
PHYS 506	General Physics III Laboratory	1
MATH 528	Multidimensional Calculus	4
ECE 541	Electric Circuits	4
Discovery Course		4
<b>Credits</b>		<b>16</b>

#### Spring

PHYS 615	Classical Mechanics and Mathematical Physics I	4
MATH 527	Differential Equations with Linear Algebra	4
ECE 548	Electronic Design I	4
Discovery Course		4
<b>Credits</b>		<b>16</b>

### Third Year

#### Fall

PHYS 508	Thermodynamics and Statistical Mechanics	4
ECE 651	Electronic Design II	4
PHYS 616	Classical Mechanics and Mathematical Physics II	4
Discovery Course		4
<b>Credits</b>		<b>16</b>

#### Spring

PHYS 703	Electricity and Magnetism I	4
ECE 543	Introduction to Digital Systems	4
Elective in Major		3-4
Discovery Course		4
<b>Credits</b>		<b>15-16</b>

### Fourth Year

#### Fall

PHYS 797	Senior Design Project	2
PHYS 704 or PHYS 708	Electricity and Magnetism II or Optics	4
Elective in Major		3-4
Free Elective		4

Discovery Course		4
<b>Credits</b>		<b>17-18</b>
<b>Spring</b>		
PHYS 797	Senior Design Project	2
Elective in Major		3-4
Elective in Major		3-4
Free Elective		4
Discovery Course		4
<b>Credits</b>		<b>16-18</b>
<b>Total Credits</b>		<b>129-133</b>

## Student Learning Outcomes

### Program Learning Outcomes

Students are expected to achieve the outcomes below upon graduation.

- Students will master the fundamentals of a broad set of physics subjects (e.g., mechanics, electricity and magnetism, quantum mechanics, thermodynamics, optics).
- Students will have a solid understanding of mathematics (e.g., calculus, differential equations, linear algebra).
- Students will be able to solve physics and engineering problems using computational methods.
- Students will have excellent knowledge of the principles and practice of their chosen engineering disciplines.
- Students will be able to use physical principles to design systems, apparatuses, experiments or models; collect and analyze data; and develop conclusions.
- Students will be able to identify and solve complex engineering and physics problems by applying physical principles and mathematical tools.
- Students will be able to communicate technical content effectively to a range of audiences.