MAJOR IN PHYSICS

The Physics major is divided into several concentrations and one track designed to give the student the greatest possible flexibility in preparation for graduate study in physics, materials science astrophysics, medicine, engineering, or other related fields, and for professional practice as a physicist in industrial, governmental, or institutional laboratories.

To provide students a broad and solid base in physics and also to provide the flexibility which enables students to take courses in areas where physics can be applied, all Physics majors take a core set of physics courses, including a three-course sequence in fundamental classical physics and courses in computational methods, modern physics, and laboratory techniques. The junior and senior physics courses treat classical and modern physics in greater depth. In addition to physics courses, all majors are required to complete courses in mathematics, chemistry, and computer science.

It is recommended that those who intend to pursue graduate studies in physics or astrophysics, take the General Physics Concentration or the Astrophysics Concentration, as well as additional physics electives and mathematics courses. Those who intend to participate in applied research and development in industrial or government laboratories are encouraged to take Applied Physics Concentration. Those who are interested in pursuing a degree in an engineering field at another institution while earning a physics degree from Towson University along the way, should select the Engineering Dual Degree Track.

Students will be assigned an adviser in the Department of Physics, Astronomy, and Geosciences who will assist them in selecting elective courses within their program to best meet their career goals.

Requirements

Requirements for the Physics Major

All Physics majors must take these required courses (34 units of Physics courses and 8 units of non-Physics courses) in addition to the requirements specified by their chosen concentration or track (see below). All courses that count toward the major must be completed with a grade equivalent of 2.00 or higher.

Code	Title	Units
Required Physics Courses		
PHYS 185	INTRODUCTORY SEMINAR IN PHYSICS	1
Select one of the following sequences:		8
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 HONORS GENERAL PHYSICS II CALCULUS-BASED	
PHYS 243	GENERAL PHYSICS III	4
PHYS 305	COMPUTERS IN PHYSICS	4
PHYS 307	INTRODUCTORY MATHEMATICAL PHYSICS	3
PHYS 311	MODERN PHYSICS I	3
PHYS 341	INTERMEDIATE PHYSICS LABORATORY	3
PHYS 351	MECHANICS	4
PHYS 354	ELECTRICITY AND MAGNETISM	4
Required Non-Physics Courses		
MATH 273	CALCULUS I	4
MATH 274	CALCULUS II	4
Total Units		**42**

General Physics Concentration

The common physics and non-physics requirements must be completed, as well as the following courses. All required courses in this concentration must be completed with a grade equivalent of 2.00 or higher.

Code	Title	Units
Advanced Physics Courses		
EPHY 442	MATERIALS CHARACTERIZATION & INSTRUMENTATION LABORATORY	3
PHYS 312	MODERN PHYSICS II	3
PHYS 352	THERMODYNAMICS AND KINETIC THEORY	3
PHYS 385	PHYSICS SEMINAR	1
PHYS 455	INTRODUCTORY QUANTUM MECHANICS	3
PHYS 486	PHYSICS SEMINAR II	1
Non-Physics Courses		
CHEM 131 & 131L	GENERAL CHEMISTRY I LECTURE and GENERAL CHEMISTRY I LABORATORY	4
COSC 175	GEN COMPUTER SCI	4
MATH 275	CALCULUS III	4
MATH 374	DIFFERENTIAL EQUATIONS	3
Physics/Engineering Physics/Astrophysics Upper-Level Electives [1]		**9**
ASTR 452	HIGH ENERGY ASTROPHYSICS	
EPHY 335	ANALOG ELECTRONICS	
EPHY 337	DIGITAL ELECTRONICS	
PHYS 361	OPTICS FUNDAMENTALS	
PHYS 411	GRAVITATION, RELATIVITY, AND COSMOLOGY	
PHYS 457	SOLID STATE PHYSICS	
PHYS 458	MAGNETISM AND MAGNETIC MATERIALS	
PHYS 459	NUCLEAR AND PARTICLE PHYSICS	
Total Units		**38**

[1] A full list of allowed PHYS, EPHY, and ASTR electives for the concentration can be found on the Elective tab. A maximum of 3 units may be fulfilled with independent-format courses.

Applied & Engineering Physics Concentration

The common physics and non-physics requirements must be completed, as well as the following courses. All required courses in this concentration must be completed with a grade equivalent of 2.00 or higher.

Code	Title	Units
Required Physics and Engineering Physics Courses		
EPHY 155	ENGINEERING DESIGN FOR SOCIETY	3
EPHY 335	ANALOG ELECTRONICS	4
EPHY 337	DIGITAL ELECTRONICS	4

EPHY 373	ENGINEERING DESIGN IN PHYSICS	3
EPHY 385	ENGINEERING PHYSICS SEMINAR	1
EPHY 442	MATERIALS CHARACTERIZATION & INSTRUMENTATION LABORATORY	3
PHYS 312	MODERN PHYSICS II	3
PHYS 361	OPTICS FUNDAMENTALS	4
PHYS 486	PHYSICS SEMINAR II	1
Non-Physics Courses		
CHEM 131 & 131L	GENERAL CHEMISTRY I LECTURE and GENERAL CHEMISTRY I LABORATORY	4
COSC 175	GEN COMPUTER SCI	4
MATH 275	CALCULUS III	4
MATH 374	DIFFERENTIAL EQUATIONS	3
Physics/Engineering Physics Upper-Level Electives [1]		**6**
EPHY 381	OPTICAL SYSTEMS DESIGN	
EPHY 423	FLUID DYNAMICS	
PHYS 352	THERMODYNAMICS AND KINETIC THEORY	
PHYS 455	INTRODUCTORY QUANTUM MECHANICS	
PHYS 457	SOLID STATE PHYSICS	
PHYS 458	MAGNETISM AND MAGNETIC MATERIALS	
Total Units		**47**

[1] A full list of allowed PHYS, EPHY, and ASTR electives for the concentration can be found on the Elective tab. A maximum of 3 units may be fulfilled with independent-format courses.

Astrophysics Concentration

The common physics and non-physics requirements must be completed, as well as the following courses. All required courses in this concentration must be completed with a grade equivalent of 2.00 or higher.

Code	Title	Units
Physics and Astrophysics Courses		
ASTR 261	INTRODUCTION TO ASTROPHYSICS	4
ASTR 303	ASTROPHYSICAL TECHNIQUES	3
ASTR 331	STELLAR ASTROPHYSICS	3
ASTR 385	ASTROPHYSICS SEMINAR	1
ASTR 432	GALAXIES AND COSMOLOGY	3
PHYS 312	MODERN PHYSICS II	3
PHYS 486	PHYSICS SEMINAR II	1
Non-Physics Courses		
CHEM 131 & 131L	GENERAL CHEMISTRY I LECTURE and GENERAL CHEMISTRY I LABORATORY	4
COSC 175	GEN COMPUTER SCI	4
MATH 275	CALCULUS III	4
MATH 374	DIFFERENTIAL EQUATIONS	3
Physics/Engineering Physics/Astrophysics Upper-Level Electives [1]		**6**
ASTR 371	PLANETARY ASTRONOMY	
ASTR 452	HIGH ENERGY ASTROPHYSICS	
EPHY 335	ANALOG ELECTRONICS	
EPHY 337	DIGITAL ELECTRONICS	
PHYS 352	THERMODYNAMICS AND KINETIC THEORY	
PHYS 361	OPTICS FUNDAMENTALS	
PHYS 411	GRAVITATION, RELATIVITY, AND COSMOLOGY	
PHYS 455	INTRODUCTORY QUANTUM MECHANICS	
PHYS 459	NUCLEAR AND PARTICLE PHYSICS	
Total Units		**39**

[1] A full list of allowed PHYS, EPHY, and ASTR electives for the concentration can be found on the Elective tab. A maximum of 3 units may be fulfilled with independent-format courses.

Engineering Dual Degree Track

This track is only available to those students participating in the Dual Degree Program. The common physics and non-physics requirements must be completed, as well as the following courses. All required courses in this track must be completed with a grade equivalent of 2.00 or higher. Please see the Department of Physics, Astronomy and Geosciences for further details.

Code	Title	Units
Advanced Physics Courses		
PHYS 385	PHYSICS SEMINAR	1
Minimum two upper (300-400) level engineering courses		8
Non-Physics Courses		
CHEM 131 & 131L	GENERAL CHEMISTRY I LECTURE and GENERAL CHEMISTRY I LABORATORY	4
CHEM 132 & 132L	GENERAL CHEMISTRY II LECTURE and GENERAL CHEMISTRY II LABORATORY	4
MATH 275	CALCULUS III	4
MATH 374	DIFFERENTIAL EQUATIONS	3
Total Units		**24**

Electives

List of Physics Electives

Code	Title	Units
General Physics Concentration		
ASTR 303	ASTROPHYSICAL TECHNIQUES	3
ASTR 331	STELLAR ASTROPHYSICS	3
ASTR 371	PLANETARY ASTRONOMY	3
ASTR 432	GALAXIES AND COSMOLOGY	3
ASTR 452	HIGH ENERGY ASTROPHYSICS [2]	3
ASTR 491	DIRECTED READINGS IN ASTROPHYSICS	1-4
ASTR 495	RESEARCH PROBLEMS IN ASTROPHYSICS	1-4
ASTR 499	HONORS THESIS IN ASTROPHYSICS	1-4
EPHY 373	ENGINEERING DESIGN IN PHYSICS	3
EPHY 381	OPTICAL SYSTEMS DESIGN	4
EPHY 423	FLUID DYNAMICS [2]	3
EPHY 495	RESEARCH PROBLEMS IN ENGINEERING PHYSICS	1-4
HONR 495	HONORS DIRECTED READINGS [1]	1-6
HONR 497	HONORS INDEPENDENT INVESTIGATION [1]	1-6
HONR 499	HONORS THESIS [1]	3-6
PHYS 361	OPTICS FUNDAMENTALS [2]	4

PHYS 395	RESEARCH PROBLEMS IN PHYSICS	1-4
PHYS 411	GRAVITATION, RELATIVITY, AND COSMOLOGY [2]	3
PHYS 457	SOLID STATE PHYSICS [2]	3
PHYS 458	MAGNETISM AND MAGNETIC MATERIALS [2]	3
PHYS 459	NUCLEAR AND PARTICLE PHYSICS [2]	3
PHYS 470	SPECIAL TOPICS IN PHYSICS	1-4
PHYS 490	INDEPENDENT STUDY IN PHYSICS	1-4
PHYS 491	DIRECTED READINGS IN PHYSICS	1-4
PHYS 495	RESEARCH PROBLEMS IN PHYSICS	1-4
PHYS 497	CAPSTONE RESEARCH IN PHYSICS	1-4
PHYS 499	HONORS THESIS IN PHYSICS	1-4

1. Also accepted, if done under the supervision of a physics faculty member
2. Suggested electives

Code	Title	Units
Applied and Engineering Physics Concentration		
ASTR 303	ASTROPHYSICAL TECHNIQUES	3
ASTR 331	STELLAR ASTROPHYSICS	3
ASTR 371	PLANETARY ASTRONOMY	3
ASTR 432	GALAXIES AND COSMOLOGY	3
ASTR 452	HIGH ENERGY ASTROPHYSICS	3
ASTR 491	DIRECTED READINGS IN ASTROPHYSICS	1-4
ASTR 495	RESEARCH PROBLEMS IN ASTROPHYSICS	1-4
ASTR 499	HONORS THESIS IN ASTROPHYSICS	1-4
EPHY 335	ANALOG ELECTRONICS [2]	4
EPHY 337	DIGITAL ELECTRONICS [2]	4
EPHY 373	ENGINEERING DESIGN IN PHYSICS [2]	3
EPHY 381	OPTICAL SYSTEMS DESIGN [2]	4
EPHY 423	FLUID DYNAMICS [2]	3
EPHY 495	RESEARCH PROBLEMS IN ENGINEERING PHYSICS	1-4
HONR 495	HONORS DIRECTED READINGS [1]	1-6
HONR 497	HONORS INDEPENDENT INVESTIGATION [1]	1-6
HONR 499	HONORS THESIS [1]	3-6
PHYS 352	THERMODYNAMICS AND KINETIC THEORY [2]	3
PHYS 395	RESEARCH PROBLEMS IN PHYSICS	1-4
PHYS 411	GRAVITATION, RELATIVITY, AND COSMOLOGY	3
PHYS 455	INTRODUCTORY QUANTUM MECHANICS [2]	3
PHYS 457	SOLID STATE PHYSICS [2]	3
PHYS 458	MAGNETISM AND MAGNETIC MATERIALS [2]	3
PHYS 459	NUCLEAR AND PARTICLE PHYSICS	3
PHYS 470	SPECIAL TOPICS IN PHYSICS	1-4
PHYS 490	INDEPENDENT STUDY IN PHYSICS	1-4
PHYS 491	DIRECTED READINGS IN PHYSICS	1-4
PHYS 495	RESEARCH PROBLEMS IN PHYSICS	1-4
PHYS 497	CAPSTONE RESEARCH IN PHYSICS	1-4
PHYS 499	HONORS THESIS IN PHYSICS	1-4

1. Also accepted, if done under the supervision of a physics faculty member
2. Suggested electives

Code	Title	Units
Astrophysics Concentration		
ASTR 371	PLANETARY ASTRONOMY [2]	3
ASTR 452	HIGH ENERGY ASTROPHYSICS [2]	3
ASTR 491	DIRECTED READINGS IN ASTROPHYSICS	1-4
ASTR 495	RESEARCH PROBLEMS IN ASTROPHYSICS	1-4
ASTR 499	HONORS THESIS IN ASTROPHYSICS	1-4
EPHY 335	ANALOG ELECTRONICS [2]	4
EPHY 337	DIGITAL ELECTRONICS [2]	4
EPHY 373	ENGINEERING DESIGN IN PHYSICS	3
EPHY 381	OPTICAL SYSTEMS DESIGN [2]	4
EPHY 423	FLUID DYNAMICS [2]	3
EPHY 495	RESEARCH PROBLEMS IN ENGINEERING PHYSICS	1-4
HONR 495	HONORS DIRECTED READINGS [1]	1-6
HONR 497	HONORS INDEPENDENT INVESTIGATION [1]	1-6
HONR 499	HONORS THESIS [1]	3-6
PHYS 352	THERMODYNAMICS AND KINETIC THEORY [2]	3
PHYS 361	OPTICS FUNDAMENTALS [2]	4
PHYS 395	RESEARCH PROBLEMS IN PHYSICS	1-4
PHYS 411	GRAVITATION, RELATIVITY, AND COSMOLOGY [2]	3
PHYS 455	INTRODUCTORY QUANTUM MECHANICS [2]	3
PHYS 457	SOLID STATE PHYSICS	3
PHYS 458	MAGNETISM AND MAGNETIC MATERIALS	3
PHYS 459	NUCLEAR AND PARTICLE PHYSICS [2]	3
PHYS 470	SPECIAL TOPICS IN PHYSICS	1-4
PHYS 490	INDEPENDENT STUDY IN PHYSICS	1-4
PHYS 491	DIRECTED READINGS IN PHYSICS	1-4
PHYS 495	RESEARCH PROBLEMS IN PHYSICS	1-4
PHYS 497	CAPSTONE RESEARCH IN PHYSICS	1-4
PHYS 499	HONORS THESIS IN PHYSICS	1-4

1. Also accepted, if done under the supervision of a physics faculty member
2. Suggested electives

Four-Year Plan of Study

By its very nature, physics is more hierarchical in its course structure than typical humanities or social science disciplines. Therefore, many courses depend heavily on prerequisite courses (such as calculus and general physics). Any time that is required to prepare for calculus, such as taking MATH 119, must be added to the four-year minimum. Normally, progress in mathematics and general physics is the pacesetter.

General Concentration in Physics Sample Four-Year Plan

The selected course sequence below is an example of the simplest path to degree completion. Based on course schedules, student needs, and student choice, individual plans may vary. Students should consult with their adviser to make the most appropriate elective choices and to ensure that they have completed the required number of units (120) to graduate.

Freshman

Term 1	Units Term 2	Units
CHEM 131 & 131L (Core 7)	4 MATH 274	4
MATH 273 (Core 3)	4 PHYS 241 or 251 (Core 8)	4
PHYS 185	1 COSC 175	4
Core 1 (or Core 2)	3 Core 2 (or Core 1)	3
Core 4	3	
	15	**15**

Sophomore

Term 1	Units Term 2	Units
MATH 275	4 MATH 374	3
PHYS 242 or 252	4 PHYS 243	4
PHYS 305	4 PHYS 307	3
Core 5	3 Core 6	3
	15	**13**

Junior

Term 1	Units Term 2	Units
PHYS 311	3 EPHY 442	3
PHYS 341	3 PHYS 312	3
PHYS 351	4 PHYS 354	4
Core 9	3 PHYS 385	1
Core 10	3 Core 11	3
	Core 12	3
	16	**17**

Senior

Term 1	Units Term 2	Units
PHYS 455	3 PHYS 352	3
PHYS 486	1 PHYS Elective	3
PHYS Elective	3 PHYS Elective	3
Core 13	3 Core 14	3
Elective	3 Elective	1
Elective	3	
	16	**13**

Total Units 120

Applied and Engineering Concentration in Physics Sample Four-Year Plan

The selected course sequence below is an example of the simplest path to degree completion. Based on course schedules, student needs, and student choice, individual plans may vary. Students should consult with their adviser to make the most appropriate elective choices and to ensure that they have completed the required number of units (120) to graduate.

Freshman

Term 1	Units Term 2	Units
CHEM 131 & 131L (Core 7)	4 MATH 274	4
EPHY 155	3 PHYS 241 or 251 (Core 8)	4
MATH 273 (Core 3)	4 COSC 175	4
PHYS 185	1 Core 2 (or Core 1)	3
Core 1 (or Core 2)	3	
	15	**15**

Sophomore

Term 1	Units Term 2	Units
MATH 275	4 EPHY 373	3
PHYS 242 or 252	4 MATH 374	3
PHYS 305	4 PHYS 243	4
Core 5	3 PHYS 307	3
	Core 6	3
	15	**16**

Junior

Term 1	Units Term 2	Units
PHYS 311	3 EPHY 385	1
PHYS 341	3 EPHY 442	3
PHYS 351	4 PHYS 312	3
Core 9	3 PHYS 354	4
Core 10	3 Core 11	3
	Core 12	3
	16	**17**

Senior

Term 1	Units Term 2	Units
EPHY 337	4 EPHY 335	4
PHYS 361	4 PHYS Elective	3
PHYS 486	1 PHYS Elective	3
Core 13	3 Core 14	3
Elective	1	
	13	**13**

Total Units 120

Astrophysics Concentration Sample Four-Year Plan

The selected course sequence below is an example of the simplest path to degree completion. Based on course schedules, student needs, and student choice, individual plans may vary. Students should consult with their adviser to make the most appropriate elective choices and to ensure that they have completed the required number of units (120) to graduate.

Freshman

Term 1	Units Term 2	Units
COSC 175	4 CHEM 131 & 131L (Core 7)	4
MATH 273 (Core 3)	4 MATH 274	4
PHYS 185	1 PHYS 241 or 251 (Core 8)	4
Core 1 (or Core 2)	3 Core 2 (or Core 1)	3
Core 4	3	
	15	**15**

Sophomore

Term 1	Units	Term 2	Units
ASTR 261	4	MATH 374	3
MATH 275	4	PHYS 243	4
PHYS 242 or 252	4	PHYS 307	3
PHYS 305	4	Core 5	3
		Core 6	3
	16		**16**

Junior

Term 1	Units	Term 2	Units
PHYS 311	3	ASTR 303	3
PHYS 341	3	ASTR 331	3
PHYS 351	4	ASTR 385	1
Core 9	3	PHYS 312	3
Core 10	3	PHYS 354	4
	16		**14**

Senior

Term 1	Units	Term 2	Units
ASTR 432	3	PHYS/ASTR Elective	3
PHYS 486	1	Elective	3
PHYS/ASTR Elective	3	Core 12	3
Elective	3	Core 13	3
Core 11	3	Core 14	3
	13		**15**

Total Units 120

Learning Outcomes

1. Demonstrate an understanding of fundamental principles of physics and major concepts in a student's chosen track and be able to apply these principles to solve quantitative problems.
2. Demonstrate an understanding of the nature of scientific research.
3. Communicate scientific information effectively in both oral and written formats.
4. Utilize and apply technology to investigate experimental and theoretical scientific problems.