

Physics (PHY)

The Department of Physics offers both a major and minor course of study. Students interested in the physics major can tailor-make their curriculum to meet their post-graduate needs. Wofford physics majors often go on to graduate school in physics or engineering, medical school, law school, or enter successful careers in the private sector. All students majoring in physics complete a core set of courses rounded out by several electives in areas of personal interest. In addition, students may enhance their physics major by participating in the Pre-Engineering Program (<http://catalog.wofford.edu/archive/2024-2025/degree-program-requirements/preprofessional-programs/>), the Emphasis in Computational Science (<http://catalog.wofford.edu/archive/2024-2025/courses-programs-departments/computer-science/#emphasisrequirements>), or the Energy Studies Program (<http://catalog.wofford.edu/archive/2024-2025/courses-programs-departments/energy-studies/>).

Honors Courses

The Department of Physics encourages its students to undertake honors work. For further information, students should review the section on Honors Courses (<http://catalog.wofford.edu/archive/2024-2025/academics/academic-honors/honors-courses/>) in this *Catalog*.

Chair

Carolyn M. Martsberger

Professors

Solmaz Bastani
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Requirements for the Major in Physics

Course	Title	Hours
Foundational Courses ¹		24
CHEM 123	General Chemistry I (with lab)	
CHEM 124	General Chemistry II (with lab)	
MATH 181	Calculus I	
MATH 182	Calculus II	
MATH 212	Vector Calculus	
MATH 240	Ordinary Differential Equations	
PHY 141	Physics for Science & Engineering I (with lab) ²	
Required Major Courses		20
PHY 142	Physics for Science & Engineering II (with lab) ²	
PHY 206	Electronics (with lab)	
PHY 211	Modern Physics	
PHY 221	Mechanics	
PHY 311	Contemporary Physics	
PHY 331	Electricity and Magnetism	
Advanced Labs		2
Select two courses from the following:		
PHY 371	Advanced Laboratory I	
PHY 372	Advanced Laboratory II	

PHY 373	Advanced Laboratory III	
PHY 374	Advanced Laboratory IV	
Electives		9
Select 9 credit hours in Physics (PHY) at the 200- level or above		
Total Hours		55

¹ Foundational courses must be completed with a grade of 'C' or better.

² PHY 141 has a pre-requisite of MATH 181 and PHY 142 has a pre-requisite of MATH 182.

Requirements for the Minor in Physics

Course	Title	Hours
Required Minor Courses		14
MATH 181	Calculus I	
MATH 182	Calculus II	
PHY 141	Physics for Science & Engineering I (with lab) ¹	
PHY 142	Physics for Science & Engineering II (with lab) ¹	
Electives		9
Select 9 credit hours in Physics (PHY) at the 200- level or above (excluding the Advanced Lab series, PHY 371-374)		
Total Hours		23

¹ PHY 141 has a pre-requisite of MATH 181 and PHY 142 has a pre-requisite of MATH 182.

PHY 103. Physics: Science in Context. 3 Hours.

Students will explore the features that make science an important way of understanding the natural world. This exploration will focus on science-based topics and issues important in our contemporary world.

PHY 104. Physics: Concepts & Methods (with lab). 4 Hours.

A study of topics selected to introduce students to basic concepts in physics and/or astronomy, and to the scientific method.

PHY 108. Astronomy (with lab). 4 Hours.

A survey course in astronomy which includes observational astronomy, the solar system, stellar structure and evolution, galaxies, cosmological models, and a general introduction to the scientific method.

PHY 110. Introduction to Engineering Science. 1 Hour.

An analysis of introductory level engineering projects. Students will engage in practices (design, build, test) that form the critical foundations in the engineering profession which includes professional and societal issues related to engineering science and software tools such as spreadsheets and CAD design.

PHY 112. First Year Physics Seminar. 1 Hour.

This course introduces the physics discipline and provides foundational material for the physics major. Students will be engaged in discussions on the nature of physics as a college major, as the basis for graduate work and as a potential career path. In addition, the course will focus on efficient study skills, problem solving methods and mathematical techniques that enhance student performance in later physics coursework.

Corequisite: PHY 141.

PHY 121. General Physics I (with lab). 4 Hours.

A study of mechanics, heat, light, sound, electricity, magnetism, and modern physics using algebra, trigonometry, and limits.

PHY 122. General Physics II (with lab). 4 Hours.

A continuation of PHY 121 in the study of mechanics, heat, light, sound, electricity, magnetism, and modern physics using algebra, trigonometry, and limits.

Prerequisite: PHY 121 with a minimum grade of D.

PHY 141. Physics for Science & Engineering I (with lab). 4 Hours.

A calculus-based study of mechanics, heat, light, sound, electricity, magnetism, and modern physics suitable for those majoring in areas such as physics or chemistry and for those in pre-engineering. Students may take MATH 181 concurrently.

Prerequisite: MATH 181 with a minimum grade of C.

PHY 142. Physics for Science & Engineering II (with lab). 4 Hours.

A continuation of PHY 141 in a calculus-based study of mechanics, heat, light, sound, electricity, magnetism, and modern physics suitable for majors in areas such as physics or chemistry and programs in pre-engineering.

Prerequisite: PHY 141 with a minimum grade of C and MATH 181 with a minimum grade of C.

PHY 202. Energy. 3 Hours.

An introduction to the scientific framework behind energy and how this fundamental property of our universe applies to a variety of environmental issues. Students will learn the language scientists use to discuss energy, gain the skills to understand the complexities of energy production from a scientific lens, and learn how these aspects directly impact our community.

Prerequisite: PHY 121 with a minimum grade of C or PHY 141 with a minimum grade of C or CHEM 123 with a minimum grade of C or ENVS 150 with a minimum grade of C.

PHY 204. Medical Physics. 3 Hours.

An introduction to the basic principles of medical physics, principles of physics for medical imaging and the applications of medical physics equipment for diagnosis and treatment of disease. Topics covered will include but not limited to imaging metrics, ionizing radiation and radiation safety, radiation therapy, computed tomography, ultra-sound, and magnetic resonance imaging.

Prerequisite: (PHY 121 with a minimum grade of C and PHY 122 with a minimum grade of C) or (PHY 141 with a minimum grade of C and PHY 142 with a minimum grade of C).

PHY 206. Electronics (with lab). 4 Hours.

An elementary course in the principles of electronic devices, circuits, and instruments. It is intended for students of science who desire some understanding of the electronic instrumentation they use.

Prerequisite: PHY 122 with a minimum grade of C or PHY 142 with a minimum grade of C.

PHY 208. Introduction to Astrophysics. 3 Hours.

Explore the major topics in planetary and stellar astrophysics, with an emphasis on the physical properties behind each astrophysical phenomenon.

Prerequisite: MATH 181 with a minimum grade of C and PHY 142 with a minimum grade of C.

PHY 211. Modern Physics. 3 Hours.

Examine the major developments in physics since 1895, with emphasis on special relativity, the atom, the nucleus, and 'elementary particles'. MATH 210 or 212 may be taken concurrently.

Prerequisite: PHY 142 with a minimum grade of C and (MATH 210 with a minimum grade of C or MATH 212 with a minimum grade of C).

PHY 215. Mathematical Methods in Physics. 3 Hours.

A reimagining of calculus, vector calculus, linear algebra and ordinary differential equations through the lens of physical scenarios originating in mechanics, thermodynamics, fluid dynamics, electricity, magnetism, optics and modern physics. Emphasis will be equally placed on both analytical and numerical approaches to the physical situations considered.

Prerequisite: PHY 211 with a minimum grade of D.

PHY 221. Mechanics. 3 Hours.

Classical Newtonian analytical mechanics. Newton's laws are used together with vector analysis to analyze problems in statics and dynamics, with emphasis upon the latter. Problem-solving situations include rectilinear particle dynamics (especially oscillators), general particle dynamics, non-inertial reference frames, central forces, systems of particles, and mechanics of rigid bodies.

Prerequisite: (MATH 210 with a minimum grade of C or MATH 212 with a minimum grade of C) and PHY 141 with a minimum grade of C.

PHY 231. Thermodynamics. 3 Hours.

Development and application of basic concepts and methods useful in understanding thermal phenomena. The approach is divided into three basic branches: classical thermodynamics, kinetic theory, and statistical mechanics.

Prerequisite: (MATH 210 with a minimum grade of C or MATH 212 with a minimum grade of C) and PHY 142 with a minimum grade of C.

PHY 250. Introduction to Research. 1 Hour.

An opportunity to learn the elements of research in physics by participating in one of the department's existing research projects. A maximum of four semester hours may be earned in this way. Instructor permission required.

PHY 280. Selected Topics in Physics. 1 to 4 Hours.

An opportunity to participate in a special intermediate course offering. Students planning to take this course should consult with the instructor during the previous semester.

PHY 311. Contemporary Physics. 3 Hours.

The general physics background of the student serves as a tool for comprehending readings taken from professional physics publications on topics with significant relationship to life outside the laboratory. The course demands substantial progress in technical writing, technical speaking, and technical literature search skills as measured against normal professional requirements in the field.

Prerequisite: PHY 331 with a minimum grade of C.

PHY 321. Optics. 3 Hours.

The presentation and demonstration of the proper use of several alternative models of the electromagnetic spectrum, including the ray model, the wave model, and the quantum model.

Prerequisite: (MATH 210 with a minimum grade of C or MATH 212 with a minimum grade of C) and PHY 142 with a minimum grade of C.

PHY 331. Electricity and Magnetism. 3 Hours.

Explore physics and mathematics of the classical description of the electromagnetic field including the experimental and theoretical background for each of Maxwell's equations in both vacuum and matter.

Prerequisite: PHY 142 with a minimum grade of C and (MATH 210 with a minimum grade of C or MATH 212 with a minimum grade of C).

PHY 341. Quantum Physics. 3 Hours.

The mathematical structure and physical meaning of quantum mechanics, as a fundamental theory of physics, are developed at the intermediate level. Problems are drawn from areas such as the structure of nuclei, atoms, molecules, and crystals.

Prerequisite: (MATH 210 with a minimum grade of C or MATH 212 with a minimum grade of C) and PHY 211 with a minimum grade of C.

PHY 371. Advanced Laboratory I. 1 Hour.

The first in a series of four semester-long courses focused on experiments and projects that develop the basic experimental skills that a student majoring in physics should have. These include use of standard physics instrumentation, some familiarity with shop tools, laboratory record-keeping and report-writing, and knowledge of ways in which basic physical quantities are measured. This course is the pre-requisite for all advanced laboratory courses. Students may take PHY 211 concurrently.

Prerequisite: PHY 142 with a minimum grade of C.

PHY 372. Advanced Laboratory II. 1 Hour.

One in a series of four semester-long courses focused on experiments and projects that develop the basic experimental skills that a student majoring in physics should have. These include use of standard physics instrumentation, some familiarity with shop tools, laboratory record-keeping and report-writing, and knowledge of ways in which basic physical quantities are measured.

Prerequisite: PHY 371 with a minimum grade of C.

PHY 373. Advanced Laboratory III. 1 Hour.

One in a series of four semester-long courses focused on experiments and projects that develop the basic experimental skills that a student majoring in physics should have. These include use of standard physics instrumentation, some familiarity with shop tools, laboratory record-keeping and report-writing, and knowledge of ways in which basic physical quantities are measured.

Prerequisite: PHY 371 with a minimum grade of C.

PHY 374. Advanced Laboratory IV. 1 Hour.

One in a series of four semester long-courses focused on experiments and projects that develop the basic experimental skills that a student majoring in physics should have. These include use of standard physics instrumentation, some familiarity with shop tools, laboratory record-keeping and report-writing, and knowledge of ways in which basic physical quantities are measured.

Prerequisite: PHY 371 with a minimum grade of C.

PHY 441. Advanced Mechanics. 3 Hours.

An advanced treatment of topics studied in PHY 221, Mechanics, including Lagrangian mechanics, coupled oscillators, numerical calculations, and other selected topics.

Prerequisite: MATH 240 with a minimum grade of C- and PHY 221 with a minimum grade of C-.

PHY 442. Advanced Electricity and Magnetism. 3 Hours.

An advanced treatment of topics studied in PHY 331, Electricity and Magnetism, including applications of Maxwell's equations, radiation theory, electrodynamics, and other selected topics.

Prerequisite: MATH 240 with a minimum grade of C- and PHY 331 with a minimum grade of C-.

PHY 451. Research I. 2 Hours.

Active participation in a research project selected from one of the department's existing projects, or developed earlier in Physics 250 or in coordination with a faculty member. The student is expected to maintain a regular weekly schedule of lab and library work in connection with this project, keep a notebook in standard format, and write a detailed research report to be retained by the faculty member. Permission of instructor required.

PHY 452. Research II. 2 Hours.

Active participation in a research project selected from one of the department's existing projects, or developed earlier in Physics 250 or in coordination with a faculty member. The student is expected to maintain a regular weekly schedule of lab and library work in connection with this project, keep a notebook in standard format, and write a detailed research report to be retained by the faculty member. Permission of instructor required.

PHY 470. Independent Study in Physics. 1 to 3 Hours.

Study of a specific topic in physics under the direction of a departmental faculty member. The readings, program of research, and written work to be undertaken by the student will be determined in consultation with the instructor.

PHY 480. Advanced Topics in Physics. 1 to 4 Hours.

An opportunity to participate in a special advanced course offering. Students planning to take this course should consult with the instructor during the previous semester. Permission of instructor required.

PHY 500. Honors Course. 3 Hours.

At the discretion of the faculty, students may undertake a six-hour independent course of study in the senior year in order to broaden their educational experience within their major area of study. Students must meet specific GPA standards and arrange a faculty sponsor. The honors course criteria are outlined in the Academic Honors portion of the catalog.