

# PHYSICS (PHY)

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## Courses and Descriptions

### PHY 100 Principles of Physics I 3 Credits

Introductory noncalculus physics with applications for pre-professional, biology, and geological, environmental and marine sciences majors. Classical mechanics, energy, mechanical waves, fluid statics and dynamics, thermodynamics. Elements of modern physics are interwoven with those of classical physics from the beginning. Not open to chemistry, physics, or mathematics majors. Three hours of lecture per week. Prerequisite(s): MTH 105, MTH 210, MTH 211 or MTH 212. **Corequisite(s):** PHY 100L.

### PHY 100L Principles of Physics I Lab 1 Credits

For students concurrently taking PHY 100. One three-hour lab per week. **Corequisite(s):** PHY 100.

### PHY 101 Principles of Physics II 3 Credits

Continuation of Physics 100. Electrostatics, electricity, and magnetism; DC and AC circuits, physical and geometrical optics, introduction to elementary particle and quantum physics. Three hours of lecture per week. Prerequisite(s): PHY 100. **Corequisite(s):** PHY 101L.

### PHY 101L Principles of Physics II Lab 1 Credits

For students concurrently taking Physics 101. One three-hour lab per week. **Corequisite(s):** PHY 101.

### PHY 103 Science of Light and Color 3 Credits

An introduction to the science of light, color, and optics. Covers history of theories of light and vision, applications in art, photography, natural phenomena (rainbows, mirages, etc.), and modern technology, e.g., lasers and telecommunications. Many topics are illustrated by in-class demonstration experiments with lasers and other optical devices.

### PHY 104 Energy, the Environment & Man 3 Credits

The many vital roles played by energy in the universe at large, on the earth, and in the activities of man are examined, including the basic sources of energy, the impact upon the environment due to these processes and possible future sources. A high school course in physics or chemistry is desirable but not necessary.

### PHY 105 Matter, Forces, and Energy: A Exploration of Physics Concepts 4 Credits

An introduction to the basic principles of physics focusing on the concepts of matter, force, and energy. The course will study, in depth, simple physical systems chosen to emphasize the interconnection of these three basic concepts. It will explore the behavior of these simple physical systems using directed group exercises coordinated with hands-on laboratory activities. One three-hour lecture and one three-hour lab per week.

### PHY 105L Matter, Forces and Energy Lab 0 Credits

### PHY 180 Astronomy 3 Credits

Examines mankind's quest to understand the origin and form of the universe. Emphasis on the ideas of modern cosmology and their impact on our changing perception of our place in the universe, making use of information gleaned by simply looking at the night sky as well as post Apollo-era views of the solar system and the evolving universe as a whole.

### PHY 200 General Physics I 4 Credits

Introductory classical physics; Newtonian mechanics, including the conservation laws, wave motion, gravity, thermodynamics. Three hours of lecture and one three-hour lab per week. Prerequisite(s): MTH 210 or concurrent enrollment **Corequisite(s):** PHY 200L.

### PHY 200L General Physics I Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course. **Corequisite(s):** PHY 200.

### PHY 201 General Physics II 4 Credits

A continuation of the concepts developed in Physics 200. Electricity, electrical circuits, magnetism, Maxwell's equations. Light and optics, including lenses, interference, and diffraction. Three hours of lecture and one three-hour lab per week. Prerequisite(s): PHY 200, MTH 211 or concurrent enrollment. **Corequisite(s):** PHY 201L.

### PHY 201L General Physics II Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course. **Corequisite(s):** PHY 201.

### PHY 203 Introduction to Modern Physics 3 Credits

Covers space-time relativity, elementary particles, and basic quantum mechanics, including solutions of the Schrodinger wave equation. Applications of quantum theory in atomic, nuclear, and solid-state physics. **Prerequisite(s):** PHY 201 or permission of instructor.

### PHY 250 Scientific Computing 3 Credits

Introduces students to modern techniques and applications of scientific computing. Students will learn to write code in python, a popular, modern programming language used by scientists and industry around the world. They will also retrieve and analyze large datasets using SQL, a standard database language. Students will develop their own software and learn to manage it online using github, an online code repository.

### PHY 300 Mechanics 3 Credits

Kinematics and dynamics of particles and systems, analysis of harmonic oscillator systems, normal modes, Lagrangian and Hamiltonian dynamics and classical waves are studied. **Prerequisite(s):** PHY 201, MTH 250.

### PHY 305 Electricity and Magnetism 3 Credits

Electro- and magnetostatics, fields and potentials, and boundary value problems are covered. **Prerequisite(s):** PHY 201, MTH 250.

### PHY 310 Advanced Electricity and Magnetism 3 Credits

Maxwell's equations; electromagnetic waves in vacuum and in material media; radiation, propagation, reflection, and refraction. **Prerequisite(s):** PHY 305, MTH 308.

### PHY 315 Thermodynamics and Statistical Mechanics 3 Credits

Thermodynamic systems; the first and second laws of thermodynamics; entropy and thermodynamic potentials; distribution of molecular speeds; Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac distributions. **Prerequisite(s):** PHY 201.

**PHY 320 Quantum Mechanics 3 Credits**

Historical background; the Bohr Theory; the Schrodinger equation, its interpretation and applications; the uncertainty and exclusion principles; development of the formalism.

**Prerequisite(s):** PHY 300.

**PHY 330 Basic Electronics 3 Credits**

An experimental study of devices and circuits in analog and digital electronics. No previous experience with electronic circuits is assumed; introductory topics including signal acquisition, computer interfaces, and analog/digital signal processing will be covered. One hour of lecture plus two three-hour labs per week.

**Prerequisite(s):** PHY 201 or permission of instructor.

**PHY 350 Advanced Laboratory 2 Credits**

Experiments in atomic and nuclear physics, electricity and magnetism, and physical optics. Students have the opportunity to work intensively on a particular experiment. Minimum of five to six hours per week.

**PHY 400 Atomic Physics 3 Credits**

Quantum mechanics and the one-electron atom; atomic structure and optical spectra of multi-electron atoms. Quantum statistics, band theory of solids.

**Prerequisite(s):** PHY 320.

**PHY 405 Fundamentals of Nuclear Physics 3 Credits**

Nuclear mass and size; nuclear forces and some models of the nucleus; radioactivity and detection; subnuclear particles and resonances.

**Prerequisite(s):** PHY 320.

**PHY 415 Physical Optics 3 Credits**

Waves and the superposition principle; interference, Fraunhofer and Fresnel diffraction; electromagnetic nature of light; absorption and scattering; dispersion; polarization.

**Prerequisite(s):** PHY 201, MTH 250.

**PHY 416 Modern Experimental Optics Lab 1 Credits**

A laboratory course in geometrical and physical (wave) optics, designed to supplement the material presented in PHY 415. Serves as an introduction to the optical equipment and techniques that are employed in laboratory research. A series of experiments cover the topics of polarization, interference, image formation, Fourier optics and lasers, and optical spectroscopy.

**Prerequisite(s):** PHY 201.

**PHY 450 Topics in Modern Physics 3 Credits**

A selected topic of contemporary interest in physics, e.g., general relativity and gravity waves, is studied. Emphasis on current journal literature and research. May be taken more than once with departmental approval. An excellent introduction to independent research in one area of physics.

**Prerequisite(s):** PHY 201.

**PHY 490 Independent Study: Research and Creative Expression 1-4 Credits**

Immerses the student in laboratory research. The student learns to organize material, use the literature, make precise measurements, and obtain reproducible data. If possible, the student will publish the results or present them at a scientific meeting.

**PHY 491 Internship in Physics 1-4 Credits**

A supervised research experience in an approved organization where qualified students gain real-world knowledge and utilize their academic training in a professional environment. Placement may be in private, public, non-profit, or governmental organizations under the guidance of a mentor. The mentor and student will have regular consultation with the departmental internship coordinator to assess the student's progress. Normally, 50 hours of internship per credit is required. The grade for the course will be determined by the student's overall performance in their research work, a research paper documenting their work with their internship mentor and an oral or poster presentation at the end of the semester.

**Prerequisite(s):** 2.5 GPA and permission of the instructor.