

# PHYSICS (PHY)

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## **PHY093. Physics Special Topics. 0 Credits.**

### **PHY100. Physics for the Inquiring Mind . 3 Credits.**

A course in basic physics for non-science majors that stresses conceptual understanding of familiar (and not so familiar) phenomena. Mathematical formalism is held to a minimum, although some elementary algebra is helpful.

### **PHY108. Seeing the Light: Physics, Vision and Art. 3 Credits.**

A study of light, vision and art from an optical physics perspective, learning about photons, wavelength, and energy how our eyes see light, and the creation of visual art. Learn the function of the eye's lens, retina and visual cortex, and explore parallel developments in art, vision and physics.

### **PHY109. Physics of Sound and Music . 3 Credits.**

Nature, transmission, and absorption of sound; speech; hearing; music; noise; musical instruments and amplifying systems; rooms and auditoriums; sources of noise and noise pollution; noise codes; control of noise; and practical means of noise reduction.

### **PHY193. Physics Selected Topic. 1-12 Credits.**

### **PHY199. Modular Course. 0 Credits.**

### **PHY201. General Physics 1. 3 Credits.**

Basic principles of mechanics, wave motion, and thermodynamics using vector analysis and calculus. Primarily for students majoring in physics, engineering, mathematics, and chemistry; students majoring in biology and geology should consult their advisor if they wish to take this course in preference to PHY221.

### **PHY202. General Physics 2. 3 Credits.**

Basic principles of electricity, magnetism, and optics using vector analysis and calculus. Primarily for students majoring in physics, engineering, mathematics, and chemistry; students majoring in biology and geology should consult their advisor if they wish to take this course in preference to PHY222.

### **PHY203. General Physics I Workshop . 0 Credits.**

Problem-solving course to be taken concurrently with PHY201 gives students an opportunity to solve additional problems, preview sample exams or review exams, and ask questions about lecture material.

### **PHY204. General Physics II Workshop . 0 Credits.**

Problem-solving course to be taken concurrently with PHY202 gives students an opportunity to solve additional problems, preview sample exams or review exams, and ask questions about lecture materials.

### **PHY205. Exploring the Solar System. 3 Credits.**

Introduction to solar system including history of astronomy, laws of mechanics and gravitation, motions of heavenly bodies, telescopes, space exploration and descriptions of sun, planets, moons, asteroids, comets and meteors. Planetarium demonstrations, sky viewing with telescopes and computer simulations. No science preparation required. Limited use of algebra. No prerequisite.

### **PHY206. Exploring the Universe. 3 Credits.**

Introduction to the universe beyond the solar system. Distance to stars, classes of stars, structure of stars, stellar evolution, white dwarfs, neutron stars, black holes, pulsars, quasars, radio astronomy, the Milky Way, galaxies, relativity and cosmology. Planetarium demonstrations, sky viewing with telescopes and computer simulation. No science preparation required. Limited use of Algebra.

### **PHY207. Exploring Astronomy Laboratory. 1 Credit.**

Application of astronomy principles through observing the night sky and modeling astronomical phenomena in a lab setting. Students will use and construct simple telescopes and other tools to take astronomical measurements and interpret results. Computer simulations and other models will be used to demonstrate sky and planetary motion.

### **PHY211. Physics 1 Laboratory. 1 Credit.**

Experiments involve measurement and analysis using equipment such as air tracks, motion sensors, force meters, and photogate timers, coupled with computer software, to gain insight into linear and rotational motion phenomena.

### **PHY212. General Physics 2 Lab. 1 Credit.**

### **PHY221. Fundamental Physics 1. 3 Credits.**

An algebra-based introduction to particle mechanics, rigid-body and continuous matter motion, fluid mechanics, wave motion, structure of matter and thermo-dynamic principles.

### **PHY222. Fundamental Physics II. 3 Credits.**

An algebra-based introduction to electricity, magnetism, electromagnetic waves, optics, relativity, quanta, Bohr atom, complex atom, ions and molecules, solid state, nucleus, nuclear transformation, and elementary particles.

### **PHY223. Fundamental Physics I Workshop . 0 Credits.**

Problem-solving course to be taken concurrently with PHY221 gives students an opportunity to solve additional problems, preview sample exams or review exams, and ask questions about lecture material.

### **PHY224. Fundamental Physics II Workshop . 0 Credits.**

Problem-solving course to be taken concurrently with PHY222 gives students an opportunity to solve additional problems, preview sample exams or review exams, and ask questions about lecture material.

### **PHY231. Fundamental Physics 1 Lab. 1 Credit.**

### **PHY232. Fundamental Physics 2 Lab. 1 Credit.**

### **PHY293. Physics Selected Topic. 1-12 Credits.**

### **PHY295. Indep Study Physics. 1-12 Credits.**

### **PHY299. Modular Course. 0 Credits.**

### **PHY300. Mathematical Physics I . 3 Credits.**

A study of the differential equations, linear algebra, and vector calculus in the context of the physical problems in which they arise. Computational techniques are used where appropriate.

### **PHY301. Mathematical Physics II . 3 Credits.**

A continuation of Mathematical Physics I. Fourier series, partial differential equations, and complex analysis, all discussed in the context of the physical problems in which they arise. Computer techniques are used where appropriate.

### **PHY305. Computational Physics . 3 Credits.**

Introduction to numerical techniques -- root finding, integration, matrix manipulations, differential equations. Numerical simulations -- oscillations, space flight, electric fields, linear and non-linear waves, crystal growth.

**PHY306. Mechanics 1 . 3 Credits.**

This is the first of a two-semester sequence comprising a traditional classical mechanics course. Topics include one-dimensional motion, energy and momentum conservation, central forces, Lagrangian and Hamiltonian formulations, systems of particles, and accelerated coordinated systems.

**PHY307. Mechanics 2 . 3 Credits.**

This is the second of a two-semester sequence comprising a traditional classical mechanics course. Topics include Lagrange and Hamiltonian formulations; gravitation, central force problems, and planetary motion; systems of particles; accelerated coordinate systems.

**PHY308. Modern Physics I . 3 Credits.**

An introduction to the physics of atoms, starting with the origin of the quantum theory. Extensive discussion of the hydrogen atom. Other topics chosen from solid state physics, statistical physics, and nuclear physics if time permits. Computational techniques are used where appropriate.

**PHY309. Modern Physics II . 3 Credits.**

A continuation of Modern Physics I, covering special relativity and other topics chosen from atomic physics, nuclear physics, statistical physics, and solid state physics. Computational techniques are used where appropriate.

**PHY310. Modern Physics Laboratory . 1 Credit.**

A laboratory course demonstrating the principles of Modern Physics PHY309. Required for Physics majors.

**PHY311. Classical Mechanics . 3 Credits.**

An intermediate level course in Newtonian mechanics. Linear and angular motion, conservation laws, Lagrangian and Hamiltonian formulations. Computational methods are used where appropriate.

**PHY313. Electricity and Magnetism . 3 Credits.**

Laws of electricity and magnetism and their applications using vector analysis and computational techniques. Differential forms of Maxwell's equations.

**PHY314. Relativity . 1 Credit.**

This is a short course in Special Relativity covering the following aspects: experiments leading up to the theory, relative nature of time and distance measurements, constancy of the speed of light, Lorentz transformations, length contraction, time dilation, simultaneity, momentum and energy relations, mass-energy equivalence, and relativistic Doppler effect.

**PHY315. Engineering Mechanics . 4 Credits.**

A study of static and dynamic force systems. Vector and conventional techniques are used in problem solving. Properties of force systems, free body analysis, properties of area and mass, friction, kinematics and kinetics of particles and rigid bodies, energy and momentum method. Both English and SI units are used.

**PHY322. Optics . 3 Credits.**

Geometrical and physical optics including thick lenses, polarization, coherence, interference and diffraction; propagation in crystals; non-linear optics; photon statistics; radiation pressure; electro-optics; gas crystals; semi-conductor laser.

**PHY331. Quantum Physics . 3 Credits.**

Origin of Planck's quantum hypothesis and its later development through the deBroglie wave-particle duality to the modern quantum mechanics of Schroedinger and Heisenberg. Principles of correspondence, complementarity, and uncertainty. Application of quantum mechanics to basic problems such as the time-independent Schroedinger Equ., hydrogen atom and spin phenomena.

**PHY340. Introduction to Astrophysics. 3 Credits.**

Introduction for science majors. Formation of stars, H-R diagram, binaries, brightness scale, distance ladder, doppler effect, stellar masses, parallax, proper motion, radial motion, mass-luminosity, black-body radiation, spectroscopy, telescopes, dense stars, black holes, galaxies, relativity and cosmology.

**PHY341. Observational Astronomy. 3 Credits.**

An introduction to the tools and techniques of observational astronomy, including astronomical image analysis, telescopes and CCD detectors, reduction and analysis of astronomical spectra. Course requires nighttime telescopic work.

**PHY342. Planetarium Operation. 3 Credits.**

Principles and operation of planetarium projection devices, and their use in developing public planetarium shows.

**PHY343. Solar Physics. 3 Credits.**

A study of the structure of the Sun, and the physical phenomena (such as sunquakes, eclipses, sunspots, flares, prominences) that take place in its interior and near the surface.

**PHY344. Extraterrestrial Life. 3 Credits.**

Origin of life in the solar system, existence of other planetary systems, possibilities and techniques for detection of and communication with other intelligences.

**PHY393. Physics Selected Topic. 1-12 Credits.**

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**PHY399. Modular Course. 0 Credits.**

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**PHY402. Fluid Mechanics . 3 Credits.**

Fundamental physical characteristics, fluid statics; kinematics; flow of incompressible, compressible, and real fluids. Theory of models as applied to physical systems and development of several models of fluids.

**PHY422. Thermal Physics. 3 Credits.**

Basic laws of thermodynamics. Conditions of equilibrium equations of state, Euler equation. Gibbs-Duhem relations, thermodynamic potentials, and the Nernst Theorem.

**PHY424. Advanced Laboratory . 2 Credits.**

Selected experiments (5-8) picked from various areas -- mechanics, optics, quantum mechanics, electronics, fluid mechanics, solid state physics, and nuclear physics. Emphasis on individual work.

**PHY429. Solid State Physics . 3 Credits.**

Crystals: Binding, symmetries, diffraction, reciprocal lattice, defects. Lattice dynamics: Phonons, modes, specific heat, thermal conduction. Metals: Free electron theory, band theory, superconductivity. Semiconductors: Fermi-Dirac Statistics, transport, band shapes, p-n junction, electronic devices.

**PHY432. Atomic and Nuclear Physics . 3 Credits.**

Elementary quantum mechanics applied to multielectron atoms, identical particles, magnetic effects and nuclear systems. Quantum nature of elementary particles. Selections from quantum statistics, solid state physics, superconductivity and magnetic properties of solids according to class interest.

**PHY491. Physics Senior Project (3-6) . 3 Credits.**

Project may be either experimental or theoretical physics by arrangement with a physics faculty advisor. Plan must be approved in the prior semester by chairperson.

**PHY492. Physics Senior Project Continuation (1-3) . 3 Credits.**

Continuation of senior project. Student must have completed PHY491 and have approval of chairperson.

PHY493. Physics Selected Topic. 3-12 Credits.

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PHY494. Fieldwork in Physics . 0 Credits.

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PHY495. Indep Study Physics. 1-12 Credits.

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PHY499. Modular Course. 0 Credits.

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