

## Department Courses in Physics

- PH201. Elements of Physics I. (0-3-3) f** ..... 4  
General principles of mechanics. Prerequisites: College algebra, trigonometry.
- PH202. Elements of Physics II. (0-3-3) w** ..... 4  
General principles of electricity and magnetism. Prerequisite: PH201.
- PH203. Elements of Physics III (0-3-3) s** ..... 4  
General principles of heat, sound, and light. Prerequisite: PH201.
- PH207. General Physics I. (2-2-2) f, w, s** ..... 4  
An introductory course in mechanics. This is a technical course in physics designed for the student majoring in engineering or its allied sciences. Prerequisite: Preceded or accompanied by MA132.
- PH208. General Physics II. (2-2-2) f, w, s** ..... 4  
An introductory course in sound, heat, and geometric optics. Prerequisites: PH207, and preceded or accompanied by MA133.
- PH209. General Physics III. (2-2-2) f, w, s** ..... 4  
An introductory course in electricity and magnetism. Prerequisites: PH207 and preceded or accompanied by MA134.
- PH310. General Physics IV. (0-3-0) f, w, s** ..... 4  
An introductory course in physical optics and modern physics. Prerequisite: PH209.
- PH316. Electrical Measurements. (0-3-0) f** ..... 3  
A course in which detailed consideration is given to the fundamental aspects of electricity and electric units. Precise measurements of resistance, inductance and capacitance are studied. Prerequisite: MA231.
- PH317. Electrical Measurements Laboratory. (0-0-2) w** ..... 1  
Laboratory application of the theory discussed in PH316. Prerequisite: PH316.
- PH320. Photography. (1-2-2) f, s** ..... 3  
For students who wish to acquaint themselves with the physics and chemistry of photographic equipment and processes. A study of cameras, lens systems, lighting, photographic chemicals, films, papers, and darkroom manipulations. Prerequisite PH208.
- PH336. Electric and Magnetic Measurements. (0-3-3) s (alternate years)** ..... 4  
A continuation of work begun in PH316-317, intended for those who wish to pursue further the theory and practice of precise electric and magnetic measurements. Types of all the principal instruments used in modern electrical methods are available for use in this course. Prerequisite: PH317.
- PH338. Introduction to Optics. (0-3-3) w** ..... 4  
Introduction to geometrical optics, including spherical mirrors, thin and thick lenses, construction and use of optical instruments. Introduction to physical optics, including interference, diffraction, and study of spectra. Prerequisite: PH310.

- PH361. Theoretical Physics I. (0-5-0) f** ..... 5  
 Mechanics of single particles, systems of particles, and rigid bodies. A vector and differential equation treatment. The material in this course is fundamental to many of the succeeding courses. Prerequisites: PH207, MA310.
- PH362. Theoretical Physics II. (0-5-0) w** ..... 5  
 An intermediate course covering the fundamental concepts of equilibrium thermodynamics from both the classical point of view of continuous media and the microscopic point of view of statistics. The course includes discussion of the three laws of thermodynamics, the thermodynamic potentials, phase equilibrium, the statistical concept of entropy, etc. Prerequisite: PH361.
- PH363. Theoretical Physics III. (0-5-0) s** ..... 5  
 Electrostatics and magnetostatics presented from the standpoint of field theory. Electric and magnetic properties of matter. Maxwell's equations, the potentials, Poynting's theorem. Free use of vector analysis throughout. Prerequisites: PH316, PH317, MA311, MA415 (may be taken concurrently) or permission of instructor.
- PH380. Introduction to Geophysics. (0-3-0) f** ..... 3  
 A study of the broad aspects of geophysics as related to terrestrial magnetism and electricity, oceanography, earthquake seismology, volcanism, mountain building, geodesy, and isostasy. Open to juniors with the consent of the department.
- PH381. Geophysics I. (0-3-0) f** ..... 3  
 Magnetic and gravitational prospecting methods. A study of fundamental principles, instruments, field methods, and interpretation. Special attention is given to geological and mining problems and to geological conditions which may influence interpretation. Prerequisites: GE102 and PH209.
- PH382. Geophysics II. (0-3-0) w** ..... 3  
 Electric, seismic, and radiometric methods of prospecting. A study of natural and induced seismic and electrical fields in the earth's surface and a brief introduction to well logging. Emphasis is placed on interpretation of data with reference to engineering and geological problems. Prerequisites: GE102 and PH209.
- PH385. Applied Geophysics. (0-0-4) s** ..... 2  
 A laboratory and field course to familiarize the student with the construction, calibration, and use of selected geophysical prospecting equipment. Emphasis is placed on the recording, reduction, mapping, and interpretation of data. Prerequisites: PH381 and PH382.
- PH411. Advanced Undergraduate Laboratory. (0-0-6) f** ..... 2  
 Experiments in all areas of classical and modern physics with emphasis on the effect of the instruments or the experimental method on the result. Student initiative, originality, and ingenuity is emphasized. Prerequisites: PH317, PH436, MA310.
- PH412. Advanced Undergraduate Laboratory. (0-0-6) w** ..... 2
- PH413. Advanced Undergraduate Laboratory. (0-0-6) s** ..... 2
- PH418. Intermediate Optics. (0-3-3) s** ..... 4  
 A continuation of PH338. Selected topics in geometric optics. Physical optics including polarization, spectra, and quantum optics. Prerequisites: MA311 and PH338.

- PH422. Modern Physics Seminar. (0-3-0) s** ..... 3  
 Detailed discussion of selected topics in modern physics, including relativity, high energy physics, and “strange” particles. Current literature will be used as source material. Topics will be presented by students and by the instructor. Admission by permission of the Department.
- PH425. Response of Physical Systems. (0-3-0) f (alternate years)** ..... 3  
 A study of the theory applicable to physical systems and the application of mathematics to system response. Admission by permission of the department.
- PH435. Introductory Plasma Physics. (0-3-0) f** ..... 3  
 An introductory course in the theoretical aspects of plasmas including statistical distribution functions, charged particle behavior in static and time varying electric and magnetic fields, and microscopic and macroscopic plasma characteristics. Prerequisites: PH363, PH461 (may be taken concurrently).
- PH436. Electronics I. (0-3-3) s** ..... 4  
 Fundamental principles of electron ballistics, electron emission, gaseous conduction, multi-element tubes, and solid-state electronics. Also rectifier tubes and circuits. Prerequisite: PH310.
- PH437. Electornics II. (0-3-3) W** ..... 4  
 The fundamental principles of circuits and amplifiers, vacuum tub oscillators, wave shaping devices, and photoelectric cells. Prerequisite: PH436.
- PH440. Space Science (0-3-0) f** ..... 3  
 Space exploration techniques, aeronomy, trapped radiation, interaction of the geomagnetic field with the solar wind, interplanetary medium, solar physics, planetary atmosphere, stellar physics, cosmogony. Prerequisites: PH310 and permission of instructor.
- PH451. Senior Physics Colloquium (0-2-0) f** ..... 1
- PH452. Senior Physics Colloquium (0-2-0) w** ..... 1
- PH453. Senior Physics Colloquium (0-2-0) s** ..... 1  
 Discussion of current literature and recent advances in the field of physics, under supervision of the department staff. Open to seniors with the consent of the department.
- PH461. Theoretical Physics IV. (0-5-0) f** ..... 5  
 Plane electromagnetic waves in empty space, reflection, refraction, diffraction, dispersion. The field of an oscillating dipole; sperical waves. Electron theory of dielectric constant; permeability, polarization. Prerequisite: PH363.
- PH462. Theoretical Physics V. (0-5-0) w** ..... 5  
 A study of the foundations of modern physics including the great ideas and experiments of the late 19<sup>th</sup> and 20<sup>th</sup> centuries which culminated in the quantum theory. Development of the quantum theory and its applications in atomic and molecular structure and solid state physics. Prerequisites: PH361, MA310 and permission of the instructor.
- PH463. Theoretical Physics VI. (0-5-0) s** ..... 5  
 A study of very recent developments in physics, the relativity theory, nuclear physics, high energy physics, the particles of modern physics. Prerequisites: PH462 and permission of instructor.

- PH465. Classical Wave Motion. (0-3-0) w** ..... 3  
 A comprehensive treatment of the propagation of disturbances through compressible and incompressible fluids and through deformable solid bodies. Prerequisites: PH310 or PH461, MA310 and permission of instructor.
- PH470. Introduction to Solid State Physics. (0-3-0) f** ..... 3  
 A study of the physical properties of crystalline solids including structural, mechanical, thermal, and electrical properties which can be treated by classical or semi-classical methods. Prerequisites: MA310, PH310, and permission of the instructor.
- PH483. Seismic Prospecting for Oil. (0-3-0) s** ..... 3  
 A study of theory and practice in seismic prospecting for oil, including instrumentation, field techniques, seismological wave theory, and actual field problems. Prerequisite: PH382.
- PH484. Well Logging. (0-3-0) s** ..... 3  
 Theory and application of well logging as related to geological correlation problems and the quantitative determinations of porosity, permeability, and connate water saturations. Includes electrical, radioactive, caliper, induction, magnetic, temperature, and velocity logging. Prerequisites: PH381 and PH382.
- PH487. Special Problem in Geophysics** ..... 3  
 An elective course involving undergraduate research in exploration, instrumentation, or theory. Scheduled by arrangement; admission by permission of the department.
- PH488. Problems in Mining Geophysics. (0-3-0) f** ..... 3  
 A study of interpretation of geophysical problems associated with the mining industry. Prerequisite: PH385.
- PH490. Special Problems in Physics, f, w, s** ..... 1-6  
 A course designed to permit students to study a particular area of physics at greater depth than is done in presently scheduled formal courses. Prerequisites: Junior or senior standing and permission of instructor.
- PH500. Graduate Research** ..... 9 to 15  
 Research in physics or geophysics. Scheduled by arrangement; admission by permission of the department.
- PH504. Introduction to Seismology. (0-3-0) f** ..... 3  
 Basic theory of seismology, propagation of waves, energy transfer through the earth, and problems associated with earthquake seismology. Admission by permission of the department.
- PH510. Theory of Geophysical Instrumentation. (0-3-0) s** ..... 3  
 The theory involved in the design of geophysical instruments. Prerequisites: MA310 and PH436.
- PH512. Methods of Geophysical Interpretation. (0-3-0) w** ..... 3  
 Statistical and analytical methods of analysis of magnetic and gravimetric anomalies. Calculation of anomalies and terrain effects for two dimensional bodies by means of line integrals and higher order derivatives. Prerequisites: MA310, PH381, and PH382.
- PH516. Geophysics Seminar. (0-3-0) w** ..... 3  
 An exhaustive study of a particular topic in geophysics. Choice of topic is left to staff and students. Selection of topic made during fall term prior to course offering. Admission by permission of department.

- PH522. Theoretical Physics I. (0-4-0) f** ..... 4  
 An introduction to field theory including the Lorentz transformation, waves, Maxwell's equations, Lagrange's and Hamilton's equations, and scalar and vector fields. Prerequisites: MA310, MA425, PH310 and permission of the department.
- PH523. Theoretical Physics II. (0-4-0) w** ..... 4  
 The general methods for the solution of boundary value problems including Laplace's equation, the wave equation, Eigen functions, integral representation, and Legendre functions. Prerequisite: PH522.
- PH524. Theoretical Physics III. (0-4-0) s** ..... 4  
 Potential theory and wave theory described with the aid of Green's functions and integral equations. Prerequisite: PH523.
- PH532. Advanced Solid State Physics. (0-3-0) s** ..... 3  
 Ferromagnetism, band theory, semiconductivity, superconductivity, lattice defects, crystal field theory. Prerequisite: PH470.
- PH533. Quantum Mechanics I. (0-3-0) w** ..... 3  
 A study of the origin and mathematical formulation of Quantum Theory, the Uncertainty Principle, Schrodinger's Equation, and applications to simple systems. Prerequisites: MA310, PH310, and permission of the instructor.
- PH534. Quantum Mechanics II. (0-3-0) s** ..... 3  
 A continuation of PH533 including approximation methods, the matrix formulation, spin and angular momentum, and many-electron systems. Prerequisite: PH533.
- PH540. Kinetic Theory and Statistical Mechanics. (0-3-0) f** ..... 3  
 A study of the mean free path, distribution of molecular velocities, transport phenomena, quantum statistics, derivation of the laws of thermodynamics, and applications to a perfect gas. Prerequisite: PH446 or equivalent.
- PH544. Nuclear Physics I. (0-3-0) w** ..... 3  
 Natural and induced radioactivity, constitution of the nucleus, properties of radiation and their interactions with matter. Radioactive decay series, time constants and equilibria, the relation between radioactivity and nuclear changes, stable and unstable nuclei and relation to radioactivity Prerequisite: PH422.
- PH545. Nuclear Physics II. (0-3-0) s** ..... 3  
 Review of radioactivity, interactions of alpha particles and other nucleons with matter, discovery of the neutron, its place in the nucleus, the neutrino, energy relations and energy levels of the nucleus. Study of other particles such as the meson, and their relation to the nucleus. Prerequisite: PH422 or equivalent.
- PH561. Special Topics in Physics. (0-3-0) f** ..... 3
- PH562. Special Topics in Physics. (0-3-0) w** ..... 3
- PH563. Special Topics in Physics. (0-3-0) s** ..... 3  
 The subject matter may vary from term to term and from year to year depending on the needs of advanced students. Admission by permission of the department.