

Physics and Geology

Physics is a discipline primarily concerned with the study of matter and energy. It is an analytical science based on observation of mechanistic processes in nature. It has as its goal the enunciation and refinement of postulated "laws" which form the basis for descriptive models of the physical universe. Physics is a discipline worthy of study in its own right, but the fundamental nature of the subject also makes an understanding of its principles, techniques and limitations important in the acquisition and extension of knowledge in the other sciences. In addition, it has historical connections to metaphysics and natural philosophy, which further justify its place in a balanced liberal arts curriculum. The Physics and Geology Department therefore strives to provide a broad range of courses so that all students, regardless of their specific majors, can pursue interests in this field of study.

Physics Major

Consists of 32 credits, of which at least 18 must be upper division. Required courses include:

- PHY 271-272 Analytical Physics
- PHY 271L-272L Analytical Physics Laboratory
- PHY 240 Electronics
- PHY 240L Electronics Laboratory
- PHY 301 Theoretical Mechanics
- PHY 313 Thermal Physics
- PHY 330 Electricity and Magnetism
- PHY 402 Quantum Mechanics
- PHY 494 Independent Study

Physics majors should recognize and gracefully accept that an ability to acquire and use mathematical tools is an assumed part of their programs. Students are therefore expected to complete, at minimum, MAT 152, 251 and 352 or their equivalents. Some facility with a general purpose programming language will also be expected.

Physics Minor

Consists of 20 credits, to include:

- PHY 231-232
- PHY 231L-232L **or** PHY 271-272 and 271L-272L
- PHY 10-12 additional credits of upper-division physics.

Note that upper-division physics courses normally require completion of MAT 352.

Pre-Engineering Option

This pre-professional option is coordinated by the Physics Department, but is not strictly a program in physics. Requirements are:

- PHY 170
- PHY 271-272

- PHY 271L-272
- MAT 152
- MAT 251
- MAT 352
- CHE 141-142
- Completion of the General Graduation Requirements (see Academic Information).

Also see [Geography/Geology](#) for course descriptions.

Interdisciplinary (IND)

SCI-101 Science 3.0 cr.

A multidisciplinary approach to science, scientific methods, and major theories of science. Includes topics in biology, chemistry, earth science, and physics, with an emphasis on living systems. Students may fulfill the general graduation requirement in natural sciences by taking this course and one other four-credit laboratory course in any of the natural sciences.

Physics (PHY)

LOWER DIVISION

PHY-105 Introduction to CAD 2.0 cr.

Winter. A beginning level survey of computer drafting and engineering graphics. No previous CAD experience is required but students should have some basic understanding of science and mathematics as well as some experience as a computer user. Pass/fail only. This course does not count toward the general graduation requirement in natural science.

PHY-115 The Solar System 2.0 cr.

First six weeks. A course for non-physics majors that examines the celestial sphere and constellations, measurements of time, astronomical instruments, earth as a planet, the moon, eclipses, planets and their satellites, comets, meteors, and theories of the origin of the solar system. May be taken with or without PHY 116. (NON-LAB NATURAL SCIENCE)

PHY-116 Stars and Galaxies 2.0 cr.

Second six weeks. A course for non-science majors that examines the sun as a star, physical properties of stars, principles of spectroscopy as applied to astronomy, double stars, variable stars, star clusters, gaseous nebulae, stellar motions and distribution, Milky Way system, external galaxies, expanding universe, and cosmic time scale. May be taken with or without PHY 115. (NON-LAB NATURAL SCIENCE)

PHY-121 Astronomy Project 1.0 cr.

An optional supplement to PHY 115 and PHY 116 for students in need of three credits in the natural sciences. Consists of independent reading of current astronomy literature and/or completion of astronomical activities. (NON-LAB NATURAL SCIENCE; NOT INDEPENDENT WORK)

PHY-170 Engineering Analysis 2.0 cr.

First six weeks. An application of mathematical modeling and computer techniques to solving problems in engineering. This course does not count toward the general graduation requirement in natural science.

PHY-210 Statics 3.0 cr.

Prereq.: PHY 271. Structural analysis of beams and trusses subjected to both concentrated and distributed loads. This course is normally taken by pre-engineering students. This course does not count toward the general graduation requirement in natural science.

PHY-230 Digital Electronics 3.0 cr.

An introduction to digital logic gates, digital integrated circuits, and the design of combinational and sequential digital systems. No previous electronics experience is required. This course does not count toward the general graduation requirement in natural sciences.

PHY-231 General Physics 4.0 cr.

A non-calculus survey of physics. Facility with algebra and trigonometry will be assumed. Students with secondary school experience in physics and/or mathematics through calculus are strongly urged to take the PHY 271-272 sequence. Three lectures weekly. In special circumstances, this course may be taken for 3 credits without lab. Consult instructor. (NATURAL SCIENCE)

PHY-231L General Physics Lab 0 cr.

An integral part of PHY 231-232 with which the lab should normally be taken concurrently. One laboratory weekly. (NATURAL SCIENCE LAB)

PHY-232 General Physics 4.0 cr.

A noncalculus survey of physics. Facility with algebra and trigonometry will be assumed. Students with secondary school experience in physics and/or mathematics through calculus are strongly urged to take the PHY 271-272 sequence. Three lectures weekly. In special circumstances, this course may be taken for 3 credits without lab. Consult instructor. (NATURAL SCIENCE)

PHY-232L General Physics Lab 0 cr.

An integral part of PHY 231-232 with which the lab should normally be taken concurrently. One laboratory weekly. (NATURAL SCIENCE LAB)

PHY-240 Electronics 3.0 cr.

An introduction to DC and AC circuits, circuit principles, semiconductor devices and applications. PHY 240L should be taken concurrently. Three lectures weekly. This course does not count toward the general graduation requirement in natural sciences.

PHY-240L Electronics Lab 1.0 cr.

An introduction to measurement techniques in electronics. PHY 240L may be taken independently of 240. One laboratory weekly. (NATURAL SCIENCE LAB)

PHY-271-272 Analytical Physics 4.0 cr.

Prereq: Completion of one full year of calculus; PHY 271 is a prerequisite for PHY 272. A general survey of physics for physics majors and pre-engineering students and strongly recommended for any student who plans to do graduate work in any of the sciences or mathematics. Calculus is used extensively and some familiarity with computers is assumed. Four lectures weekly. (NATURAL SCIENCE LAB when taken with PHY 271L or PHY 272L)

PHY-271L-272L Analytical Physics Lab 1.0 cr. each

Laboratory to accompany PHY 271-272, with which it should be taken concurrently. One laboratory period weekly. (NATURAL SCIENCE LAB)

PHY-294 Independent Study 1.0 to 3.0 cr.

Prereq.: Freshman or sophomore standing. May be repeated up to a maximum of 4 credits and is subject to arrangement with the Physics Department. This course does not fulfill the general graduation requirement for independent work. See independent study guidelines.

UPPER DIVISION

PHY-301 Theoretical Mechanics 3.0 cr.

Prereq: PHY 272 and MAT 352. A survey of classical and modern topics in dynamics. Topics include orbital mechanics, noninertial reference frames, rigidbody motion, Lagrangian and Hamiltonian methods, and elements of nonlinear mechanics and chaos.

PHY-304 Advanced Laboratory 2.0 cr.

Alt. years. Prereq.: PHY 272 and MAT 352. An advanced laboratory in modern physics. The course will be project oriented and may include topics in atomic physics, nuclear physics, solid state physics and computer assisted experimentation. Two 2-hour laboratory periods weekly.

PHY-306 Modern Optics 3.0 cr.

Alt. years. Prereq.: PHY 272 and MAT 352. A study relating optical physics to classical and contemporary applications in research and technological instrumentation. Topics include models of light, imaging systems, interferometers, sources and detectors.

PHY-312 Special Topics 2.0 cr.

Prereq.: permission. Independent study of selected areas of physics not available in the regular curriculum.

PHY-313 Thermal Physics 3.0 cr.

~~Fall~~. Alt. years. Prereq.: PHY 272 and MAT 352. An introduction to Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics and their application to the solution of thermal, mechanical and electrical problems in fluids and solids.

PHY-324 Solid State Physics 3.0 cr.

Alt. years. Prereq.: PHY 272 and MAT 352. The physics of solids, including crystalline structure and symmetry, lattice dynamics, thermal properties, the free electron model and the band theory of solids.

PHY-330 Electricity & Magnetism 3.0 cr.

Prereq.: PHY 272 and MAT 352. An intermediate level survey of classical electromagnetic theory up to and including the unification of the subject matter in the form of Maxwell's equations.

PHY-355 Computational Methods in the Sciences 3.0 cr.

Alt. years. Prereq.: PHY 272 and MAT 352. Computing and mathematical methods and techniques applied to a broad spectrum of physical science problems. Emphasis on least squares method and other curve fitting techniques of nonlinear functions, monte carlo methods, data manipulation, fourier analysis, and partial differential equations. This course does not count toward the General Graduation Requirement in natural science.

PHY-399T.01 Digital Image Analysis 3.0 cr.

(Same as MAT 399T.01) Spring 2003. Prereq.: MAT 150 or 151 and MAT 137 or permission. MAT 233.1 recommended. Topics covered include color concepts, display devices, image compression algorithms and storage formats, two- and three-dimensional graphics concepts, digital imaging, and simple pattern matching algorithms. The collection, processing, and analysis of digital images will be demonstrated mainly through astronomical applications. Other imaging techniques such as Magnetic Resonance Imaging, Ultrasound, and Computer Tomography will also be explored. This course does not fulfill any general graduation requirement.

PHY-402 Quantum Mechanics 3.0 cr.

Alt. years. Prereq.: PHY 272 and MAT 352. An introduction to Schroedinger's wave mechanics, including applications to atomic and molecular, solid state and nuclear systems.

PHY-441 Relativity 3.0 cr.

Alt. years. Prereq.: Mathematics through multivariate calculus and differential equations and physics through theoretical mechanics and electromagnetism. Principles of special and general relativity and associated tensor calculus.

PHY-494 Independent Study 1.0 to 3.0 cr.

Prereq.: Junior or senior standing. May be repeated up to a maximum of 4 credits and is subject to arrangement with the Physics Department. See independent study guidelines. (INDEPENDENT WORK)

PHY-497 Internship 1.0 to 3.0 cr.

Prereq.: junior or senior standing and permission. Individually arranged programs of work and study with the department, academic institutions, private industries, or government agencies. See internship guidelines. (INDEPENDENT WORK)

Geography (GOG)**GOG-150 Physical Geography 3.0 cr.**

Fall. Alt. years. This course will examine major natural systems within our physical environment: climate, vegetation, soils, hydrology, and landforms. Emphasis will be given to analysis of the processes and environmental interactions that shape these systems. Students will develop skills in 1) the collection of both historical and primary data; 2) the utilization of geographic models to explain processes; 3) the complexity and application of maps and mapmaking techniques; 4) examining GIS output as an analytical tool for solving location problems in different scientific fields. (NON-LAB NATURAL SCIENCE)

GOG-152 Cultural Geography 3.0 cr.

Fall. Alt. Years. An introduction to the basic cultural elements of geography. Culture can be defined as the total of the knowledge, attitudes, and habitual behavior patterns shared and transmitted by the members of a society. Cultural geography examines how place shapes culture and how cultures shape place. The major themes of cultural geography to be addressed include culture hearths, cultural diffusion, cultural ecology, cultural landscapes, and culture regions. (CULTURAL DIVERSITY NOT NATURAL SCIENCE)

Geology (GOL)**GOL-101 Physical Geology 4.0 cr.**

Fall, spring. Physical geology is the study of the materials the earth is made of and the processes that occur both on and beneath the surface. The course heightens awareness of how the earth continually changes, the rates of geologic change, and the finite character of the earth's resources. The course is designed to help students develop their own views of how human activity impacts geologic processes, and how geologic processes affect human activity. (NATURAL SCIENCE LAB)

GOL-102 Historical Geology 4.0 cr.

Spring. Alt. years. Recommended prereq.: GOL101. Historical geology is the study of the sequence of events involved in the physical evolution of continents and ocean basins. Emphasis will be placed on the growth and development of the North American continent as can be deciphered from the rock and fossil records. (NATURAL SCIENCE)

LAB)