

Description of Courses

PHYS 101. General Physics I (1). An introduction to the fundamental concepts of classical mechanics: Newton's laws, conservation of momentum and energy, and oscillatory and rotational motion. Four class hours and 1 laboratory period per week. Students planning to take additional physics courses should take Mathematics 110 concurrently with Physics 101. (1S) Offered each fall. Prerequisite: *high-school mathematics, including trigonometry.*

PHYS 102. General Physics II (1). A continuation of Physics 101. Introduction to geometric optics, electric circuits, and electric and magnetic fields. Four class hours and 1 laboratory period per week. (4U) Offered each spring. Prerequisite: *Physics 101 and Mathematics 110.*

PHYS 115. Light, Lasers, and Holography (1). Designed to introduce non-science majors to the physics of optics and holography. The course begins with an investigation of human vision through the study of monocular and binocular vision before proceeding to the study of color theory. Interference and diffraction are studied next, followed by the physics of lasers and holography. There are 8 laboratory sessions during the semester and 4 holographic studio sessions during which students create transmission and reflection holograms. (4U) Offered occasionally.

PHYS 130. Astronomy (1). An introduction to modern astronomy, with emphasis on the development of planetary, stellar, and galactic systems. Study of the observations and physical laws that lead astronomers to our current understanding of the universe. Evening laboratories include outdoor observations using binoculars and telescopes, as well as indoor observations using planetarium software and astronomical datasets. Four class hours per week. (4U) Offered odd years, fall semester.

PHYS 150. History of Physics (1). A course in which the historical development of physics, from late medieval times to the present, is explored. The interplay of mathematics, technology, and theoretical physics is studied by examining a series of paradigms in physics. Students recreate a number of historically significant experiments in

order to understand the scientific process in physics. (4U) Offered each year.

PHYS 155. Physics of Music (1). The physics of music is an important part of the seven original liberal arts, forming a major portion of the Quadrivium. In this course we will investigate, both theoretically and experimentally, vibrations of strings, rods, and columns of air; sound; harmonics; resonance; Western musical scales and chords; aural illusions; electronic tone generation; and physical responses to sounds. The latter portion of the course will deal with room acoustics and design. (4U) Offered each spring.

PHYS 200. Topics in Astronomy (½, 1). An in-depth development of a selected area from the realm of modern astronomy. Examples of topics: cosmology, exoplanets, astrophysical disks. Offered occasionally. Prerequisite: *Physics 101 or 130 and facility with high-school algebra and trigonometry. Depending on the topic, other courses may be required.*

PHYS 206. Mathematical Methods for Scientists (1). Solution of ordinary and partial differential equations, Fourier analysis, introduction to linear algebra and vector analysis. (1S) Offered each fall. Prerequisite: *Physics 101 and Mathematics 115. Physics 102 recommended.*

PHYS 208. Intermediate Physics Lab (½). Covers experimental technique and data analysis beyond the level of introductory physics courses, 101 and 102. Mechanics, electricity and magnetism, and optics are covered, including damped oscillators, coupled oscillators, nonlinear behavior and approaches to chaos, optical interference and diffraction, and Fourier optics. (4U) Offered each fall. Prerequisite: *Physics 102, Physics 206, or Mathematics 190 should be taken previously or concurrently.*

PHYS 210. Modern Physics (1). An introduction to the special theory of relativity, early quantum theory, and non-relativistic quantum mechanics. Application of these ideas to selected topics in atomic, nuclear, and condensed matter physics. The laboratory will require independent use of advanced equipment and statistical analysis of data. Offered each spring. Prerequisite: *Physics 101 and Mathematics 115. Physics 102 recommended.*

PHYS 220. Electronics (1). Introduction to analog and digital electronics. Analog electronics, the study of circuits that respond in a continuous manner to signals, comprises the first half of the course. Digital electronics, the study of circuits that respond in a discrete manner to signals, comprises the second half of the course. The course is designed to provide science majors with an introduction to electronic circuit design and construction. *Offered even years, spring semester. Prerequisite: Mathematics 110.*

PHYS 235. Nuclear and Particle Physics (1). Relativistic dynamics, nuclear models, nuclear decay and reactions, high energy physics, elementary particles. *Offered occasionally. Prerequisite: Physics 206 and 210.*

PHYS 249. Metalworking for Physicists (1/4). This course introduces the student to the use of hand and machine tools, and the metal joining techniques used in the construction of experimental apparatus in physics and astronomy. Preference is given to students who have declared a major or minor in physics. *Graded credit/no credit. Offered on demand.*

PHYS 250. Advanced Laboratory (1/2). Experiments from acoustics, atomic physics, electricity and magnetism, fluid dynamics, mechanics, nuclear physics, optics, optoelectronics, solid state physics, and thermodynamics. May be repeated for credit with departmental permission. *Offered odd years, spring semester. Prerequisite: Physics 210.*

PHYS 260. Topics in Physics (1/2, 1). An in-depth development of a selected area of physics. Examples of topics: general relativity, nonlinear dynamics, acoustics. May be repeated for credit if topic is different. *Offered occasionally. Prerequisite: Physics 206. Depending upon the topic, other courses may be required.*

PHYS 270. Computational and Numerical Methods (1). An applied course in numerical methods and computational techniques related to problems in the natural sciences and engineering. Systems of equations, integration, differential equations, and parallel techniques will be examined within the framework of spreadsheets and structured programming. Error analysis and run-time will be addressed, as well as Unix system

administration. *Prerequisite: Physics 101, Mathematics 110, and some previous computer experience required; Physics 206, Mathematics 115 and a course in computer programming recommended.*

PHYS 280. Tools for Physics and Astronomy (1/2). Writing papers with the LaTeX document preparation system, including equations, tables, figures, and bibliographies; incorporating information from articles in the scientific literature. Problem-solving with Matlab, Mathematics, and other tools. Applications for summer REUs, internships, jobs, and graduate school. (4U) *Offered each fall. Graded credit/no credit. Prerequisite: sophomore standing.*

PHYS 300. Research (1/2, 1). Research project conducted by a student with supervision by a faculty member. Projects may include a laboratory investigation, a design study, or other work in applied physics or astronomy. The work must be documented, and a final report suitable for publication is required. *Prerequisite: Physics 210. Consent of faculty supervisor and department chair. Physics 250 recommended.*

PHYS 320. Statistical Mechanics (1). First, second, and third laws of thermodynamics; principles of classical and quantum statistical mechanics and their relationships to thermodynamics; fluctuations; applications of the theory of gases, liquids, and solids; heat engines. *Offered even years, spring semester. Prerequisite: Physics 102 and Mathematics 115.*

PHYS 330. Dynamics (1). Dynamics of particles and rigid bodies, oscillatory motion, variational methods, Hamilton's principle, Lagrangian dynamics, systems with many degrees of freedom. Both analytical and numerical techniques are utilized. *Offered even years, fall semester. Prerequisite: Physics 206.*

PHYS 340. Electromagnetism (1). Classical field theory. Maxwell's equations, waves and radiation, fields in continuous media; relativistic considerations. *Offered odd years, fall semester. Prerequisite: Physics 102 and 206.*

PHYS 350. Quantum Mechanics (1). Foundations and mathematical techniques of quantum mechanics, including variational methods and perturbation theory; applications to

atomic, molecular, and nuclear structure and processes. *Offered odd years, spring semester. Prerequisite: Physics 206 and 210.*

PHYS 380. Department Seminar (1/2). Topics of current research or of historical, philosophical, or epistemological interest in physics. The seminar will involve oral and written presentations by each student. *Offered each spring. Prerequisite: junior or senior standing, with a major in physics.*

PHYS 385. Senior Thesis (1/2). Group and individual guidance on methods of writing a comprehensive paper, composed of critical evaluation of a topic or original research in consultation at various stages of revision with a primary and secondary faculty reader. This course is required to be considered for honors in Physics. *Offered each semester, on demand. Prerequisite: senior standing in Physics, and prior approval of a thesis advisor.*

PHYS 390. Special Projects (1/2, 1). Independent library research or independent theoretical work in physics, astronomy, or a cross-disciplinary area involving physics or astronomy. *Prerequisite: at least 2 units of physics and sophomore standing. Physics 206 recommended.*

PHYS 395. Teaching Assistant in Physics (1/4, 1/2). Work with faculty in classroom and laboratory instruction. *Graded credit/ no credit. Prerequisite: sophomore standing. Consent of faculty supervisor and the chair of the department.*