

PHYSICS (PHYS)

PHYS 100 UNDERSTANDING PHYSICS (3)

Designed for non-science majors. An inquiry into intuitive, philosophical, historical, and scientific understanding of principal concepts of classical and modern physics. Elementary algebra is used in this course, but emphasis is placed on physical understanding. Demonstrations and short illustrative experiments will be a part of the course. Three lecture hours. Core: Biological & Physical Sciences.

PHYS 102 ENGINEERING MECHANICS I (3)

The equilibrium of stationary bodies under the influence of various kinds of forces. Forces, moments, couples, equilibrium, trusses, frames and machines, centroids, moment of inertia, beams, friction, stress/strain, material properties. Vector and scalar methods are used to solve problems. Prerequisite: MATH 273.

PHYS 103 HOW THINGS WORK (3)

For non-science majors: a practical introduction to physics and science in everyday life. Examines the workings of everyday things from toys to next generation computers. Introduces fundamental science concepts underpinning ordinary to high tech objects, their principles of operation, the histories of their development. Emphasizes critical thinking and communication skills. Core: Biological & Physical Sciences.

PHYS 131 LIGHT AND COLOR (4)

Some aspects of light and color and of vision will be examined on a factual and descriptive basis. Predominantly qualitative explorations will be made of the origin of light, of its wave and particular behavior, of the polarization of light, of lasers and holography, of the origin and physical basis of color and of the physics of vision. This course in liberal arts physics is offered for curious inquirers who have had minimal contact with physics. Three lecture hours and two laboratory hours. Core: Biological & Physical Sciences. Lab/Class fee will be assessed.

PHYS 143 PHYSICS SOUND AND MUSIC (LAB) (4)

Study of sound and its production by various instruments, including the human voice. Physical interpretations of concepts, such as noise, pitch, mechanical and acoustic waves and oscillations, loudness, harmonics and timbre, scales and temperament. Three lecture hours, two laboratory hours. Not open to students who have successfully completed PHYS 141. Core: Biological & Physical Sciences. Lab/Class fee will be assessed.

PHYS 185 INTRODUCTORY HONORS SEMINAR IN PHYSICS (1)

This seminar is intended for freshmen and sophomores who have demonstrated exceptional ability in the sciences and will involve them directly with current ideas and research in physics. Classical physics, quantum physics, relativity, and the new astronomy will be covered.

PHYS 202 GENERAL PHYSICS FOR THE HEALTH SCIENCES (5)

Special emphasis on motion including kinematics and dynamics of linear and angular motion. Not intended for pre-medical, pre-dental or pre-physical therapy programs. Core: Biological & Physical Sciences. Lab/Class fee will be assessed.

PHYS 203 TOPICS IN PHYSICS FOR BIOLOGY MAJORS (5)

Topics may include mechanical and thermal properties of matter; forms of energy and conversion; optics; waves; electromagnetics. Students who may wish to seek advanced degrees in biology, dentistry, medicine, or related fields should enroll in PHYS 211 or PHYS 212 or PHYS 241, PHYS 242 - PHYS 243.

PHYS 205 PHYSICS FOR MIDDLE SCHOOL TEACHERS (3)

Physics for middle school education majors, emphasizing development of principles from experiments and discussion. Topics include force and motion, energy, electricity, magnetism, and heat. Lab/Class fee will be assessed.

PHYS 211 GENERAL PHYSICS I; NON CALCULUS-BASED (4)

For Arts and Sciences, Biology and Geosciences majors: mechanics, heat, light, electricity, magnetism, and a brief introduction to modern physics. Three lecture units and one three-unit laboratory period. Prerequisite: MATH 115 or good standing in high school algebra and trigonometry. Core: Biological & Physical Sciences. Lab/Class fee will be assessed.

PHYS 212 GENERAL PHYSICS II; NON CALCULUS-BASED (4)

For Arts and Sciences, Biology and Geosciences majors: mechanics, heat, light, electricity, magnetism, and a brief introduction to modern physics. Three lecture units and one three-unit laboratory period. Prerequisite: PHYS 211. Core: Biological & Physical Sciences. Lab/Class fee will be assessed.

PHYS 220 ENGINEERING MECHANICS II (3)

Stress and deformation of solid-rods, beams, shafts, columns, tanks, and other structural, machine and vehicle members. Topics include stress transformation using Mohr's circle; shear and moment diagrams; derivation of elastic curves; and Euler's buckling formula. Prerequisite: PHYS 102.

PHYS 241 GENERAL PHYSICS I CALCULUS-BASED (4)

Calculus-based physics for science and engineering majors. Mechanics and the conservation laws, gravitation, simple harmonic motion. Prerequisite: MATH 273 (may be taken concurrently). Core: Biological & Physical Sciences. Lab/Class fee will be assessed.

PHYS 242 GENERAL PHYSICS II CALCULUS-BASED (4)

Continuation of PHYS 241. Electricity, magnetism, DC and AC currents, geometric optics. Prerequisites: PHYS 241, MATH 274 (may be taken concurrently). Core: Biological & Physical Sciences. Lab/Class fee will be assessed.

PHYS 243 GENERAL PHYSICS III (4)

Special relativity, fluid kinematics and dynamics, waves, thermodynamics. Prerequisite: PHYS 242.

PHYS 251 HONORS GENERAL PHYSICS I CALCULUS-BASED (4)

Calculus based physics for science and engineering majors. Mechanics and the conservation laws, gravitation, simple harmonic motion, electricity, magnetism, DC and AC currents, geometric optics. Honors college course. Students who have successfully completed the non-honors version of this course will not receive additional credit for this course. Core: Biological & Physical Sciences.

PHYS 252 HONORS GENERAL PHYSICS II CALCULUS-BASED (4)

Continuation of PHYS 241. Electricity, magnetism, DC and AC currents, geometric optics. Honors College course. Students who have successfully completed the non-honors version of this course will not receive additional credit for this course. Prerequisites: PHYS 241, MATH 274 (may be taken concurrently). Core: Biological & Physical Sciences.

PHYS 270 COMPUTERS IN PHYSICS (4)

Introduction to hardware and software applications of computers in physics, including computer interfacing to experiments, computer aided design, LabView programming, data analysis, simulation and modeling techniques. Prerequisite: PHYS 241. Lab/Class fee will be assessed.

PHYS 295 RESEARCH PROBLEMS IN PHYSICS (1-3)

Individual project in any branch of physics. Students can choose either to work on projects or in areas suggested by physics faculty. At the completion of a project, the student must write a formal research paper on the work done. Repeatable for credit at different levels.

PHYS 296 RESEARCH PROBLEMS IN PHYSICS (1-3)

Individual project in any branch of physics. Students can choose either to work on projects or in areas suggested by physics faculty. At the completion of a project, the student must write a formal research paper on the work done. Repeatable for credit at different levels.

PHYS 307 INTRODUCTORY MATHEMATICAL PHYSICS (3)

Mathematical expressions for selected topics, such as forces and potentials, vector analysis, applications of Fourier series and complex variables, and solutions of the harmonic oscillator and wave equations.

PHYS 311 MODERN PHYSICS I (3)

A description of the the quantum theory, atomic structure, and spectra. Three lecture hours. Prerequisites: MATH 274, PHYS 242 or PHYS 252; or PHYS 212 with consent of instructor).

PHYS 312 MODERN PHYSICS II (3)

Required course for the Applied and General tracks of the Physics major. Applications of special relativity and quantum theory to the various disciplines in physics, including solid state, nuclear, elementary particles, and cosmology. Prerequisite: PHYS 311.

PHYS 335 BASIC ELECTRONICS (4)

Circuit components, characteristics of semi-conductors, electrical measurements, method of circuit analysis, electronic devices. Three lecture hours and one three-hour laboratory period. Lab/Class fee will be assessed.

PHYS 337 DIGITAL ELECTRONICS (4)

Subjects covered will be basic concepts of digital electronics such as gates, logic modules, truth tables, digital codes, sequential systems, semi-conductor memories, decade counters, etc. The laboratory program is designed to give students first hand experience on the material covered in lecture using integrated circuits and LED display systems. Two hours lecture, three hours laboratory. Lab/Class fee will be assessed.

PHYS 341 INTERMEDIATE PHYSICS LABORATORY I (3)

First Term: The measurement of several fundamental physical constants. Exploration of classical and modern research methods: lasers, holography, optical and nuclear spectroscopy. Second Term: Several advanced experiments, a research project. Familiarization with machine shop procedure, vacuum and other experimental techniques. Five laboratory units. Prerequisites: PHYS 270; PHYS 311 (may be taken concurrently). Lab/Class fee will be assessed.

PHYS 342 INTERMEDIATE PHYSICS LABORATORY II (3)

First Term: measurement of several fundamental physical constants. Exploration of classical and modern research methods: lasers, holography, optical and nuclear spectroscopy. Second Term: several advanced experiments, a research project. Familiarization with machine shop procedure, vacuum and other experimental techniques. Five laboratory hours. Lab/Class fee will be assessed.

PHYS 351 MECHANICS (4)

Systems of coordinates, kinematics, and transformations: Newtonian dynamics of particles and systems of particles; linear systems, oscillations, and series techniques; calculus of variations and the Lagrangian and Hamiltonian formulations; application of Lagrangians to gravitation/central force motion. Optional: non-linear oscillations.

PHYS 352 THERMODYNAMICS AND KINETIC THEORY (3)

Principles and laws of classical thermodynamics applied to simple irreversible processes, including chemical, elastic, electric and magnetic phenomena; thermodynamic functions and Maxwell's relations; the conservation equations in elementary kinetic theory; fluctuations; and irreversible transfer effects. Three lecture hours. Prerequisites: PHYS 212 or PHYS 243, MATH 274 (may be taken concurrently with PHYS 243 or by permission).

PHYS 354 ELECTRICITY & MAGNETISM (4)

Electrostatics, magnetostatics and electromagnetic radiation, including Divergence Theorem and Stokes' Theorem, electrostatics in free space and dielectric materials, the Biot-Savart Law, the magnetic vector potential, inductance and electromotance, magnetic materials, Maxwell's Equation in free space and in materials, boundary value problems (Snell's and Fresnel's Law). Prerequisites: PHYS 243; PHYS 307 or consent of instructor.

PHYS 361 OPTICS FUNDAMENTALS (4)

Geometric, wave and quantum optics; lenses and mirrors, lens aberrations and design, optical instruments, interference diffraction, polarization, absorption and scattering, lasers, holography, and the dual nature of light. Three lecture hours and one three-hour laboratory each week. Prerequisites: PHYS 243, COSC 165, and PHYS 341 or consent of the instructor. Lab/Class fee will be assessed.

PHYS 385 PHYSICS SEMINAR (1)

Students participate in colloquia on topics of current interest in physics research under guidance of instructor. One lecture hour. Prerequisite: at least junior standing.

PHYS 391 INTERNSHIP IN PHYSICS (2-3)

Practical experience in industry, public and private agencies. Not for major or minor credit. Special permit and fee required. May be repeated for a maximum of 6 units. Graded S/U. Prerequisites: 2.70 GPA, junior or senior standing, major in Physics, consent of department.

PHYS 395 RESEARCH PROBLEMS IN PHYSICS (1-3)

Individual project in any branch of physics. Students can choose to work either on projects or in areas suggested by physics faculty. At the completion of a project, the student must write a formal research paper on the work done. Repeatable for a maximum of 6 units. Prerequisite: permission of the faculty member who will direct the proposed work.

PHYS 396 RESEARCH PROBLEMS IN PHYSICS (1-3)

Individual project in any branch of physics. Students can choose either to work on projects or in areas suggested by physics faculty. At the completion of a project, the student must write a formal research paper on the work done. Repeatable for a maximum of 6 units.

PHYS 411 GRAVITATION, RELATIVITY, AND COSMOLOGY (3)

Development of Einstein's general theory of relativity and its relevance to astrophysics: theory of gravity, relativistic effects of massive stars, black holes, gravity waves, cosmology. Offered in alternate years.

PHYS 451 MECHANICS II (3)

A continuation of PHYS 351. Rotation transformations; perturbation and Green's function techniques in solution of oscillating systems; collision; rotating frames of reference and dynamics of rigid bodies (including Euler's angles, precession, nutation); theory of coupled small oscillations. Optional: special relativity; continuum mechanics. Prerequisite: PHYS 351.

PHYS 453 PHYSICAL OPTICS (3)

Electromagnetic theory of light, wave solutions, interference, diffraction, scattering, radiation from coherent and incoherent sources, elementary theory of masers and lasers. Three lecture hours. Prerequisite: PHYS 354 or consent of instructor.

PHYS 454 ELECTRICITY AND MAGNETISM II (3)

Continuation of PHYS 354. Wave guides, retarded potentials, dipole radiation, relativistic electrodynamics. Prerequisite: PHYS 354.

PHYS 455 INTRODUCTORY QUANTUM MECHANICS (3)

Schrodinger equation, states of one particle in one dimension, potential barrier problems in one dimension, the harmonic oscillator, system of particles in one dimension, motion in three dimensions, angular momentum, spin, application to atomic physics. Prerequisites: PHYS 311, PHYS 351 (may be taken concurrently).

PHYS 456 INTRODUCTION TO STATISTICAL MECHANICS (3)

Distribution functions, microcanonical, canonical and grand canonical ensembles, the partition function and thermodynamics relations. Fermi-Dirac and Bose-Einstein statistics, some simple models and applications, the Maxwell-Boltzmann transport equation and the hydrodynamic equation, transport coefficients. Three lecture hours. Prerequisite: PHYS 455.

PHYS 457 SOLID STATE PHYSICS (3)

Crystal structure, wave propagation in periodic structures, the Fermi gas, energy bands, magnetism, are presented as a central theoretical core for the study of the solid state. Some of the basic models, concepts, and manifest properties of solids are also included. Prerequisites: PHYS 311, PHYS 351 and PHYS 354.

PHYS 458 MAGNETISM AND MAGNETIC MATERIALS (3)

It is impossible to imagine our modern technological society without magnetic materials. We use these materials and techniques virtually everywhere: in permanent magnets, sensors, information storage and processing. In this course, students will learn about the basic principles that govern different applications of magnetism and magnetic materials. We will discuss magnetic moments and their interactions, magnetic order and magnetic structures, implications of magnetism for real materials, experimental techniques and applications. Prerequisite: consent of department.

PHYS 459 NUCLEAR AND PARTICLE PHYSICS (3)

Experimental and theoretical methods for the study of nuclear and particle physics. Topics include properties of nuclei, nuclear transitions, nuclear models, nuclear reactions, relativistic interactions, symmetry, fundamental interactions, and contemporary models. Offered in alternate years. Prerequisites: PHYS 311; PHYS 307 or consent of instructor.

PHYS 470 SPECIAL TOPICS IN PHYSICS (1-4)

Special topics in the area of physics. Special topics will be determined by current interests of the faculty and the needs of the curriculum. Prerequisite: department consent.

PHYS 486 PHYSICS SEMINAR II (1)

Students participate in colloquia on topics of current interests in physics research under guidance of instructor. One lecture hour. Prerequisite: senior standing or consent of instructor.

PHYS 490 INDEPENDENT STUDY IN PHYSICS (1-4)

May be repeated for a maximum of 6 units. Prerequisite: at least junior status and one course in the Department of Physics.

PHYS 491 DIRECTED READINGS (1-4)

May be repeated for a maximum of 6 units. Prerequisites: At least junior status and one course in the department.

PHYS 495 CAPSTONE PROJECT IN PHYSICS (1-4)

Individual project in applied or theoretical physics research. May be completed over two semesters. Prerequisite: Consent of instructor who will mentor the research project.

PHYS 496 RESEARCH PROBLEMS IN PHYSICS (1-3)

Individual projects in any branch of physics. Students can choose to work either on projects or in areas suggested by physics faculty. At the completion of a project, students must write a formal research paper on the work done. Repeatable for credit at different levels. Prerequisite: permission of the instructor who will direct the proposed work.

PHYS 497 RESEARCH PROBLEMS IN PHYSICS (1-4)

Individual projects in any branch of physics. Students can choose to work either on projects or in areas suggested by physics faculty. At the completion of a project, students must write a formal research paper on the work done. Repeatable for credit at different levels. Prerequisite: permission of the instructor who will direct the proposed work.

PHYS 499 HONORS THESIS IN PHYSICS (1-4)

Writing of an honors thesis based on independent research done under the direction of a staff member. May be repeated for a maximum of 6 units. Honors College course. Prerequisites: consent of instructor and open only to advanced honors candidates.