PHYSICS (PHYS)

Courses

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 SEMINAR IN PHYSICS (1)

This seminar is intended for freshmen and sophomores who have an interest in the sciences and will expose them to current ideas, opportunities, and research in physics and astronomy.

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 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. Students who have successfully completed the honors version of this course (PHYS 251) will not receive additional credit for this course. 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, Maxwell's equations. Students who have successfully completed the honors version of this course (PHYS 252) will not receive additional credit for this course. Prerequisites: PHYS 241 (or a grade of B (3.0) or higher in PHYS 211), MATH 274 (may be taken concurrently). Core: Biological & Physical Sciences. Lab/Class fee will be assessed.

PHYS 243 GENERAL PHYSICS III (4)

Fluid kinematics and dynamics, waves, thermodynamics and optics. 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 295 RESEARCH PROBLEMS IN PHYSICS (1-4)

Individual project in any branch of physics. May be repeated for a maximum of 6 units. Prerequisites: freshman or sophomore status and permission of the faculty member who will mentor the research project.

PHYS 305 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. Not open to students who have successfully completed PHYS 270. Prerequisite: PHYS 241. Lab/Class fee will be assessed.

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. Prerequisites: PHYS 212 or PHYS 242; MATH 274; and consent of department.

PHYS 311 MODERN PHYSICS I (3)

A description of special relativity, quantum theory, atomic structure, and spectra. 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 320 BIOPHYSICS (3)

Application of physical principles and techniques to problems in biology, with emphasis on understanding cellular and subcellular structure and function. Prerequisites: CHEM 131/ CHEM 131L, BIOL 200/ BIOL 200L, and PHYS 243.

PHYS 341 INTERMEDIATE PHYSICS LABORATORY (3)

Experiments which defined modern physics. Exploration of classical and modern research methods: data acquisition and analysis, optical and nuclear spectroscopy. Six laboratory hours. Prerequisites: PHYS 305; PHYS 311 (may be taken concurrently). 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. Prerequisites: MATH 374 (may be taken concurrently); PHYS 242; PHYS 307 or consent of the instructor.

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 AND MAGNETISM (4)

Electrostatics, magnetostatics and electromagnetic radiation, including the Divergence Theorem and Stokes' Theorem, electrostatics in free space and dielectric materials, dielectric polarization, Laplace's Equation, the Biot-Savart Law, the magnetic vector potential, inductance, magnetic materials, Maxwell's Equations in free space and in materials, and electrostatic boundary value problems. Prerequisites: MATH 374 (may be taken concurrently); 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 and PHYS 341 (may be taken concurrently) 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. May be repeated for a maximum of 6 units. Graded S/U. Prerequisites: junior or senior standing, consent of department.

PHYS 395 RESEARCH PROBLEMS IN PHYSICS (1-4)

Individual project in any branch of physics. May be repeated for a maximum of 9 units. Prerequisites: junior status and permission of the faculty member who will mentor the research project.

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. Prerequisites: PHYS 307, PHYS 311, and MATH 275.

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 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 instructor.

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 460 COMPUTATIONAL METHODS IN PHYSICS (3)

Introduction to the basic concepts and programming skills of computational physics. Students will develop their own computer programs to solve problems in mechanics, electromagnetism, quantum mechanics, chaos, nonlinear dynamics, and other areas. No previous computer programming experience is required. Prerequisites: MATH 374 and PHYS 307 or consent of the 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. Prerequisites: junior status and consent of the instructor.

PHYS 491 DIRECTED READINGS IN PHYSICS (1-4)

May be repeated for a maximum of 6 units. Prerequisites: junior status and consent of the instructor.

PHYS 495 RESEARCH PROBLEMS IN PHYSICS (1-4)

Individual project in any branch of physics. May be repeated for a maximum of 9 units. Prerequisites: senior status and permission of the faculty member who will mentor the research project.

PHYS 497 CAPSTONE RESEARCH IN PHYSICS (1-4)

Individual projects in any branch of physics. At the completion of a project, students must write a formal research paper on the work done. May be repeated for a maximum of 6 units. Prerequisites: junior status and permission of the faculty member who will mentor the research project.

PHYS 499 HONORS THESIS IN PHYSICS (1-4)

Writing of an honors thesis based on independent research done under the direction of a faculty member. May be repeated for a maximum of 6 units. Prerequisites: senior major status and permission of the faculty member who will mentor the research project.