

PHYSICS (PHY)

PHY 100 PHYSICS FOR NON-SCIENCE MAJORS

3, 3/0; NS23

A non-mathematical consideration of historical world views in physics and their relevance to society. May not be substituted for PHY 107, PHY 108, PHY 111, or PHY 112. Not open to physics majors. Offered every semester.

PHY 103 UNDERSTANDING SOUND

3, 2/2; NS23

The basics of sound, intended for non-science majors. Wave characteristics and behavior, applied to sonic phenomena. Interfaces of sound with humans and society (music, hearing, sound production and recording). Offered every semester.

PHY 104 PHYSICS FOR K-8 TEACHERS

3, 2/2; NS23

Prerequisite: Acceptance to Pre-K-8 teaching majors or pre-majors. High school algebra and writing. Nature of science, energy transfer, force interactions, systems, Newton's Laws, magnetic, gravitational, light, and thermal interactions, conservation of energy, and simple circuits as appropriate for teachers of K-8 science. Meets National Science Education Standards S (NRC) and the New York State Education Department (NYSED) learning standards for Math Science and Technology and elementary and intermediate physical standards (Standard 4). Inquiry-based classroom co-mingles laboratory with lecture. Offered every semester.

PHY 107 GENERAL PHYSICS I

4, 3/2; NS23

Algebra-based study of mechanics, measurement, kinematics, Newton's laws, gravity, conservation of energy and momentum, and rotation; laboratory. Offered every semester.

PHY 108 GENERAL PHYSICS II

4, 3/2

Prerequisite: PHY 107. Algebra-based study of electricity and magnetism: static electricity (including electricity fields and potential), current electricity and circuits, magnetism and electromagnetic interactions; laboratory. Offered every semester.

PHY 111 UNIVERSITY PHYSICS I

5, 4/2; NS23

Corequisites: MAT 161 and MAT 163. Calculus-based treatment for science majors of particle motion, kinematics, mechanics, Newtonian dynamics, energy transformation, conservation laws of energy and momentum, gravitation and rotation; laboratory. Required for majors. Offered every semester.

PHY 112 UNIVERSITY PHYSICS II

5, 4/2

Prerequisite: PHY 111 or equivalent. Corequisites: MAT 162 and MAT 164. Continuation of PHY 111. Calculus-based introduction to heat, electricity, magnetism, and optics; laboratory. Required for physics majors. Offered every fall.

PHY 189 TOPICS COURSE

1-3, 1/0

Offered occasionally.

PHY 213 UNIVERSITY PHYSICS III

3, 3/0

Prerequisites: PHY 108 or PHY 112. Continuation of PHY 112. A calculus-based introduction to wave motion, physical optics, interference and diffraction phenomena, thermodynamics, and the kinetic theory of gases. Offered in the fall semester.

PHY 214 OPTICS AND HEAT LABORATORY

1, 0/2

Prerequisites: PHY 108 or PHY 112. Performing basic physics experiments chosen from the areas of optics, heat, and thermodynamics. Students carry out experiments; acquire, analyze, and interpret experimental data; write lab reports in a standard scientific format. Offered annually each fall semester.

PHY 295 RESEARCH EXPERIENCE IN PHYSICS

1-3, 0/0

Prerequisite: Instructor Permission. Scholarship or creative work conducted under the supervision of a faculty member. Offered occasionally.

PHY 304 OPTICS AND VISION FOR TEACHERS AND ARTISTS

3, 2/2

Prerequisites: Any college or high school introductory physics course; CWP 101; any first-year MAT or instructor permission. Phenomena of light, vision, color, and photography, as appropriate for teachers of science and visual arts majors. Meets the National Science Education Standards S (NRC) and the New York State Education Department (NYSED) learning standards for Math, Science and Technology and elementary and intermediate physical setting standards (Standard 4). Inquiry-based classroom co-mingles laboratory with lecture using handheld apparatus and demonstrations in the lecture theater and take-home laboratory activities using everyday materials. Can be used as a sequence with PHY 104. Offered occasionally.

PHY 305 MODERN PHYSICS I

3, 3/0; RE23

Prerequisites: PHY 213 and CHE 112 or instructor permission. Introduction to Special Relativity, the Bohr model of the atom, wave-particle duality, introduction to quantum mechanics, applications of quantum mechanics to the atoms. Offered in the spring semester each year.

PHY 306 MODERN PHYSICS II

3, 0/0

Prerequisites: PHY 305 or instructor permission. Continuation of PHY 305. Features of atomic spectra and their explanation in terms of magnetic properties; differences between classical and quantum statistical distributions and their origins; structural features of molecules; how properties of solids are determined by quantum statistics; properties of nuclei, including stability and different decay modes. Offered in the fall semester each year.

PHY 307 MODERN PHYSICS LABORATORY

2, 0/3; IN23

Prerequisite: PHY 305 (or corequisite) or instructor permission. Selected modern physics experiments in optics, atomic physics, electricity and magnetism, and nuclear physics. Students will acquire, analyze, and interpret the experimental data and write lab reports in a scientific format. Offered every fall semester.

PHY 308 OPTICS

3, 3/0

Prerequisites: PHY 108 or PHY 112 or equivalent. Fundamentals of geometrical and physical optics; the nature and propagation of light; Fraunhofer and Fresnel diffraction, polarization; single, double slit and grating diffraction, lasers, and holography. Offered occasionally.

PHY 310 COMPUTATIONAL PHYSICS LABORATORY

3, 1/4

Prerequisites: PHY 107 or PHY 111. Introduction to basic computational techniques using physics material from intermediate-level courses. Required for physics majors. Offered fall only.

PHY 315 HEAT AND THERMODYNAMICS

3, 3/0

Prerequisites: PHY 108 or PHY 112 or equivalent. First, second laws; entropy; chemical potential; enthalpy; free energy; Gibbs function; Maxwell relations; phase transitions; and statistical mechanics of classical and quantum distributions. Offered occasionally.

PHY 320 INTRODUCTION TO THEORETICAL PHYSICS

3, 3/0

Prerequisites: PHY 108 and MAT 127 or PHY 112 or Instructor permission. Introduction to advanced mathematical applications in physics: complex numbers, linear algebra, eigenvalue problems, multiple integrals, vector analysis, Fourier series and transforms, differential equations, and Legendre polynomials. Required for physics majors. Offered spring only.

PHY 323 STATICS

3, 3/0

Prerequisites: PHY 112. Application of mechanics to the study of static equilibrium of rigid and elastic bodies. Includes composition and resolution of forces; moments and couples; equivalent force systems, free-body diagrams; equilibrium of particles and rigid bodies; forces in trusses and beams; friction forces; first and second moments of area; moments and product of inertia; methods of virtual work and total potential energy. Offered occasionally.

PHY 324 ELECTRIC CIRCUIT ANALYSIS

3, 2/2

Prerequisites: PHY 108 or PHY 112. Calculus-based treatment of DC and AC circuits with introduction to commonly used analysis methods; laboratory. Offered fall only.

PHY 340 NONLINEAR DYNAMICS AND CHAOS

3, 3/0

Prerequisites: PHY 310 and PHY 320 or instructor permission. Introduction to nonlinear mechanics in one, two and three dimensions. Bifurcations, phase planes, fixed points, limit cycles, fractals, chaos and strange attractors. Applications to many areas of science such as weather prediction, lasers, vibrational instabilities, and population variations of predators and prey. Offered occasionally.

PHY 389 TOPICS IN PHYSICS

1-3, 3/0

Prerequisite: Instructor permission. Current topics not covered in the courses regularly offered. Offered occasionally

PHY 410 ADVANCED PHYSICS LABORATORY

3, 0/6

Prerequisite: PHY 307 or equivalent. Selected advanced experiments chosen from the areas of modern physics, optics, nuclear physics, solid-state physics, and semiconductors. Offered every spring semester.

PHY 425 CLASSICAL MECHANICS

3, 3/0

Prerequisites: PHY 310, PHY 320, or instructor permission. Particle mechanics in one, two, and three dimensions: rigid body motions in three dimensions: motion in central fields; moving frames of reference; forced harmonic oscillators, and introduction to mechanics in Lagrangian and Hamiltonian formulations. Offered in alternate Fall semesters.

PHY 435 INTRODUCTION TO QUANTUM MECHANICS

3, 3/0

Prerequisites: PHY 310, PHY 320, PHY 305 or instructor permission. Postulates of Quantum Mechanics introduced and explored through examples of different model Hamiltonians. Operator formalism and its connection with the application of the Schrödinger equation. Analytical and numerical techniques applied to physical systems in atomic, nuclear and condensed matter physics. Theoretical and experimental investigations of the foundations of Quantum Mechanics and recent applications. Offered in spring semester in alternate years.

PHY 440 ELECTRICITY AND MAGNETISM I

3, 3/0

Prerequisite: PHY 310 and PHY 320, or instructor permission. Coulomb forces; electric fields and potentials; Laplace equation; boundary value problems and dielectrics; multipole distributions; magnetic induction; introduction to Maxwell's equations. Offered every alternate fall semester.

PHY 441 ELECTRICITY AND MAGNETISM II

3, 3/0

Prerequisite: PHY 440, or instructor permission. Continuation of PHY 440. Electric Induction; Maxwell's equations; momentum and energy of electromagnetic fields; propagating waves; radiation; special relativity; relativistic electrodynamics. Offered every alternate spring semester.

PHY 450 SUPERVISED PHYSICS LABORATORY TEACHING

1-2, 0/0

Prerequisites: Physics major; upper-division status; minimum cumulative GPA of 3.0, 3.25 in major coursework; physics faculty permission based on academic performance, maturity, and potential. Supervised in-classroom introduction to college laboratory teaching techniques and procedures for selected upper-division physics majors. Offered occasionally.

PHY 495 SPECIAL PROJECT

1-3, 0/0

Prerequisite: Faculty sponsor approval. Physics and physics-related areas. Offered occasionally.

PHY 499 INDEPENDENT STUDY

3, 0/0

Prerequisite: Faculty sponsor approval. Physics and physics-related areas. Offered occasionally.

PHY 500 PHYSICS EDUCATION RESEARCH SEMINAR

3, 3/0

Designed for practicing or future high school physics teachers. Includes reading and discussion of current research in physics education, evaluation and discussion of the application of this research to the New York State physics core curriculum, and the exploration and practice of assessment techniques in high school physics.

PHY 502 INITIAL PHYSICS TEACHING EXPERIENCE FOR ALTERNATIVE CERTIFICATION

3-6, 3/0

Prerequisite: Acceptance to the alternative certification in physics program. Full-time physics teaching with college supervision and school supervision: lesson and unit design, classroom management, designing and implementing student assessment, participation in school community.

PHY 507 ENERGY AND FORCE INTERACTIONS FOR K-8 TEACHERS

3, 1/4

Designed for elementary teachers to better understand physics and the nature of science. Focus on interactions and energy: energy, force, friction, gravity, magnetic fields, light, and electricity. Not appropriate for students with extensive physics background.

PHY 510 REGENT'S PHYSICS SCIENCE PRACTICES

4, 2/4

Prerequisites: Graduate standing, Introductory physics sequence or permission of instructor. Students apply the Next Generation Science Standards (NGSS Lead States, 2013) practices of asking questions, developing and using models, planning and carrying out investigations, analyzing and interpreting data, using mathematics, constructing explanations, and engaging in argument from evidence. Students apply these practices to physics concepts. Offered summer sessions.

PHY 511 COMPUTATIONAL PHYSICS FOR TEACHERS

3, 3/0

Prerequisites: PHY 111, PHY 112 and PHY 213 or instructor permission. Study of problems from various physics content areas using a variety of computational tools (e.g. spreadsheets, computer programming) and techniques (Newton's method, Runge-Kutta). Physical systems including harmonic oscillator with damping, gravitational force (orbits, central force problem), electric and magnetic field and potential calculations, thermal and statistical physics, motion with air friction, wave motion, quantum mechanical tunneling and scattering. Pedagogical issues associated with using computation in the high school classroom.

PHY 518 WAVE PHENOMENA AND OPTICS FOR TEACHERS

3, 3/0

Wave phenomena, including types, motion, interaction, and propagation; diffraction and interference; geometrical optics. Emphasizes research-based profiles of student conceptual difficulties and instructional strategies to remedy them.

PHY 520 MODERN PHYSICS FOR TEACHERS

3, 3/0

Major developments in twentieth and twenty-first century physics and how they changed our understanding of the nature of space and time and the structure of matter. Application of physics education research to teaching relativity and quantum physics in a high school physics course.

PHY 521 EXPERIMENTS IN MODERN PHYSICS FOR TEACHERS

3, 0/6

Prerequisite: PHY 520 or equivalent. Hands-on activities and advanced experiments chosen from the areas of optics, modern physics, nuclear physics, and solid state physics with the goals of learning modern laboratory techniques, data analysis, and lab report writing.

PHY 522 ENERGY: SUSTAINABILITY AND RENEWABILITY FOR TEACHERS

3, 2/2

Prerequisites: PHY 107 and PHY 108. Different energy sources, their global supply, and physical laws governing their present use in the world. Topical energy sources and physical laws for the hydrogen fuel cell, solar cell and wind turbine; using them in applications and devices.

PHY 525 NUCLEAR AND PARTICLE PHYSICS FOR TEACHERS

3, 3/0

Major developments in nuclear and particle physics in the twentieth and twenty-first century, culminating in the standard model. Discussion of how these developments changed our understanding of the structure or matter.

PHY 588 TOPICS COURSE

3, 3/0

PHY 590 INDEPENDENT STUDY

1-3, 0/0

PHY 594 GRADUATE WORKSHOP

1-3, 0/0

In-depth study of a current issue in physics for grade school physics teachers culminating in a professional presentation or manuscript. Offered occasionally.

PHY 596 GRADUATE CONFERENCE

1-3, 0/0

Prepare and conduct a scholarly presentation (poster or paper) on physics for school teaching at a regional, national or international professional academic conference. Offered occasionally.

PHY 620 MECHANICS FOR HIGH-SCHOOL TEACHERS

6, 3/6

Prerequisites: PHY 111 and PHY 510, or instructor permission. Designed for practicing or future high school physics teachers. Activities and laboratory experiences develop ideas in force, motion, and energy. Exemplary pedagogical techniques are modeled and examined. Offered every alternate summer.

PHY 622 ELECTRICITY AND MAGNETISM FOR HIGH SCHOOL TEACHERS

6, 3/3

Prerequisites: PHY 510 and PHY 112, or instructor permission. Designed for high school physics teachers. Activities and laboratory experiences develop ideas in electricity and magnetism. Exemplary pedagogical techniques are modeled and examined. Offered summer only.

PHY 690 MASTER'S PROJECT

1-3, 0/0

Study of a problem of special interest, preapproved by the physics graduate committee and submitted in acceptable form according to directions given by the Physics Department.

PHY 721 THESIS/PROJECT CONTINUATION

0, 0/0

PHY 722 THESIS/PROJECT EXTENDED

0, 0/0