PHYS PHYSICS

PHYS 1000 GATEWAY TO PHYSICS
Credit Hour(s): 2.0

Gateway to Physics. Two lecture hours a week. This is a seminar course intended for anyone curious about physics and its relevance to contemporary life. No background in physics is necessary. This course is appropriate for pre-professional students in education, medicine, law, and business, as well as students pursuing degrees in natural sciences, social sciences, humanities, music, and fine arts. It is required for physics majors. The course engages a broad spectrum of resources and experiential opportunities (e.g. popular science books & articles, videos, websites, lab tours, field trips, service learning opportunities, and guest presenters) to explore compelling interconnections between physics and other disciplines and career interests. Course topics may include Physics and the Human Body, Physics and the Nano-scale, Physics and the Cosmos, Physics and Technology, Physics and Art, and Chaos & Complexity.

PHYS 1111K INTRODUCTORY PHYSICS I
Credit Hour(s): 4.0


PHYS 1112K INTRODUCTORY PHYSICS II
Credit Hour(s): 4.0

Introductory Physics II. Three lecture and two laboratory hours a week. Electricity, light, modern physics. Phys 1111K and Phys 1112K meet the science requirement for the B.A., the B.B.A., and the B.S. in Education degrees, and the physics requirement for students in the biological and life sciences. Most natural science majors should enroll in Phys 2211K and Phys 2212K.

PHYS 2030K PHSC: PHYSICS OF MUSIC &SPEECH
Credit Hour(s): 3.0

Physical Science: Physics of Music and Speech. Two lecture and two laboratory hours a week. No science background required. Not accepted as a part of the requirements for a major or an allied field in physics. Physical characteristics of musical sound; applications to musical tones, scales, harmony, and acoustics; problems of recording, amplifying, transmitting, and reproducing sound.
PHYS 2211K  PRINCIPLES OF PHYSICS I
Credit Hour(s): 4.0

Principles of Physics I. Prerequisite: Math 2211 with grade of D or higher. Three lecture and three laboratory hours a week. Mechanics, Heat, and Waves. Phys 2211K - Phys 2212K is the beginning sequence for students majoring in physics, chemistry, or geology. It is recommended for mathematics majors and other students with the necessary mathematical background. No credit if the Phys 1111K - 1112K sequence is taken.

PHYS 2212K  PRINCIPLES OF PHYSICS II
Credit Hour(s): 4.0

Principles of Physics II. Prerequisites: Math 2212 and Phys 2211K with grades of D or higher. Three lecture and three laboratory hours a week. Electricity and magnetism, light, modern physics. Phys 2211K - 2212K is the beginning sequence for students majoring in physics, chemistry, or computer science. It is recommended for mathematics majors and other students with the necessary mathematical background. No credit if the Phys 1111K - Phys 1112K sequence is taken.

PHYS 2940  DIRECTED LAB INVESTIGATIONS
Credit Hour(s): 1.0 TO 2.0

Directed Laboratory Investigations. Prerequisite: consent of the department. Directed laboratory investigation in physics involving the development of experimental skills required for advanced study in physics or a related science. May be repeated for no more than two hours total credit.

PHYS 3150  ADVANCED GENERAL PHYSICS
Credit Hour(s): 3.0

Advanced General Physics. Prerequisites: a non-calculus elementary physics sequence such as Phys 1111K and 1112K; Math 2212 with grades of D or higher, or equivalent. Three lecture hours a week. Not acceptable for credit for students who have had Phys 2211K-2212K. Designed to prepare the student who has completed a non-calculus-level elementary physics sequence for more advanced physics courses. The utilization of calculus in solving problems in classical physics is stressed.

PHYS 3300  ADVANCED PHYSICS LAB-CTW
Credit Hour(s): 3.0

Advanced Physics Laboratory-CTW. Prerequisites: Phys 2212 and Math 2215 with grades of C or higher. Corequisite: Phys 3401. Advanced laboratory experiments in modern physics, optics, and astronomy with emphasis on scientific report writing. Required for all physics majors.
Serves as one of the two Critical Thinking Through Writing (CTW) courses required of all physics majors.

**PHYS 3401  MODERN PHYSICS I**

**Credit Hour(s):** 4.0

Modern Physics I. Prerequisites: Phys 2212K and Math 2215 with grade of C or higher. Four lecture hours a week. Special relativity, quantum optics, wave and particle duality, Bohr theory, Schrodinger’s quantum mechanics, one-electron atom, spin, and angular momentum.

**PHYS 3402  MODERN PHYSICS II**

**Credit Hour(s):** 3.0

Modern Physics II. Prerequisite: Phys 3401 with grade of C or higher. Three lecture hours a week. Atomic spectra, X-ray spectra, nuclear structure, nuclear reactions, elementary particles, molecular spectra and structure, solid-state physics.

**PHYS 3500  ELECTRONICS**

**Credit Hour(s):** 3.0

Electronics. Prerequisite: Phys 2212K or Phys 1112K with grade of C or higher. Two lecture and four laboratory hours a week. Fundamentals of analog and digital circuit design; discrete and integrated circuit devices; electronic instrumentation.

**PHYS 3800  OPTICS**

**Credit Hour(s):** 3.0

Optics. Prerequisite: Phys 2212K with grade of C or higher. Three lecture hours a week. Fundamentals and applications of optics: diffraction, interference, lasers, fiber optics, and applications of optical instrumentation.

**PHYS 3850  STATISTICAL & THERMAL PHYSICS**

**Credit Hour(s):** 3.0

Statistical and Thermal Physics. Prerequisites: Phys 2212K and Math 2215 with grades of C or higher. Three lecture hours a week. Physical statistics, quantum states and degeneracy, statistical definition of entropy, development of thermodynamics; applications to gases, radiation, and solids.

**PHYS 3901  MODERN PHYSICS LAB I**

**Credit Hour(s):** 1.0
Modern Physics Laboratory I. Corequisite: Phys 3401. Three laboratory hours a week. Experiments in physical optics, spectroscopy, and atomic physics.

**PHYS 3902 MODERN PHYSICS LAB II**

*Credit Hour(s): 1.0*

Modern Physics Laboratory II. Corequisite: Phys 3402. Three laboratory hours a week. Experiments in atomic, nuclear, and solid-state physics.

**PHYS 4030 DIGITAL INSTRUMENTATION LAB**

*Credit Hour(s): 1.0*

Digital Instrumentation Laboratory. Prerequisite: consent of instructor. Three laboratory hours a week.

**PHYS 4110 EMBEDDED SYSTEMS**

*Credit Hour(s): 4.0*

Introduction to Embedded Systems Laboratory. Prerequisite: Phys 3500 or CSc 3210 with grade of D or higher, or equivalent course work with consent of instructor. (Same as CSc 4110.) Four lecture hours per week. Topics taken from: review of basic logic functions; automatic systems; microprocessor-based systems and applications; embedded system software survey; digital communications; and embedded systems programming.

**PHYS 4340 NEUROPHYSICS**

*Credit Hour(s): 3.0*

Neurophysics. Prerequisites: Neur 3000 and Phys 2212 with grades of B or higher, or equivalent, or consent of instructor. Three lecture hours per week. Course provides fundamental findings of physics of neuronal systems. The course covers such topics as introduction to biomechanics, membranes, transport, electroosmotic effects, ion pumping, cellular homeostasis, the Hodgkin-Huxley formalism, energetics of spiking, neural coding, and dynamics of neurons and neuronal networks. It also covers methods of recording of neuronal activity.

**PHYS 4391 INTRO TO DIFFERENTIAL GEOMETRY**

*Credit Hour(s): 3.0*

Introduction to Differential Geometry and Its Applications. Prerequisite: Math 2215 with grade of C or higher. (Same as Math 4391.) Three lecture hours a week. The theory of curves and surfaces in parametric and implicit form. Curvature and torsion of a curve; the shape operator and the total and mean curvature of a surface. The Gauss-Weingarten equation; the Egregium Theorem; surfaces of constant curvature and non-Euclidean geometry; minimal surfaces; the
Gauss Bonnet Theorem; submanifolds in Euclidian spaces, vector fields, differential forms, and the theorems of Frobenius and Stokes. Application to Physics.

**PHYS 4410  NUCLEAR AND PARTICLE PHYSICS**  
Credit Hour(s): 3.0

Nuclear and Particle Physics. Prerequisite: Phys 3401 with grade of C or higher. Three lecture hours a week. Properties of nuclei; nuclear models; nuclear reactions and radioactive decay processes; properties of elementary particles, their symmetries and interactions; standard model of elementary particles.

**PHYS 4510  MATHEMATICS OF PHYSICS I**  
Credit Hour(s): 3.0

Mathematics of Physics I. Prerequisite: Math 2215 with grade of C or higher. (Same as Math 4258.) Three lecture hours a week. Algebra of vectors, vector calculus, divergence, gradient, curl, line integrals, surface integrals, divergence theorem of Gauss, Stokes's theorem, conservative fields, orthogonal curvilinear coordinates, matrices, and Eigen value problems.

**PHYS 4520  MATHEMATICS OF PHYSICS II**  
Credit Hour(s): 3.0

Mathematics of Physics II. Prerequisite: Math 3260 with grade of C or higher. (Same as Math 4265.) Three lecture hours a week. Derivation and solution of partial differential equations of physics, wave equation, LaPlace's equation, Schroedinger's equation, special functions of mathematical physics, Fourier series, Sturm-Liouville system, complex analysis, and integration.

**PHYS 4600  CLASSICAL MECHANICS**  
Credit Hour(s): 4.0

Classical Mechanics. Prerequisites: Phys 2212K and Math 3260 with grades of C or higher, or equivalent, or consent of instructor. Four lecture hours a week. Vector algebra, Newton's laws, conservation laws, many body systems, motion in central fields, small oscillations, motion in electromagnetic fields, rotation of rigid bodies, Lagrangian equations, Hamilton's principle, and virtual work.

**PHYS 4700  ELECTRICITY AND MAGNETISM**  
Credit Hour(s): 4.0

Electricity and Magnetism. Prerequisites: Phys 2212K and Math 2215 with grades of C or higher. Four lecture hours a week. Electrostatics, steady currents, magnetic fields, magnetic induction, AC circuits, dielectrics, magnetic properties of matter, Maxwell's equations, and wave propagation.
PHYS 4710  FUNCTIONAL NEUROIMAGING
Credit Hour(s): 3.0

Functional Neuroimaging. Prerequisite: consent of instructor. Three lecture hours a week. Foundations of physics principles applied to brain processes, different imaging modalities, and neuroimaging data analysis methods. Topics include physiological basis of functional neuroimaging, physics of different imaging modalities (fMRI, PET, EEG, MEG, fNIR, TMS), experimental design, neuroimaging data analysis, and applications in cognitive neuroscience. This course is appropriate for students majoring in physics, chemistry, biology, neuroscience, psychology, mathematics, statistics, and computer science with an interest in the use of functional neuroimaging.

PHYS 4810  QUANTUM MECHANICS
Credit Hour(s): 3.0

Quantum Mechanics. Prerequisites: Phys 3401 and Math 3260 with grades of C or higher, or consent of instructor. Three lecture hours a week. Schrodinger's theory of quantum mechanics; solutions of Schrodinger's equation; perturbation theory; one-electron atoms; magnetic moments, spin, and relativistic effects; identical particles; multi-electron atoms.

PHYS 4900  RESEARCH PROJECT-CTW
Credit Hour(s): 3.0

Research Project-CTW. Prerequisites: Phys 3300 and Phys 3401 with grades of C or higher and permission of the instructor. Research Project in physics, astronomy, or a related field including preparation of a written and an oral report. Projects are performed under mentoring of a faculty member. Written reports are developed under the guidance of course coordinator. Required for all physics majors. Serves as one of the two Critical Thinking Through Writing (CTW) courses required of all physics majors.

PHYS 4910  SOLID STATE PHYSICS
Credit Hour(s): 3.0

Solid State Physics. Prerequisites: Phys 3401 and 3402 with grades of C or higher, or equivalent or consent of instructor. Three lecture hours a week. Atoms in crystals (crystal structure); waves in crystals; crystal binding, lattice constants; lattice vibrations and other thermal properties of solids, free electrons in crystals, energy bands, and semiconductors.

PHYS 4920  ELEMENTARY SCIENCE ED PARTNERS
Credit Hour(s): 1.0
Elementary Science Education Partners. Prerequisites: junior or senior majoring in natural science and consent of the ESEP coordinator. Demonstrating hands-on science in the public elementary school classroom. May be repeated for a maximum of four hours.

**PHYS 4950  SENIOR RESEARCH**

Credit Hour(s): 1.0 TO 3.0

Senior Research. Prerequisites: Phys 3401 with a grade of C or higher. Training in the techniques of basic research in physics and application of these techniques to research projects of current importance. May be repeated for a maximum of three credit hours.

**PHYS 4995  DIRECTED READINGS B.I.S.-CTW**

Credit Hour(s): 3.0 TO 4.0

Directed Readings B.I.S.-CTW. Directed Readings designed for Bachelor of Interdisciplinary Studies students. This course may satisfy the junior and/or senior-level Critical Thinking Through Writing requirements.