

## **UNDERGRADUATE PHYSICS COURSES (2016-2017 catalog)**

### **PHYS1050 The World Of Atoms [3 credit hours]**

The atomic structure of matter and the ideas of quantum physics. The sizes of objects from galaxies to nucleons. Molecules, solids, the wave nature of the electron, quarks and gluons.

### **PHYS1300 Physics In Everyday Life [3 credit hours]**

Not for major credit. Selected subjects of current interest, with their relation to the principles and concepts of physics. Content may vary from year to year. No special science or mathematics background needed.

### **PHYS1310 Physics Of Music And Sound [3 credit hours]**

Not for major credit. Physics of waves and vibration. Human sound perception. Physics principles of wind, string and percussion instruments. Analog and digital reproduction of sound.

### **PHYS1320 Jurassic Physics [3 credit hours]**

Not for major credit. Mechanics, energy, sound and thermodynamics of dinosaurs. The physics of vision and hearing. Fluids and flight. Radioactivity. Climate and the effects of an asteroid collision with the Earth.

### **PHYS1330 Physics Of Light And Color [3 credit hours]**

Not for major credit. Physics of light and human vision. Atmospheric phenomena, images, depth perception, color analysis, pigments and dyes, color perception, the physics of art, the reproduction of color, thin film interference and holography.

### **PHYS1340 The Nature Of Science [3 credit hours]**

An interdisciplinary course that discusses major scientific discoveries, the role of hypothesis testing in science, the use of mathematics in science; data presentation; and moral and ethical issues that stem from science.

### **PHYS1750 Introduction To Physics [4 credit hours]**

Not for major credit. High school mathematics including plane geometry, trigonometry and two years of algebra is strongly recommended. Fundamental laws of nature pertaining to mechanics, thermodynamics, waves, electricity, magnetism, optics, atoms and particles.

### **PHYS1910 Frontiers Of Physics And Astronomy [3 credit hours]**

An examination of our current understanding of the physical world at the conceptual level. Topics may include the ultimate structure of matter, quantum theory, relativity, astrophysics, cosmology and contemporary applications.

### **PHYS2010 Technical Physics I [0-4 credit hours]**

Topics include measurement, statics, Newton's laws, friction, work, energy, power, impulse and momentum, and simple machines. Includes integrated laboratory.

Prerequisites: MATH 1340 FOR LEVEL UG WITH MIN. GRADE OF D-

### **PHYS2020 Technical Physics II [0-4 credit hours]**

Topics include thermodynamics, electricity, and magnetism, electromagnetic radiation, optics, atomic and nuclear physics. Includes integrated laboratory.

Prerequisites: MATH 1340 FOR LEVEL UG WITH MIN. GRADE OF D-

**PHYS2070 General Physics I** [0-5 credit hours]

Calculus not required. Mechanics of energy and motion, gravitation, harmonic motion, fluids, heat, entropy and the laws of thermodynamics. Four hours lecture and discussion, two hours laboratory per week.

**PHYS2080 General Physics II** [0-5 credit hours]

Calculus not required. Electricity and magnetism, capacitors and inductors, electromagnetic waves, optics, atomic physics, nuclear physics, and elementary particles. Four hours lecture and discussion, two hours laboratory per week.

Prerequisites: PHYS 2070 FOR LEVEL UG WITH MIN. GRADE OF D-

**PHYS2100 Physics With Calculus** [2 credit hours]

A bridge course for students wishing to continue in physics after taking PHYS 2070-2080. The application of calculus and elementary differential equations in various physical contexts. No credit for students who take PHYS 2130-2140.

Prerequisites: (PHYS 2080 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 1860 FOR LEVEL UG WITH MIN. GRADE OF D-) OR (PHYS 2080 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 1840 FOR LEVEL UG WITH MIN. GRADE OF D-) OR (PHYS 2080 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 1880 FOR LEVEL UG WITH MIN. GRADE OF D-) OR (PHYS 2080 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 1930 FOR LEVEL UG WITH MIN. GRADE OF D-)

**PHYS2130 Physics For Science And Engineering Majors I** [0-5 credit hours]

Calculus based general physics. Mechanics of motion and energy, rotation, gravitation, harmonic motion, waves, fluids and the laws of thermodynamics. Five hours lecture and discussion, two hours laboratory per week.

Prerequisites: MATH 1830 FOR LEVEL UG WITH MIN. GRADE OF C OR MATH 1850 FOR LEVEL UG WITH MIN. GRADE OF C OR MATH 1920 FOR LEVEL UG WITH MIN. GRADE OF C

**PHYS2140 Physics For Science And Engineering Majors II** [0-5 credit hours]

Calculus based general physics. Electricity and magnetism, capacitors and inductors, electromagnetic oscillations, Maxwell's equations and electromagnetic radiation, optics, images, interference, and diffraction. Five hours lecture and discussion, two hours laboratory per week.

Prerequisites: PHYS 2130 FOR LEVEL UG WITH MIN. GRADE OF D-

**PHYS3150 Methods Of Theoretical Physics** [3 credit hours]

Basic theoretical methods of physics. Topics include mechanical oscillations, wave propagation, electromagnetic fields, symm and eigenfunctions. Emphasis is on techniques that are common to many areas of physics and astrophysics.

Prerequisites: (MATH 1890 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 2850 FOR LEVEL UG WITH MIN. GRADE OF D- AND PHYS 2140 FOR LEVEL UG WITH MIN. GRADE OF D-)

**PHYS3180 Intermediate Laboratory** [3 credit hours]

Physical measurements laboratory related to the development of modern physics, emphasizing techniques such as electronics, computer-aided experimental control and data acquisition, and data analysis. May be offered as writing intensive.

Prerequisites: PHYS 2140 FOR LEVEL UG WITH MIN. GRADE OF D- OR PHYS 2100 FOR LEVEL UG WITH MIN. GRADE OF D-

**PHYS3310 Modern Physics I** [3 credit hours]

Quantum mechanics: atomic and molecular structure and spectra.

Prerequisites: (PHYS 2140 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 1840 FOR LEVEL UG WITH MIN. GRADE OF D-) OR (PHYS 2140 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 1860 FOR LEVEL UG WITH MIN. GRADE OF D-) OR (PHYS 2140 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 1880 FOR LEVEL UG WITH MIN. GRADE OF D-) OR (PHYS 2140 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 1930 FOR LEVEL UG WITH MIN. GRADE OF D-)

**PHYS3320 Modern Physics II** [3 credit hours]

Quantum statistics, applications of quantum mechanics and quantum statistics in laser physics and solid state physics, nuclear physics.

**PHYS3400 Physical Principles Of Energy Sources For Humans** [3 credit hours]

This course will involve the study of various conventional and unconventional sources of energy for human consumption. Past, present, and future energy sources will be examined on scientifically established principles and data.

Prerequisites: PHYS 2140 FOR LEVEL UG WITH MIN. GRADE OF D- OR PHYS 2080 FOR LEVEL UG WITH MIN. GRADE OF D- AND CHEM 1240 FOR LEVEL UG WITH MIN. GRADE OF D-

**PHYS3410 Thermal Physics** [3 credit hours]

Statistical mechanics, kinetic theory and thermodynamics from a unified microscopic point of view, with applications to a variety of topics from different areas of physics.

Prerequisites: PHYS 3310 FOR LEVEL UG WITH MIN. GRADE OF D-

**PHYS3610 Optics And Lasers** [3 credit hours]

Electromagnetic theory, ray and wave optics including matrix methods, polarization, interference, diffraction, basic laser physics and survey of current laser systems.

Prerequisites: PHYS 2140 FOR LEVEL UG WITH MIN. GRADE OF D-

**PHYS4130 Computational Physics** [3 credit hours]

Working knowledge of computer operations and programming required. Numerical accuracy, advanced programming, graphics and spreadsheet packages, numerical techniques for differentiation, integration, matrices, solving differential equations and eigenvalue problems.

**PHYS4210 Theoretical Mechanics** [3 credit hours]

Statics and dynamics of particles, work, energy, Lagrange equations of motion, small oscillations, dynamics of rigid bodies.

Prerequisites: (PHYS 2140 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 1890 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 2860 FOR LEVEL UG WITH MIN. GRADE OF D-) OR (PHYS 2140 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 2890 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 2860 FOR LEVEL UG WITH MIN. GRADE OF D-)

**PHYS4230 Electricity And Magnetism I** [3 credit hours]

Mathematical formulation of electrostatic and magnetostatic fields, potential theory solution of boundary value problems, method of images, dielectric and magnetic materials.

Prerequisites: (PHYS 2140 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 1890 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 2860 FOR LEVEL UG WITH MIN. GRADE OF D-) OR (PHYS 2140 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 2890 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 2860 FOR LEVEL UG WITH MIN. GRADE OF D-)

**PHYS4240 Electricity And Magnetism II** [3 credit hours]

Maxwell's field equations, production and propagation of electromagnetic waves, solution of boundary value problems with application to the laws of optics and guided waves.

Prerequisites: PHYS 4230 FOR LEVEL UG WITH MIN. GRADE OF D-

**PHYS4310 Quantum Mechanics** [3 credit hours]

Formalism and applications of quantum mechanics: Hilbert space, time-independent and time-dependent perturbation theories, atomic and molecular structure and spectra, and scattering theory.

Prerequisites: (PHYS 3320 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 2860 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 1890 FOR LEVEL UG WITH MIN. GRADE OF D-) OR (PHYS 3320 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 2890 FOR LEVEL UG WITH MIN. GRADE OF D- AND MATH 2860 FOR LEVEL UG WITH MIN. GRADE OF D-)

**PHYS4400 Principles and Varieties of Solar Energy** [3 credit hours]

Types and extent of solar energy used in human society including photosynthesis, photovoltaic, solar thermal, and concentrating solar electric; scope of the necessary energy storage and long distance electricity transmission.

Prerequisites: CHEM 1240 FOR LEVEL UG WITH MIN. GRADE OF D- AND PHYS 2080 FOR LEVEL UG WITH MIN. GRADE OF D- AND PHYS 3400 FOR LEVEL UG WITH MIN. GRADE OF D-

**PHYS4430 Physics Applications in Medicine I** [3 credit hours]

Physical concepts as applied to medicine including: mechanics, exponential growth, statistical physics, fluid transport, and electricity and magnetism. This is a companion course to PHYS 4440.

Prerequisites: (PHYS 2080 FOR LEVEL UG WITH MIN. GRADE OF D- OR PHYS 2140 FOR LEVEL UG WITH MIN. GRADE OF D-) AND (MATH 1760 FOR LEVEL UG WITH MIN. GRADE OF D- OR MATH 1840 FOR LEVEL UG WITH MIN. GRADE OF D- OR MATH 1860 FOR LEVEL UG WITH MIN. GRADE OF D-)

**PHYS4440 Physics Applications in Medicine II** [3 credit hours]

Physical concepts as applied to medicine including: detectors, feedback and control, signal analysis, atomic physics, high energy particles, nuclear medicine, treatment and imaging devices. Prerequisite: PHYS 4430.

Prerequisites: PHYS 4430 FOR LEVEL UG WITH MIN. GRADE OF D-

**PHYS4510 Physics Of Condensed Matter** [3 credit hours]

Crystal lattices and structures, reciprocal lattice and kinematical diffraction theory, binding in crystals, lattice dynamics and phonons, thermodynamic, electronic, and optical properties of insulators, semiconductors, metals and alloys.

Prerequisites: (PHYS 3320 FOR LEVEL UG WITH MIN. GRADE OF D- AND PHYS 3410 FOR LEVEL UG WITH MIN. GRADE OF D-)

**PHYS4580 Molecular And Condensed Matter Laboratory** [3 credit hours]

Experiments in molecular and condensed matter physics. Measurements and analysis based on techniques such as film thickness and surface morphology, X-ray diffraction, optical absorption, four-point probe and Hall measurements. One four- hour lab and one-hour lecture per week. May be offered as writing intensive.

Prerequisites: PHYS 3320 FOR LEVEL UG WITH MIN. GRADE OF D-

**PHYS4620 The Physics Of Lasers** [3 credit hours]

Longitudinal and transverse coherence, stimulated emission, optical pumping, resonator structures, Q-switching, mode-locking and laser systems (gas, dye, diode, doped insulator and free electron lasers).

Prerequisites: PHYS 3310 FOR LEVEL UG WITH MIN. GRADE OF D-

**PHYS4780 Atomic And Nuclear Physics Laboratory** [3 credit hours]

Detectors and electronics, gamma-ray and X-ray spectroscopies, beta and alpha particle spectroscopies, nuclear magnetic resonance, grating and interferometric spectroscopy, laser applications, and solar atomic spectroscopy. One four-hour lab and one-hour lecture per week. May be offered sd writing intensive.

Prerequisites: PHYS 3310 FOR LEVEL UG WITH MIN. GRADE OF D-

**PHYS4910 Research Problems-Physics And Astronomy** [1-3 credit hours]

Individual experimental or theoretical projects selected with the approval of the department.

**PHYS4940 Internship in Renewable Energy** [1-4 credit hours]

Experiential learning in an advisor-approved business, non-profit, or academic organization. Maximum of three hours may count toward minor. Credit hours 1-4; may be repeated once for credit

Prerequisites: PHYS 3400 FOR LEVEL UG WITH MIN. GRADE OF D-

**PHYS4950 Undergraduate Professional Development Seminar** [1 credit hour]

Selected topics on professional development as it applies to junior / senior level physics or astronomy major undergraduates. Specific emphasis will be on topics relevant to near-term professional goals of students (graduate school applications, job interviews, career pathways, CV/resume, professional presentation skills, and ethical research).

**PHYS4980 Special Topics In Physics** [1-4 credit hours]

Individual or small group study of selected topics not covered in regular undergraduate courses.