PHY. PHYSICS

PHY-198-298-398. TOPICS IN PHYSICS
Credits: variable

Selected topics in the field of physics. These may include one or more of the following: astronomy; geophysics; biophysics; nuclear power and waste; relativity; quantum mechanics; semi-conductors; cryogenics; health physics. May be repeated for credit.

Pre-Requisites

Varies with topic studied.

PHY-395-396. INDEPENDENT RESEARCH
Credits: 1 - 3

Independent study and research for advanced students in the field of physics under the direction of a staff member. A research paper at a level significantly beyond a term paper is required.

Pre-Requisites

Senior standing and approval of the department chairperson.

PHY-105. CONCEPTS IN PHYSICS
Credits: 3

Basic concepts of physical science, including the scientific method, will be studied. Theories, laws, and experiments from mechanics, electricity and magnetism, thermodynamics, optics, and atomic and nuclear physics may be included. Viewpoints will be classical and modern, including quantum and relativistic. Class meets for four hours per week: two hours of lecture and one two-hour lab each week.
Click here for course fees.

Pre-Requisites

No previous background in either science or college-level mathematics is required.

PHY-140. SCIENTIFIC PROGRAMMING
Credits: 3

This course presents an introduction to computer programming with an emphasis on the techniques needed for data analysis and numerical problem solving for scientific and engineering applications. Basic programming idioms are presented including control structures, data types, methods for handling input and output as well as numerical methods such as array computing and vectorization. Emphasis is placed on proper software engineering practice as well as data analysis and presentation. Two hours of lecture and two hours of laboratory per week.

Pre-Requisites

Or Concurrent
[[MTH-100]] or [[MTH-111]]

PHY-171. PRINCIPLES OF CLASSICAL AND MODERN PHYSICS
Credits: 4

An introductory course designed to promote and understanding of the more important fundamental laws and methods of mechanics and electricity and magnetism. Laboratory work to emphasize basic principles and to acquaint the student with measuring instruments and their use, as well as the interpretation of experimental data. Three hours of demonstration and lecture, one hour of recitation, and two hours of lab per week. Co-requisite: [[MTH-111]]
Click here for course fees.

PHY-174. APPLICATION OF CLASSICAL AND MODERN PHYSICS
Credits: 4

An introductory course designed to promote an understanding of the more important fundamental laws and methods of heat, optics, and modern physics. Laboratory work to emphasize basic principles and to acquaint the student with measuring instruments and their use, as well as the interpretation of experimental data. Three hours of demonstration and lecture, one hour of recitation, and two hours of lab per week. Co-requisite: [[MTH-111]]
Click here for course fees.

PHY-201. GENERAL PHYSICS I
Credits: 3

A thorough grounding in the concepts, principles, and laws of mechanics, and wave motion. Instruction by demonstration and lecture, recitation, and problem solving. Four hours of demonstration and lecture per week.

Click here for course fee.

Co-Requisites

[[MTH-111]] and [[PHY-204]]

PHY-202. GENERAL PHYSICS II
Credits: 3

A thorough grounding in the concepts, principles, and laws of Electricity and magnetism, optics and light. Instruction by demonstration and lecture, recitation, and problem solving. Four hours of demonstration and lecture per week.

Click here for course fee.

Pre-Requisites

[[PHY-201]]

Co-Requisites

[[MTH-112]]
[[PHY-205]]

PHY-203. MODERN PHYSICS
Credits: 3

Modern physics including the experimental basis, concepts, and principles of atomic and nuclear physics. Three hours of demonstration and lecture per week.

Pre-Requisites

[[PHY-202]].

PHY-204. GENERAL PHYSICS I LAB
Credits: 1
Fees: $100

This is a one-semester introductory physics laboratory course for science and engineering students. Experiments are performed to reinforce the concepts learned in PHY 201. Includes one two-hour laboratory exercise per week.
Click here for course fee.

Co-Requisites

[[PHY-201]]

PHY-205. GENERAL PHYSICS II LAB
Credits: 1
Fees: $100

This is a one-semester introductory physics laboratory course for science and engineering students. Experiments are performed to reinforce the concepts learned in PHY 202. Includes one two-hour laboratory exercise per week.
Click here for course fee.

Pre-Requisites

[[PHY-204]]

Co-Requisites

[[PHY-202]]

PHY-206. MODERN PHYSICS LAB
Credits: 1
Fees: $150

This intermediate level laboratory course offers a modern view of some of the famous experiments in the history of physics leading to the development of relativity and quantum theory. Additionally, the experiments are designed to prepare students to conduct experiments in contemporary physics labs. In doing so, this course presents a hands-on experience to reinforce the learning of fundamental concepts in EM theory, relativity, statistical mechanics, quantum mechanics, solid state physics, atomic physics, and nuclear physics.

Click here for course fee.

Pre-Requisites

[[PHY-201]] and [[PHY-202]]

Co-Requisites

[[PHY-203]]

PHY-214. APPLIED PHYSICS
Credits: 3

Modeling of various problems in physical, chemical, biological, and environmental sciences, particularly physical dynamical systems; Includes application of ordinary differential equations, and Laplace, Fourier, and Z transforms to continuous and discrete processes, matrix mechanics and eigenvalue problems, statistics and probability, random processes and distribution functions.
2 hours of lecture and 2 hours of laboratory per week.

Click here for course fee.

Pre-Requisites

[[MTH-211]]

PHY-311. THERMODYNAMICS & STATISTICAL MECHANICS
Credits: 3

This course focuses on the laws of thermodynamics and other thermodynamic concepts including entropy, free energy, equilibrium, and fluctuations as well as their pivotal role in physics and other scientific disciplines. Topics in statistical mechanics will be covered including partition functions, ensembles, kinetic theory, and phase transitions. Three hours of lecture per week.

Pre-Requisites

[[PHY-203]] and [[MTH-211]].

PHY-312. ANALYTICAL MECHANICS
Credits: 3

Employs advanced mathematical tools to study applications in complex mechanical systems. It offers an advanced differential reformulation of Newton's laws to study dynamical systems in multiple dimensions, conservative force fields, damped and driven oscillations, two-body problem, central forces and planetary motion, and the rotational dynamics of rigid bodies. Additionally, the course delivers a thorough grounding on the calculus of variations, Lagrange's formalism and Hamiltonian mechanics, all being the essential foundations for the development of modern physics (relativity, quantum mechanics, and quantum field theory). Three hours of lecture per week.

Pre-Requisites

[[PHY-202]] and [[MTH-211]].

PHY-314. QUANTUM MECHANICS
Credits: 3

This course presents an intermediate level of Quantum Mechanics using the abstract formulation of linear vector spaces in the Dirac formalism. Topics covered include: spin, addition of angular momentum, scattering and bound particles, the harmonic oscillator, two-body problem and central potential wells in 3D, H-atom and H-like atoms, time-independent perturbation theory, identical particles and the He-atom. In addition to the foundations of Quantum Mechanics, the course offers a selection of advanced and modern topics like entanglement and quantum teleportation. Three hours of lecture per week.

Pre-Requisites

[[PHY-203]], [[CHM-115]], [[MTH-211]], and [[MTH-212]].

PHY-374. IMAGING IN BIOMEDICINE
Credits: 3

This course will cover different aspects of imaging important to medicine and biomedicine including optical microscopy, scanning probe microscopy, scanning electron microscopy, magnetic resonance, ultrasound X-ray, nuclear radiation, microwave and electro-/magneto-encephalographic techniques as well as image processing. Three hours of lecture and three hours of lab per week.
Click here for course fee.

Pre-Requisites

[[PHY-201]] & [[PHY-202]] or [[PHY-171]] & [[PHY-174]], [[MTH-112]].

PHY-377. BIOPHYSICS
Credits: 3

This course presents an overview of the important physical principles governing the behavior of cells and macromolecules. Upper-level mathematics that are useful to understand these phenomena are introduced in a way that is comprehensible to biology majors lacking background beyond basic calculus. In addition to the physical models governing the most ubiquitous molecular and cellular processes, the physics behind the most common experimental techniques used in biology, bioengineering, and biophysics are covered. Three hours of lecture and two hours of lab per week.

Pre-Requisites

[[PHY-201]] & [[PHY-202]] or [[PHY-171]] & [[PHY-174]], [[MTH-112]].

PHY-391. SENIOR PROJECT I
Credits: 1

Students will plan and execute a research project in the field of physics or at the intersection of physics and another related discipline. Projects can be theoretical, experimental or both and can include the design of unique experiments and simulations. A detailed progress report and presentation are required. Students pursuing a dual degree or double major may be eligible to combine this project with the capstone project of another program (subject to the approval of their advisors in both programs).
Click here for course fee.

Pre-Requisites

Senior standing in Physics

PHY-392. SENIOR PROJECT II
Credits: 2

Students will plan and execute a research project in the field of physics or at the intersection of physics and another related discipline. This is a continuation of PHY 391. A professional paper and progress report are required. Students will present the results of their work in an open-forum. Students pursuing a dual degree or double major may be eligible to combine this project with the capstone project of another program (subject to the approval of their advisors in both programs).
Click here for course fee.

Pre-Requisites

[[PHY-391]]