PHYSICS (PHY)

Physics is a discipline emphasizing the study of natural science on both a fundamental and a practical level. The courses are designed to provide the student with a framework both by which to render intelligible the nature of creation, and by which to solve a broad range of technical problems. They are also designed to sharpen his or her ability to distinguish between observation and speculation within the natural sciences. Introductory courses are offered for students with majors both outside and inside the natural sciences. In addition, advanced courses are offered to equip students with the knowledge and technical skills necessary for academic or industrial work.

Course of Study

A physics major consist of a minimum of 40 credits of physics courses and 20 credits of collateral mathematics courses:

1. Core: PHY 101, 201, 202 & 203*.
2. At least 18 credits from the following advanced physics courses: PHY 301, 302, 303, 304*, 401 & 402.
3. At least 6 credits of laboratory/practical courses from the following: PHY 215, 216, 313, 314, 315, 316**, 317, 498.
4. Collateral courses: MAT 221, 222, 223, 224 and 333.

* With departmental approval, PHY 304 may be substituted for PHY 203. In this case, additional 300+ level physics coursework must be added so as to maintain a minimum total of 40 credits of physics courses.

** MAT 371 may be substituted for PHY 316.

A physics minor consist of a minimum of 22 credits of physics courses and 12 credits of collateral mathematics courses:

1. Core: PHY 101, 201, 202 & 203*.
2. At least 6 credits from the remaining PHY courses.
3. Collateral courses: MAT 221, 222 & 223.

* With departmental approval, PHY 304 may be substituted for PHY 203.

Course Descriptions

PHY 101 The Heavens and the Earth. 3 cr.
What is our place in the universe? This course provides an introduction to the science of astronomy. We will study a wide range of texts written by ancient thinkers such as Aristotle and Ptolemy, and more modern thinkers such as Copernicus, Kepler, Hubble, and Hawking. 3 lec.

PHY 201 Space, Time and Motion. 5 cr.
What does it mean for an object to be truly in motion? In this course, we will engage in a careful study the science of dynamics, paying particular attention to the ideas of space and time. We will focus on selections from Galileo's Dialogues, Newton's Principia and Einstein's Relativity. Weekly laboratory sessions complement our classroom discussions. 4 lec. 3 hrs. lab. Prereq: MAT 221 or concurrent enrollment.

PHY 202 Electricity, Magnetism and Light. 5 cr.
What is the nature of light? In this course, we will study a wide range of texts, beginning with the work of Gilbert, Coulomb, Ampere, Young and Newton, and culminating with the electromagnetic theory of light, as articulated by Faraday and Maxwell. Weekly laboratory sessions complement the classroom discussions. 4 lec. 3 hrs. lab. Prereq: MAT 222 or concurrent enrollment.

PHY 203 Atoms, Nuclei and Matter. 3 cr.
The concept of an indivisible unit of matter arose thousands of years ago with the concept of the atom. Since then, our understanding of matter has undergone revolutionary changes, particularly in the 20th century. In this course we will focus on understanding the quantum theory of atoms, nuclei and matter, as developed by thinkers such as Rutherford, Planck, Bohr, Einstein, Schrödinger, and Heisenberg. 3 lec.

PHY 215 Computerized Instrumentation. 3 cr.
The goal of this laboratory course is to train the student to combine skills in computer programming, elementary electronics and experimental physics so that he or she is able to design, build and run a low-cost computer-controlled scientific experiment from scratch. 1 lec. 6 hrs. lab.

PHY 216 Machine Shop Techniques. 2 cr.
This course provides students with basic machine shop skills, including computer aided design and the operation of a computer controlled milling machine. 3 hrs. lab.

PHY 301 Classical Mechanics. 3 cr.
Leibniz and Newton developed the method of calculus for the study of mechanics. Since their time, mechanics has become increasingly formalized, particularly with the work of Lagrange, Hamilton, Poincaré and Lorenz. In this course we will study various formal approaches to the study of mechanics. 3 lec.

PHY 302 Electrodynamics. 3 cr.
The electromagnetic theory of light, introduced by Faraday and Maxwell, has proved very successful in understanding the nature of radiation and its interaction with matter. In this course, we will engage in a detailed study of Maxwell's equations, which form the basis for the classical theory of electromagnetic waves. 3 lec.

PHY 303 Thermodynamics. 3 cr.
What is the nature of heat? And what is its effect on various types of substances? In this course we will engage in a systematic study of the science of thermodynamics. In particular, we will aim at a deeper understanding of concepts such as temperature, energy, and entropy, and of the most common phases of matter: solids, liquids and gasses. This course is cross-listed with CHE 341. 3 lec.

PHY 304 Quantum mechanics. 3 cr.
In response to Albert Einstein's famous assertion that "God does not play dice," Niels Bohr responded that Einstein should "stop telling God what he can and cannot do." In this course we will study the puzzling, yet highly successful, quantum theory of matter. Topics will include Schrödinger's wave equation and the quantum theory of light, atoms, molecules and solids. This course is cross-listed with CHE 342. 3 lec.

PHY 313 Thermodynamics Laboratory. 2 cr.
In this laboratory course, students will conduct a number of experiments illustrating thermodynamic principles. This course is cross-listed with CHE 348. 3 hrs. lab.

PHY 314 Quantum Mechanics Laboratory. 2 cr.
In this laboratory course, students will conduct a number of experiments illustrating quantum mechanical principles. This course is cross-listed with CHE 349. 3 hrs. lab.

PHY 315 Electronic Laboratory. 3 cr.
This is a laboratory course in analog and digital electronics. 1 lec. 6 hrs. lab.

PHY 316 Computational Methods. 3 cr.
In this course, students will learn to employ computational methods so as to solve a variety of scientific problems. 1 lec. 6 hrs. lab.

PHY 317 Instrumental Analysis. 4 cr.
A study of common instrumental techniques including spectroscopic, chromatographic, electrochemical, and other physical methods for the analysis of materials. This course is cross-listed with CHE 310. 2 lec., 6 hrs. lab

PHY 401 Gasses. 3 cr.
This is an advanced course in the statistical mechanics of large numbers of weakly interacting particles. Emphasis will be placed on Maxwell and Boltzmann's work on the kinetic theory of gasses. This course is cross-listed with CHE 440. 3 lec.

PHY 402 Solids. 3 cr.
This is an advanced course on the structural, vibrational and electronic properties of compounds and solids. This course is cross-listed with CHE 430. 3 lec.

PHY 403 Liquids. 3 cr.
This is an advanced course in the statics and dynamics of fluids. 3 lec.

PHY 490 Internship. 1 - 3 cr.
By arrangement with department and college internship coordinator. See college internship guidelines.

PHY x91 Special Topics in Physics. 1 - 3 cr.
This course is a seminar in a unique or contemporary field of physics. It may be repeated for different topics. Prereq: Instructor approval.

PHY 498 Undergraduate Research. 1 - 3 cr.
A research project coordinated by the department and arranged with a sponsoring faculty member

PHY 199-499 Independent Study. 1 - 3 cr.
This course allows students to pursue work beyond the level offered by existing courses. It may be repeated for additional credit. Prereq: Instructor approval.