PHYSICS (PHYS)

PHYS 125 Introductory Physics I 3 Credit Hours
Part I of a non-calculus, introductory, survey of physics. The concepts of physics are presented with an emphasis on the methods of solving physical problems. Topics are drawn from mechanics, waves, and thermal physics. This course and PHYS 126 are normally taken by students in biomedical physics, biological science, preprofessional and computer science programs. Three hours lecture, one hour discussion, three hours laboratory. (F, W, S) (F, W, S).
Prerequisite(s): MATH 105* or MATH 113* or MATH 115* or Math Placement with a score of 113
Corequisite(s): PHYS 125L

PHYS 126 Introductory Physics II 3 Credit Hours
A continuation of PHYS 125. Topics are drawn from electricity and magnetism, optics, and modern physics. Three hours lecture, one hour discussion, three hours laboratory. (F, W, S) (F, W, S).
Prerequisite(s): PHYS 125 or PHYS 150
Corequisite(s): PHYS 126L

PHYS 150 General Physics I 3 Credit Hours
Part I of an integrated, two-semester, calculus-based treatment of physics, with emphasis on the solution of physical problems through the understanding of a few basic concepts. Topics are drawn from mechanics. This course and PHYS 151 are normally taken by concentrators in physics, biomedical physics, chemistry, biochemistry, mathematics, and engineering. Three hours lecture, one hour discussion, three hours laboratory. (F, W, S) (F, W, S).
Prerequisite(s): MATH 115* or Math Placement with a score of 116
Corequisite(s): PHYS 150L

PHYS 151 General Physics II 3 Credit Hours
A continuation of PHYS 150. Topics are drawn from electricity and magnetism, and optics. Three hours lecture, one hour discussion, three hours laboratory. (F, W, S) (F, W, S).
Prerequisite(s): (PHYS 125 or PHYS 150) and MATH 116*
Corequisite(s): PHYS 151L

PHYS 260 Instrumentation and Computing for Physicists 4 Credit Hours
An introduction to electronic and computational tools used in experimental physics. Techniques of physical measurement using sensors will be explored, including the use of high-level electronic instrumentation such as the oscilloscope and digital multimeter, as well as component-level analog and digital electronics for signal conditioning and computer data acquisition. Computational skills will be developed to interface computers with experiments, to program microcontrollers, and to visually and analyze data. Students will complete individual projects. Three hours lecture, four hours laboratory. Every third semester. (F, W).
Prerequisite(s): PHYS 126* or PHYS 151*

PHYS 302 Biomedical Physics 4 Credit Hours
An interdisciplinary course that combines the principles of physics with applications in medicine and biology. The course provides an overview of the fundamental physical principles and techniques used in biomedical physics. Topics include discussions of the physical principles underlying medical imaging techniques (magnetic resonance imaging, ultrasound), diagnostic tools, therapeutic applications, biomechanical systems and functioning of the human body. Four hours lecture. Every fourth semester. (F, W).
Prerequisite(s): PHYS 126 or PHYS 151

PHYS 305 Quantum Mechanics I 4 Credit Hours
Reviews experiments demonstrating the atomic nature of matter, wave-particle duality, the uncertainty principle, the Schrödinger wave equation, properties of the electron, the nuclear atom, spin, atomic and molecular structure and spectra, statistical physics, solid state physics, and nuclear physics including nuclear structure, radioactive decay, and fission. Includes an introduction to the special theory of relativity. Four hours lecture. (Every third semester) (F, W).
Prerequisite(s): (PHYS 126 or PHYS 151) and (MATH 116 or Math Placement with a score of 215)

PHYS 314 Computational Physics 4 Credit Hours
An introduction to numerical and computational techniques in physics and astronomy. Topics include an introduction to scientific computing, fitting data to a model, visualizing results, plotting, error analysis, and writing software to solve physical problems. Applications will be selected from a variety of subfields, including: biomedical physics, classical mechanics, statistical physics, electromagnetism, astrophysics, and chaos. Four hours lecture. (Every fourth semester) (F, W).
Prerequisite(s): (PHYS 126 or PHYS 151) and (MATH 205* or MATH 215*)

PHYS 320 Environmental Physics 4 Credit Hours
A survey of the applications of physical principles to the environment, and to the conversion, transfer, and use of energy. Introductory discussion of thermodynamics and radiative transfer, with applications to planetary climate, meteorology, the greenhouse effect, and thermal pollution. Four hours lecture. (OC) (OC).
Prerequisite(s): PHYS 126 or PHYS 151

PHYS 360 Instrumentation for Scientists 4 Credit Hours
An introduction to the principles of electronic instrumentation used in scientific research. Methods of converting physical measurements into electronic signals by means of electrical circuits, transistors, digital and analog integrated circuits will be discussed. Digital computers as general purpose laboratory instruments will be explored. Students will complete individual projects. Three hours lecture, four hours laboratory. (F).
Prerequisite(s): PHYS 126 or PHYS 151

PHYS 370 Mathematical Physics 4 Credit Hours
As introduction to those mathematical methods that are widely used in understanding the physical phenomena exhibited by nature. Topics include vector analysis, linear algebra, complex variables, Fourier analysis, and differential equations. Emphasis is on the application of these techniques to physical problems of interest to students in mathematics, engineering, and the physical sciences. Four hours lecture. (Every fourth semester). (F, W).
Prerequisite(s): (MATH 205 or MATH 215 or Math Placement with a score of 215) and (PHYS 126 or PHYS 151)

PHYS 390 Current Topics in Physics 4 Credit Hours
A lecture course in a topic of current interest in physics. Topics vary and are announced in the current Schedule of Classes. Four hours lecture. (OC).
Prerequisite(s): PHYS 305*

PHYS 401 Classical Mechanics and Relativity 4 Credit Hours
A study of the classical physics of the motions of single particles, systems of particles, and rigid bodies. Topics include central force laws and planetary motion, collisions and scattering, rigid body motion, oscillations, Lagrange's equations, Hamilton's principle, and special relativity. Four hours lecture. (Every fourth semester) (F, W).
Prerequisite(s): (MATH 205 or MATH 215 or Math Placement with a score of 215) and (PHYS 126 or PHYS 151)

PHYS 403 Electricity and Magnetism 4 Credit Hours
This course integrates the study of electricity and magnetism with optics, exploring physical principles, phenomena, and applications. It builds on foundational concepts, covering electric and magnetic fields, electromagnetic waves, and light-matter interactions. Emphasizing mathematical foundations, students gain a rigorous understanding of Maxwell's equations, wave propagation, and optical phenomena. Through theoretical analysis and experimental applications, students develop comprehensive knowledge to tackle complex problems in scientific research and technology. Four hours lecture. (Every fourth semester) (F, W).
Prerequisite(s): (MATH 205 or MATH 215 or Math Placement with a score of 215) and (PHYS 126 or PHYS 151)

PHYS 405 Optics 4 Credit Hours
An upper-level physics course that explores advanced principles and applications of optics, for students in engineering, mathematics, and the physical sciences. Building on the foundations of Maxwell's equations, topics of discussion will include geometrical optics, polarization, fiber optics, interference, and Fraunhofer and Fresnel diffraction. Depending on students' needs and interests, additional topics may include coherence, interference, laser optics, Fourier optics, and holography. Four hours lecture. (OC) (OC).
Prerequisite(s): (MATH 205 or Math Placement with a score of 215 or MATH 215) and (PHYS 126 or PHYS 151)

PHYS 407 Thermal and Statistical Physics 4 Credit Hours
A study of thermodynamic phenomena using the methods of statistical mechanics. Designed for engineering students and concentrators in mathematics and the physical sciences; extensive application is made to physical, chemical, and biological systems and phenomena, including solids, liquids, gases, paramagnets, thermal radiation, DNA, hemoglobin, semiconductors, heat engines, chemical reactions, and phase transitions. Four hours lecture. (Every fourth semester) (F, W).
Prerequisite(s): (MATH 205 or MATH 215) and (PHYS 126 or PHYS 151)

PHYS 416 Biological Physics 4 Credit Hours
A course based on the methodology of physics with particular emphasis on the applications of theoretical models and experimental methods to biological objects and systems. Topics will include physical understanding of a wide range of biological phenomena, examples of which may include cytoskeletal mechanics, functioning of ion channels, packaging and replication of nucleic acids, pattern formation, and cellular motility. Four hours lecture. (Every fourth semester) (F, W).
Prerequisite(s): MATH 116 and (PHYS 126 or PHYS 151)

PHYS 421 Astrophysics 3 Credit Hours
A calculus-based introduction to several major areas of modern astrophysics for students concentrating in the physical sciences, mathematics, and engineering. Topics to be covered include observable properties of stars and star systems, stellar structure and evolution, binary systems and galactic x-ray sources, galaxies and quasars, and cosmology. Three hours lecture. (AY).
Prerequisite(s): (PHYS 305 or ASTR 301 or ASTR 330) and (MATH 205 or MATH 215)

PHYS 422 Biomedical Imaging 4 Credit Hours
Biomedical imaging technologies provide noninvasive ways to capture the structure and function of the human body for the diagnosis and treatment of disease or physiological abnormality. The major goal of this course is to introduce the fundamentals of microscopy imaging techniques, data visualization, image processing, and analysis with hands-on lab experience. Three hours lecture, three hours laboratory. Every fourth semester. (F, W).
Prerequisite(s): PHYS 126 or PHYS 151

PHYS 453 Quantum Mechanics II 4 Credit Hours
This course explores the fundamental principles and advanced concepts of quantum mechanics. Students deepen their understanding of mathematical formalism, including linear algebra and Dirac notation. Topics include wave-particle duality, the time-dependent Schrodinger equation, quantum mechanics in three dimensions, identical particles, and perturbation theory. Advanced topics may include quantum entanglement, superposition, and information theory along with applications such as quantum computation and communication. Emphasis is placed on theoretical comprehension, problem-solving, and connecting theory to practical implementation. Four hours lecture. (Every fourth semester) (F, W).
Prerequisite(s): (PHYS 126 or PHYS 151) and PHYS 305 and MATH 228

PHYS 460 Advanced Physics Laboratory 4 Credit Hours
Experiments in both classical and modern physics using contemporary techniques. Commercial apparatus is used in several experiments. Advanced students are encouraged to initiate and conduct their own experiments. Instruction in the planning of experiments and the presentation of oral and written reports is included. Two hours lecture, six hours laboratory. Course may be repeated for credit. (Every third semester) (F, W).
Prerequisite(s): PHYS 305* and PHYS 260

PHYS 495 Off-Campus Research 1 to 4 Credit Hours
Participation in ongoing experimental research at an off-campus laboratory. Assignments made by cooperative or internship agreement between the research laboratory, the student, and the physics concentration advisor. Course may be repeated for credit. Three to twelve hours laboratory. Permission of concentration advisor. (F, W, S).

PHYS 498 Directed Studies in Physics 1 to 4 Credit Hours
Special topics in physics chosen by agreement between student and instructor. Course may be repeated for credit. Permission of instructor. (F,W,S).

PHYS 499 Laboratory Studies in Physics 1 to 4 Credit Hours
Experimental studies in physics selected by agreement between student and instructor. Three to twelve hours laboratory. Course may be repeated for credit. Permission of instructor. (F, W, S).

*An asterisk denotes that a course may be taken concurrently.

Frequency of Offering

The following abbreviations are used to denote the frequency of offering: (F) fall term; (W) winter term; (S) summer term; (F, W) fall and winter terms; (YR) once a year; (AY) alternating years; (OC) offered occasionally