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<th>Course Code</th>
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<tr>
<td>PHYS 1201</td>
<td>INTRODUCTION TO ASTRONOMY. (3 Credits)</td>
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<td>PHYS 1203</td>
<td>ENVIRONMENTAL PHYSICS. (3 Credits)</td>
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<td>PHYS 1206</td>
<td>PHYSICS OF EVERYDAY LIFE. (3 Credits)</td>
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<td>PHYS 1207</td>
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<td>PHYS 1501</td>
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<td>PHYS 1502</td>
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<td>GENERAL PHYSICS I RECITATION. (0 Credits)</td>
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<td>PHYS 1504</td>
<td>GENERAL PHYSICS II RECITATION. (0 Credits)</td>
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<td>PHYS 1505</td>
<td>INTRODUCTION TO MODERN PHYSICS. (4 Credits)</td>
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<td>PHYS 1511</td>
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<td>PHYS 1512</td>
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<td>PHYS 1513</td>
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Updated: 02-13-2018
PHYS 2010. LAB METHODS AND TECHNIQUES. (1 Credit)
Topics to be covered are (a) lab safety procedures, (b) machining techniques using Machine Shop equipment and tools, (c) maintenance of equipment, (d) handling of high voltage electrical equipment, (e) trouble shooting and diagnostic tests of electronic equipment, (f) handling of precision instruments, and (g) any other topics deemed necessary to make the lab a safe place to work.
Prerequisite: PHYS 1601.

PHYS 2011. INTERMEDIATE LABORATORY. (2 Credits)
Measurements in electricity and magnetism. This course will also include practical machine shop experience. Lab fee.
Prerequisites: PHYS 2305 or PHYS 2005.

PHYS 2101. ENGINEERING STATICS AND DYNAMICS. (4 Credits)
The following topics will be covered: forced system resultants, equilibrium or rigid body, structural analysis, internal forces, friction, center of gravity centroid, moments of inertia, virtual work, impulse and momentum, rigid-body kinematics, relative motion, Coriolis accelerations, and rigid-body kinetics. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: PHYS 1601 and PHYS 1602.

PHYS 2102. MECHANICS OF MATERIALS. (4 Credits)
An introduction to the mechanical properties of materials including their response to: stress, strain, torsion, bending and shear. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Attribute: FCRH.

PHYS 2111. INTRODUCTION TO INVENTIONS AND PATENTS. (1 Credit)
Introduction to the creative process that drives innovation and inventorship. Includes discussions on creative development of ideas, formalizing patent applications, commercialization and technology transfer.
Attribute: FCRH.

PHYS 2201. CLASSICAL MECHANICS I. (4 Credits)
An introduction to classical mechanics including kinematics and dynamics of particles and rigid bodies. Includes a discussion of D’Alembert’s principle, Lagrange’s equations and Hamilton’s principle.
Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: PHYS 1601 and PHYS 1602 and PHYS 2005.

PHYS 3001. ELECTRICITY AND MAGNETISM I. (4 Credits)
Electrostatics, dielectric media, direct current circuits, magnetism and magnetic media, transients and alternating currents, electromagnetic induction, Maxwell’s equations, electromagnetic waves and wave guides. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: PHYS 1601 and PHYS 1602 and MATH 2005.

PHYS 3011. ADVANCED LABORATORY I. (2 Credits)
Measurements in electronics, diodes, transistors, and operational amplifiers. Lab fee.

PHYS 3012. ENGINEERING EXPERIMENTATION. (3 Credits)
Statistical and other measures of data uncertainty, propagations of uncertainty, curve fitting, introduction to basic instrumentation for measuring pressure, temperature, strain. The laboratory component of the course teaches the students how to construct and perform their own experiments. Laboratory experiments include material tensile and hardness testing, beam buckling, pipe flow, flow dynamics, electrical circuits, op-amps, and power circuits.

PHYS 3013. EXPERIMENTAL TECHNIQUES IN ENGINEERING AND PHYSICS. (3 Credits)
Experimental Techniques in Engineering and Physics seeks to provide broad overview of engineering and physics concepts and experimental methods through lectures and laboratory experiments. The experiments are designed to demonstrate the physical principles learned in engineering and physics courses. In addition to experimental procedure, focus will be placed on technical writing and presentation.
Prerequisite: PHYS 2101.

PHYS 3010. MATH METHODS IN PHYSICS. (4 Credits)
Implicit function theorem, Jacobians, curves and line integrals, multiple integrals, surface and volume integrals, divergence theorem, Stokes’ theorem, and Green’s theorem. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

PHYS 3101. MATH METHODS IN PHYSICS I. (4 Credits)
Matrices and determinants, series expansion, complex numbers and functions, Fourier series, ordinary differential equations, partial differential equations, and special functions of physics, theory of special relativity. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisite: MATH 2005.

PHYS 3102. MATH METHODS IN PHYSICS II. (4 Credits)
Continuation of PHYS 3101. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisite: PHYS 3101.

PHYS 3103. MATH METHODS IN PHYSICS III. (4 Credits)
Topics to be covered include suffix notation and tensor algebra, theory of complex variables, contour integration, applications of contour integration, Sturm-Liouville Theory, integral equations. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

PHYS 3201. FLUID MECHANICS. (4 Credits)
This course introduces the fundamentals of fluid statics, dimensional analysis and modeling, viscous flow in pipes, channel flows, laminar flow, transition, turbulence; flow past an object, wake, separation, vortices, drag; convection, conduction, transition from periodic to chaotic behavior, compressible flow; transition to turbulence. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisite: PHYS 1601.
PHYS 3205. FUNDAMENTALS OF ENGINEERING THERMODYNAMICS. (4 Credits)
Basic principles and laws of thermodynamics and their relation to pure substances, ideal gases, and real gases. Use of thermodynamic property tables. Development of concepts of reversibility and availability. First and Second Law application to engineering systems; power and refrigeration cycles. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Attribute: FCRH.
Prerequisites: PHYS 1601 and PHYS 1602.

PHYS 3211. COMPUTATIONAL PHYSICS AND PROGRAMMING I. (2 Credits)
An introductory course in the use of computers to numerically solve problems in physics using PASCAL or FORTRAN. Topics include numerical solution of non-linear equations, interpolation and extrapolation, numerical differentiation and integration. No prior knowledge of computer language is required.

PHYS 3401. THERMO AND STAT PHYSICS. (4 Credits)
Fundamental principles, first and second laws, thermodynamic functions; a discussion of the kinetic theory of gases and introductory statistical mechanics. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: PHYS 1602 and PHYS 2005.

PHYS 3555. MODELING, SIMULATION, AND DESIGN. (4 Credits)
Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: PHYS 1601 and PHYS 1602.

PHYS 3601. OPTICS. (4 Credits)
Wave propagation, interference, diffraction, and polarization; electromagnetic theory of light. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

PHYS 4003. CLASSICAL MECHANICS II. (4 Credits)
Lagrange's equations, variational principles, Hamilton's equations, canonical transformations, Hamilton-Jacobi theory, rigid body motion, small oscillations, central forces and Kepler's planetary motion. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: PHYS 2201 and PHYS 3101.

PHYS 4004. ELECTRICITY AND MAGNETISM II. (4 Credits)
Continuation of PHYS 3001. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: PHYS 1601 and PHYS 1602 and PHYS 3001.

PHYS 4005. QUANTUM MECHANICS I. (4 Credits)
Foundations of quantum mechanics, Schrödinger equation, Hermitian operators, solution of the Schrödinger equation, harmonic oscillator, hydrogen atom, angular momentum operators, variational method, perturbation theory. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: PHYS 2005 or PHYS 2305.

PHYS 4006. QUANTUM MECHANICS II. (4 Credits)
Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

PHYS 4010. INTRODUCTION TO ELECTRICAL ENGINEERING. (4 Credits)
Electrical circuit laws and theorems, transient and steady-state response, phasors, frequency response, resonance. Diode and transistor circuits, digital logic devices. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: PHYS 2002 or PHYS 3001.

PHYS 4011. NUCLEAR AND PARTICLE PHYSICS. (4 Credits)
A survey of nuclear and particle physics for advanced undergraduate students. It explores the common roots and tools of the nuclear (medium energy) and particle (high energy) fields. The primary goal is to understand the basic ideas of the Standard Model of quarks, leptons and the fundamental interactions of the universe. Specific topics include properties and simple models of nuclei, fundamental interactions and their mediators, quarks and leptons, symmetries and tests of conservation laws, physics beyond the Standard Model, and other ideas in theoretical and experimental nuclear and particle physics. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: PHYS 4005 and (PHYS 2005 or PHYS 2305).

PHYS 4012. SOLID STATE PHYSICS. (4 Credits)
An introduction to the elastic, thermal, electromagnetic, and optical properties of solids; energy bands, semiconductors, superconductors, surface and defect structures and device applications. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisites: PHYS 1601 and PHYS 1602 and PHYS 2005.

PHYS 4020. BIOMECHANICS. (4 Credits)
Engineering principles such as mechanics, rigid body dynamics, fluid dynamics and solid mechanics are applied to the study of biological systems such as ligaments, tendons, bone, muscles, joint, etc. Methods for both rigid body and deforming mechanicals are developed in the context of bone, muscle, and connective tissue. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisite: PHYS 2102.

PHYS 4021. MEDICAL INSTRUMENT AND IMAGING. (4 Credits)
Introduction to the physics and the practical technology associated with such methods as X-ray computed tomography (CT), magnetic resonance imaging (MRI), functional MRI (f-MRI) and spectroscopy, ultrasonics (echocardiography, Doppler flow), PET scans as well as optical methods such as bioluminescence and optical tomography. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

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PHYS 4025. MACHINE DYNAMICS AND MECHANICAL DESIGN. (4 Credits)
The principles of dynamics as applied to the analysis of the accelerations and dynamic forces in machines such as linkages, cam systems, gears, belts, chains, couplings, bearings, brakes, clutches, and flexible mechanical elements. Concepts of engineering design, material selection, failure theories, fracture and fatigue. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

PHYS 4401. UNDERGRADUATE RESEARCH I. (4 Credits)
Participation of the undergraduate in research under the direction of one of the faculty. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

PHYS 4402. UNDERGRADUATE RESEARCH II. (4 Credits)
Participation of the undergraduate in research under the direction of one of the faculty. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

PHYS 4999. INDEPENDENT STUDY (1-4 CREDITS). (1 to 4 Credits)
Independent research and reading with supervision from a faculty member.