PHYSICS (PHYS)

PHYS 100 — Topics in Physics Course count: 1
These courses introduce non-science majors to important principles and modes of inquiry of physics, explored in a particular context. Recent offerings: Earth Science; Electricity and Magnetism in Everyday Life; How Things Work; Discovery of Science. Non-science majors only. One unit

GPA units: 1
Common Area: Natural Science
Typically Offered: Annually

PHYS 101 — Introduction To Astronomy Course count: 1
Motions of celestial bodies; the sun, Earth and moon; other terrestrial planets; Jovian planets; asteroids and comets; nebular model for the origin of the solar system; stars and stellar systems; Milky Way galaxy; the universe and the big-bang model. Non-science majors only.

GPA units: 1
Common Area: Natural Science
Typically Offered: Every Third Year

PHYS 115 — Introductory Physics 1: Mechanics, Fluids and Waves Course count: 1
First semester course of a two-semester, calculus-based sequence, suitable for majors of physics, chemistry, or biology, as well as for those participating in the Health Professions Advisory Program (premedical, predental, etc.), the joint Engineering Programs, or in ROTC. Covers the theory of Newtonian mechanics and methods for solving quantitative and qualitative problems. Specific topics include motion in one and two dimensions; vectors, Newton's laws of motion, work and energy, linear momentum and collisions, rotational motion, static equilibrium, oscillatory motion, gravitation, fluid mechanics, and mechanical waves. There is an emphasis on applications of physics to natural phenomena and aspects of everyday life. The course meets four days per week and each class is a mixture of lecture and laboratory exercises; there is no separate lab meeting.

Prerequisite or Corequisite: MATH 133 or MATH 134 or MATH 135 or MATH 136 or equivalent.
GPA units: 1.25
Common Area: Natural Science
Typically Offered: Fall

PHYS 116 — Introductory Physics 2: Electromagnetism, Optics and Modern Physics Course count: 1
Second part of a two-semester sequence (see PHYS 115). Covers electricity and magnetism, optics, and some aspects of modern physics. Specific topics include electric forces, fields, and potential, electrical components and circuits, magnetic forces and fields, electromagnetic induction, geometric optics, wave optics, relativity, and atomic and nuclear physics. There is an emphasis on applications of physics to natural phenomena and aspects of everyday life. The course meets four days per week and each class is a mixture of lecture and laboratory exercises; there is no separate lab meeting.

Prerequisite: PHYS 115
GPA units: 1.25
Common Area: Natural Science
Typically Offered: Spring

PHYS 146 — The Physics of Energy Course count: 1
How do we get energy from wind? What is the physics behind global warming? What are the potentials and dangers of nuclear power? This course will give you the scientific understanding of energy sources, transformations, and systems. Students will learn how we tap various sources of energy, how energy is used in our everyday lives, and the consequences of our growing demand for energy.

GPA units: 1
Common Area: Natural Science
Typically Offered: Alternate Years

PHYS 221 — Mathematical Methods and Scientific Computing in Physics Course count: 1
Mathematical, numerical, and computational techniques needed for the study of physics at the intermediate and advanced level. Ordinary differential equations; vector calculus; partial differential equations; matrices; Fourier series; and complex variables. This course meets four days per week.

Prerequisite: PHYS 116 and MATH 136 or equivalent.
GPA units: 1
Typically Offered: Fall

PHYS 223 — Modern Physics Course count: 1
Introduction to several major areas of physics, including relativity, quantum physics (photons and de Broglie waves), atomic structure, nuclear physics, and elementary particles. One Unit.

Prerequisite: PHYS 116 and MATH 136 or equivalent.
GPA units: 1
Typically Offered: Fall

PHYS 225 — Modern Physics Lab Course count: 1
This course introduces students to advanced laboratory equipment and techniques, in the context of key experiments from modern physics. Examples of the experiments to be performed are: Nuclear Decay, Speed of Light, Gamma Rays, Balmer Lines Spectroscopy, and Cosmic Ray Muons. There is a strong emphasis on analytical methods and presentations of results.

Corequisite or Prerequisite: PHYS 223
GPA units: 1
Typically Offered: Spring

PHYS 255 — Quantum Computing Course count: 1
Quantum computing studies a type of computation that is based upon the principles of quantum mechanics. This course begins with an introduction to linear algebra and quantum mechanics, using the concepts of qubits (or quantum bits) and quantum gates. Quantum algorithms are then studied, including the quantum Fourier transform, Shor's factoring algorithm, and Grover's search algorithm. Other topics covered in this course include the application of quantum computing to cryptography, quantum teleportation, and quantum error correction. This class includes a coding component, in which students learn how to write code that can be run on a quantum computer.

Prerequisite: PHYS 221 or MATH 244
GPA units: 1
Typically Offered: Alternate Years

PHYS 275 — Intermediate Topics in Physics Course count: 1
Exploration of a selected topic at an intermediate level. Recent offerings: Introduction to Quantum Computation and Quantum Information; Introduction to Particle Physics; Atomic Physics; Solid State Physics; Fulfills one elective requirement for majors.

Prerequisite: PHYS 221 and PHYS 223.
GPA units: 1

PHYS 299-F02 — Experimental Optics Course count: 1
This course covers experimental methods and applications of optics, primarily through laboratory work, with supporting lectures on theory. Topics typically include imaging and detection systems, light sources, spectroscopy, light interference and polarization, optical fibers, and Fourier optics. The latter part of the course will usually be devoted to a more in-depth, student-led experimental investigation. With an emphasis on core areas of optics and the use of modern experimental techniques, this course will prepare students for careers or further advanced study in optics.

Prerequisites Physics 116 and Math 136 or equivalent.
GPA units: 1.25

PHYS 299-S01 — Experimental Electronics Course count: 1
This course covers experimental methods and application of electronics. A large portion of the course is the laboratory work where students build various analog and digital circuits and verify their functions. There will also be supporting lectures on the analysis of circuits and the physics of semiconductor components. By the end of the course, students should be able to design, analyze and build an original circuit that responds to human or environmental input.

PHYS 116
GPA units: 1.25

PHYS 342 — Classical Mechanics Course count: 1
Newtonian (non-relativistic) mechanics is studied in detail using advanced mathematical methods. One-dimensional motions that are studied include those with fluid friction, where the force is a function of velocity, and the forced harmonic oscillator. Two-dimensional motions include projectiles with air friction and motion under an inverse-square law central force. Motion of a system of particles includes the rocket problem, the two-body problem, coupled harmonic oscillators, and rigid-body rotation. Coriolis and centrifugal forces on the rotating Earth are studied. Finally, a thorough introduction of Lagrangian dynamics is presented.

Prerequisite: PHYS 221 and MATH 241
GPA units: 1
Typically Offered: Spring

PHYS 344 — Thermal Physics Course count: 1
How does a refrigerator work, and what is its maximum efficiency? How much energy do we need to add to a kettle of water to change it to steam? How and why does a snowflake form and how and why do liquids turn into solids? Why does an iron magnet lose its magnetism above a certain temperature? In fact, what do we mean by temperature, heat, and energy? Our understanding of these topics formed in two distinctly different ways starting about two-hundred years ago. James Joule, Sadi Carnot, and others developed what we now call classical thermodynamics, which treats matter and energy in terms of macroscopic quantities that obey the four "laws of thermodynamics." Later, Ludwig Boltzmann, James Clark Maxwell, Josiah Willard Gibbs, and others applied classical mechanics and probability theory to molecules in an approach now called statistical mechanics and kinetic theory. In our modern approach to thermal physics, we add our understanding of quantum physics and use both classical and statistical approaches as best suits the question under investigation.

Prerequisite: PHYS 221and MATH 241
GPA units: 1
Typically Offered: Fall

PHYS 351 — Electromagnetic Theory Course count: 1
The aim of this course is to introduce the basic principles of electricity and magnetism and their application in a variety of situations. The course includes substantial mathematical complexity and a solid foundation of multivariable calculus is therefore required. Specific topics covered include: the electrostatic field and potential; work and energy in electrostatics; special techniques for calculating potentials; electric fields in matter; the Lorentz force and the Biot-Savart law; magnetic vector potential; magnetostatic fields in matter; electromagnetic induction and Maxwell's equations.

Prerequisite: PHYS 221 and MATH 241
GPA units: 1
Typically Offered: Spring

PHYS 353 — Quantum Mechanics Course count: 1
The formalism of quantum mechanics; solutions of the one-dimensional Schrödinger equation including the infinite square well, the harmonic oscillator, and the finite well/barrier; solutions of the three-dimensional Schrödinger equation; the hydrogen atom; angular momentum and spin.

Prerequisite: PHYS 221 and PHYS 223 and MATH 241
GPA units: 1
Typically Offered: Fall

PHYS 355 — Introduction To Astrophysics Course count: 1
Celestial mechanics; spectra; solar physics; equations of stellar structure; thermonuclear reactions; stars and stellar systems; polytropes; stellar evolution; white dwarfs, neutron stars, and black holes; Milky Way galaxy; Hubble's law; active galactic nuclei; big-bang model.

Prerequisite: PHYS 223
GPA units: 1
Typically Offered: Alternate Years

PHYS 461 — Independent Study Course count: 1
One unit each semester.

GPA units: 1
Typically Offered: Fall, Spring

PHYS 471 — Undergraduate Research Course count: 1
Supervised research in theory or experiment.

GPA units: 1
Typically Offered: Fall, Spring

PHYS 472 — Undergraduate Research Course count: 1
Supervised research in theory or experiment.

GPA units: 1
Typically Offered: Fall, Spring