PHYSICS (PHYS)

PHYS1000 COLLEGE PHYSICS I
General introduction to mechanics. Topics include kinematics, vectors, Newton's Laws, equilibrium, work and energy, momentum, and circular motion. ***Prerequisite:*** *MATH1000 or MATH1500 or MATH1700 or MATH1750 or MATH1775 or MATH1777 (4 credits) fall, spring, summer*

PHYS1005 PHYSICS A
General introduction to mechanics, including Newton's Laws, equilibrium, work, energy and momentum. The laboratory work will support the concepts studied in class. ***Prerequisite:*** *MATH1005 (3 credits) fall, spring, summer*

PHYS1010 CONCEPTUAL PHYSICS
This course surveys physics and its applications to modern life. Students examine mechanics, force, equilibrium, and the structure of matter and materials. Emphasis is placed on understanding of concepts, rather than detailed calculations, through lectures, laboratory activities, and class projects. (4 credits) fall, spring

PHYS1035 PHYSICS B
General introduction to mechanical and thermal properties of matter, sound, light, and electricity. The laboratory work will support the concepts studied in class. ***Prerequisites:*** *PHYS1005 (3 credits) fall, spring*

PHYS1050 VIDEO-GAME PHYSICS
In this course students play games to explore physics and use physics to develop games. Students learn some basic 3D graphic design skills, techniques for assembling and programming a basic controller, and enough physics to put everything together in a playable video game they design. Video game design elements discussed in this course include the physics topics of kinematics, vectors, forces, momentum, and circular motion. Laboratory topics include measurement, graphical interpretation, data analysis, and basic electronics. No programming experience is required. ***Prerequisites:*** *MATH1000 or MATH1500 or MATH1700 or MATH1750 or MATH 1775 or MATH1777 (4 credits)*

PHYS1100 THE COSMIC SYSTEM
This course provides a tour of the universe from our own Sun and solar system to the very edge of space and time itself. Topics include the 8 planets, our Sun and the structure of stars, nuclear fusion as a stellar energy source, stellar evolution, the Milky Way galaxies and galaxy formation, large scale structure, and the fate of the universe. We finish with a discussion of exoplanets and the possibility of other life in the universe. No prior knowledge of astronomy is necessary. (3 credits)

PHYS1250 ENGINEERING PHYSICS I
This is a calculus-based course examining the principles and applications of mechanics, covering topics including Newton's laws, equilibrium, work, energy, power, momentum, and circular motion. Students engage with these topics through a mixture of lectures, guided in class activities, and laboratory exercises. ***Corequisite:*** *MATH1750 or MATH1775 or MATH1777 (4 credits) fall, spring, summer*

PHYS1300 EARLY-UNIVERSE COSMOLOGY
This course is an exploration of the earliest parts of the cosmic timeline, starting from the first instant after the Big Bang and extending until the cosmic microwave background—the oldest light we can directly observe today. The course discusses the most important events in this time period, focusing on concepts and principles and frequently referring to contemporary literature and publications. Topics include the Standard Models of both cosmology and particle physics, the formation of the first atoms, gravitational waves, and high-energy particle accelerators. (4 credits)

PHYS1400 INTRODUCTION TO MEDICAL PHYSICS
This course introduces the physics of medical devices. Topics of discussion include centrifuges, ultrasounds, nuclear magnetic resonance (NMR), mass spectrometry, microscopy, X-rays, CT scans, PET scans, radiation therapy, proton therapy, and personal protective equipment. (4 credits)

PHYS1500 COLLEGE PHYSICS II
Physical properties of solids and fluids, heat, sound, light, electric, and magnetic forces. ***Prerequisites:*** *MATH1500 and PHYS1000 (4 credits)*

PHYS1750 ENGINEERING PHYSICS II
Topics include: physical properties of solids and fluids, atomic structure, heat, sound, wave motion, electricity and magnetism. ***Prerequisites:*** *PHYS1250; and MATH1750 or MATH1775 or MATH17775;* ***Corequisite:*** *MATH1850 or MATH1875 or MATH1877 (4 credits) fall, spring, summer*

PHYS2000 INTRODUCTION TO ASTRONOMY
This course gives the student a tour of the universe, from our own Sun and Solar System to the very edge of space and time itself. Topics will include: the 8 planets; our Sun and the structure of stars, nuclear fusion as a stellar energy source; stellar evolution; the Milky Way galaxies and galaxy information; large scale structure; and the fate of the universe. No prior knowledge of astronomy is necessary (4 credits)

PHYS2300 SPACE EXPLORATION
This course is about the physics, history, and future of space exploration. Students first learn the physics involved in all aspects of spaceflight, including the motion and chemistry of rockets, aerospace engineering, gravitation and orbits, electromagnetic and particle radiation, the Sun,the solar system, and planetary atmospheres. Students then review the history of spaceflight, beginning with WW2 and continuing on through the Apollo program, the Space Shuttle era, robotic spaceflight, and advancements on living safely in space. Ongoing and near-futureprograms are discussed along with possibilities over the next century and millennium. These topics include Moon colonization, Mars missions, planetary terraforming, space elevators and other space infrastructure, and the possibility of warp drives and interstellar travel. (4 credits)

PHYS2990 INDEPENDENT STUDY IN PHYSICS
This course investigates a topic of special interest to faculty and students that is outside existing course offerings. ***Prerequisite:*** *Consent of academic unit and instructor. (1 - 4 credits)*

PHYS3000 COMPUTATIONAL PHYSICS
Numerical and computational methods and techniques applied to a variety of physics topics. Use of computers to numerically solve problems and graphically illustrate solutions involving differential equations. Integration, matrices and root finding. ***Prerequisites:*** *PHYS1750 and MATH1850 (4 credits) fall*

PHYS3100 MODERN PHYSICS
This course takes a student on a journey of the physics after 1905. Emphasis is placed on the shortcoming of classical physics at the turn of the century leading to the discoveries of the modern era. The special theory of relativity and foundations of quantum mechanics serve as the cornerstone of the course. Extensions of these topics will include the modern view of the atom, nuclear physics, wave-particle duality of light and mass, space time structure and GPS implementation of relativity. The emphasis of the class is to gain a strong mathematical and conceptual understanding of post-Newtonian physics and its applications as well as the development of specific problem solving skills, including the use of calculus, differential equations, and linear algebra. ***Prerequisites:*** *MATH1850 or MATH1875; and PHYS1750 (4 credits)*

PHYS3200 OPTICS
Optics is the physics of light. Students study electromagnetic waves with a particular emphasis on the visible spectrum. Topics include geometric optics, reflection, refraction, interference/diffraction, and polarization. Students gain familiarity with lenses, mirrors, thin films, optical fibers, and lasers. (4 credits)

PHYS3500 THERMAL PHYSICS
This course introduces the fundamental principles of thermodynamics, examining the relationship between temperature, heat, work, and energy. Topics include the laws of thermodynamics, heat engines and ideal gasses. ***Prerequisites:*** *MATH1850 or MATH1875; and PHYS1750 (4 credits) summer*

PHYS3600 CLASSICAL MECHANICS
This course emphasizes the systematic approach to the mathematical formulation of the principles of Newtonian mechanics. The fundamental concepts and principles will be applied to particles, system of particles and rigid bodies. Topics will include oscillatory motion, noninertial reference frames, Lagrangian and Hamitonian dynamics, gravitation, central force motion, and dynamics of system of particles. ***Prerequisites:*** *MATH2500 and PHYS1750 (4 credits) fall*

PHYS3700 ADVANCED LABORATORY TECHNIQUES IN PHYSICS
This is a lab-intensive course that focuses on instrumentation and experimental methods in physics. In addition, students receive training in experimental design, critical data analysis, and scientific writing. Throughout the semester, students apply techniques standard in physics and related disciplines. The course culminates in the design and execution of a project that utilizes skills built throughout the term. ***Prerequisites****; PHYS1750; and* ***Corequisites:*** *MATH1850, or MATH1875, or MATH1877 (4 credits)*

PHYS3800 SPECIAL TOPICS IN PHYSICS
These courses present topics that are not covered by existing courses and are likely to change from semester to semester. Refer to the semester schedule for the courses offered that semester. Contact the faculty assigned for more information about the course topic. (1 - 4 credits)

PHYS4500 INTRODUCTION TO QUANTUM MECHANICS
This course serves as an introduction to quantum mechanics. Students will be introduced to the mathematics necessary to understand and solve problems in quantum mechanics. The time independent Shrodinger equation will be discussed and solved to determine the quantum wavefunction for a number of different one-dimensional potentials. Quantum observables will be introduced and calculated by applying linear operators to particles wavefunctions. Realistic quantum systems such as the hydrogen atom will be explored to demonstrate how quantum mechanics shapes the nature of atomic matter. Particle spin will be used as an example of a two-state quantum system leading to an investigation of quantum entanglement. ***Prerequisites:*** *MATH2500 and PHYS3100 (4 credits) summer*

PHYS4700 ELECTRODYNAMICS
This course is designed to build on topics first investigated in PHYS 1750 in a more advanced and rigorous manner. Students will be introduced to vector calculus and its application to Maxwell's equations. Topics will include but are not limited to Electrostatics, Laplace's equation, Dielectrics, Magnetostatics, and Electrodynamics. ***Prerequisites:*** *PHYS3100 (4 credits)*

PHYS5000 SENIOR THESIS I
This is the first course of the two-semester physics thesis sequence. In this first course, students develop a research project proposal and plan of action for the second-semester thesis course. Students identify a project that can be accomplished by the end of the second thesis course semester and that will be of interest to peers in the science community. Students perform a literature review. (4 credits)

PHYS5500 SENIOR THESIS II
This is the second course in the physics senior thesis sequence. Students continue work on their proposed research projects. These projects culminate in a written thesis in journal publication style and a presentation suitable for a conference. Students are encouraged to submit their thesis to journals for publication and to present their work at a relevant conference. ***Prerequisites:*** *PHYS5000 (4 credits)*