Physics (PHYS)

PHYS 1010. Elementary Physics (PS). 3 Hours.
Fulfills General Education Physical Science requirement for students not majoring in Physics, other Sciences, or Engineering. Covers the basic concepts of physics in an historical perspective, providing many practical examples that demonstrate the role of physics in their everyday life. PHYS 1015 lab course recommended but not required. Inclusive Access Course Material (electronic book) fees may apply, see Fees tab under each course section for details. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Demonstrate a conceptual understanding of Newton's laws of motion; momentum and energy conservation; electricity and magnetism; and modern physics. Prerequisites: ACT Math Placement score 23 or higher; OR MATH 1010 (Grade C- or higher). FA, SP.

PHYS 1015. Elementary Physics Lab. 1 Hour.
Lab portion of PHYS 1010. Offered upon sufficient student need. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Apply the principles learned in Physics 1010 to real life situations. Course fee required. Corequisite: PHYS 1010.

PHYS 1040. Elementary Astronomy (PS). 3 Hours.
Fulfills General Education Physical Science requirement intended for students not majoring in Physics, other Sciences, or Engineering. Covers a general study of the solar system, including the formation of the solar systems and a brief description of its parts. Also covers a brief history of astronomy and a general study of the known universe. Inclusive Access Course Material (electronic book) fees may apply, see Fees tab under each course section for details. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Demonstrate quantitative and qualitative reasoning skills. 2. Demonstrate critical thinking skills. 3. Relate basic physics and chemistry to the origin and development of planetary systems and galaxies. 4. Describe the night sky and how its appearance changes with time and position. 5. Describe the history of astronomy and the evolution of scientific ideas. 6. Explain that physical laws and processes are universal and can be explored using the scientific method. Course fee required. Corequisites: PHYS 1045. FA, SP.

PHYS 1045. Elementary Astronomy Lab. 1 Hour.
Lab portion of PHYS 1040. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Describe familiar objects in the night sky. 2. Make simple observations with a telescope. 3. Summarize processes used by professional astronomers to classify and interpret data and images. Course fee required. Corequisite: PHYS 1040. FA, SP.

PHYS 2010. College Physics I (PS). 4 Hours.
Fulfills General Education Physical Science requirement for students majoring in some Science programs, and pre-Medical, pre-Dental, and other pre-professional programs. Covers the basics of mechanics, heat, and sound. First course in a two-semester sequence required for further study in science fields. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Demonstrate an understanding of motion by setting up and solving a variety of kinematics problems. 2. Apply Newton's laws of motion to a variety of problems involving physical systems. 3. Apply conservation laws to solve problems involving physical systems. 4. Apply kinematics, dynamics, and conservation laws to solve problems involving rotational motion. 5. Apply the equations of motion to a variety of problems involving oscillatory and wave motion. Prerequisite: (MATH 1060 OR MATH 1080) (Grade C- or higher, taken within 2 years of enrollment in this course) OR equivalent placement score into MATH 1210 (taken within 2 years of enrollment in this course). Corequisite: PHYS 2015. FA, SP.

PHYS 2015. College Physics I Lab. 1 Hour.
Lab portion of PHYS 2010. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Apply the principles learned in Physics 2010 to real life situations. Course fee required. Corequisite: PHYS 2010. FA, SP.

PHYS 2020. College Physics II. 4 Hours.
Second course in a two-semester sequence required for further study in science fields for students majoring in some Science programs, and pre-Medical, pre-Dental, and other pre-professional programs. Covers the basics of electricity, magnetism, light, and modern physics. Uses lecturers, videos, and demonstrations. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Apply both ray and wave optics to solve problems for basic optical systems. 2. Demonstrate an understanding of electricity by setting up and solving a variety of problems involving electrostatics and electrodynamics. 3. Apply the laws of magnetism to a variety of problems including physical systems which contain both electric and magnetic phenomena. 4. Demonstrate an understanding of relativity theory by setting up and solving a variety of problems involving speeds near the speed of light. 5. Set up and solve problems leading up to and including simple quantum mechanics as it applies to atomic, nuclear, and particle physics. Prerequisite: PHYS 2010 (Grade C- or higher). Corequisite: PHYS 2025. FA, SP.

PHYS 2025. College Physics II Lab. 1 Hour.
Lab portion of PHYS 2020. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Apply the principles learned in Physics 2025 to real life situations. Course fee required. Prerequisite: PHYS 2015 (Grade C- or higher). Corequisite: PHYS 2020. FA, SP.

PHYS 2210. Physics/Scientists Engineers I (PS). 4 Hours.
Fulfills General Education Physical Science requirement for students majoring in physical science, engineering, and some biological/plant sciences. First course in an intensive two-semester sequence. Covers basic principles of physics, emphasizing mechanics with the objective of developing students' capacities to analyze problems in physics and to express solutions in mathematical form utilizing mathematics up to and including calculus. Successful completion satisfies prerequisite for ENGR 2000. Inclusive Access Course Material (electronic book) fees may apply, see Fees tab under each course section for details. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Explain the major threads of physics concepts for forces. 2. Explain the major threads of physics concepts for conservation laws. 3. Explain the major threads of physics concepts for Newton's Laws. 4. Explain the major threads of physics concepts for work and energy. 5. Demonstrate how to correctly solve physics problems by using mathematics. 6. Identify key elements in the functioning of a physical system by construction of a model. Course fee required. Prerequisites: MATH 1210 (Grade C- or higher) or MATH 1220 (Grade C- or higher, can be concurrently enrolled). Corequisites: PHYS 2215. FA, SP.

PHYS 2215. Physics/Scientists Engineers I Lab. 1 Hour.
Lab portion of PHYS 2210. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Demonstrate an understanding of motion by setting up and solving a variety of kinematics problems. 2. Apply Newton's laws of motion to a variety of problems involving physical systems. 3. Explain what it means for a quantity to be conserved, and can apply conservation laws to solve problems involving physical systems. 4. Apply kinematics, dynamics, and conservation laws to solve problems involving rotational motion. Course fee required. Corequisite: PHYS 2210. FA, SP.

PHYS 2220. Physics/Scientists EngineersII. 4 Hours.
Second course in a two-semester sequence required for students majoring in physical science, engineering, and some biological/plant sciences. Covers basic principles of physics, emphasizing electricity and magnetism; optics, and relativity with the objective of developing students' capacities to analyze problems in physics and to express solutions in mathematical form utilizing mathematics up to and including calculus. Successful completion of this series satisfies Physics requirements for Physical Science and Engineering. Inclusive Access Course Material (electronic book) fees may apply, see Fees tab under each course section for details. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Analyze waves and optics, the electric charge and Coulomb's law, the electric field, Gauss' law, current and conductivity, electric potential, circuits, the magnetic field, Faraday's law of induction, Maxwell's equations, and electromagnetic waves. 2. Solve physical and mathematical problems relating to these subjects utilizing the mathematical concepts of algebra, trigonometry, and calculus evaluated by performance on homework assignments and examinations. Prerequisites: MATH 1220 and PHYS 2210 (Both grade C- or higher). Corequisites: PHYS 2225. FA, SP.

PHYS 2225. Physics/Scientists Engineers II Lab. 1 Hour.
Lab portion of PHYS 2220. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Analyze light and sound waves in a lab setting. 2. Evaluate basic properties of light that explain why it is and is not a wave. 3. Perform basic lab experiments with electric and magnetic fields. 4. Diagram simple circuit structures and components. Course fee required. Prerequisite: PHYS 2215 (Grade C- or higher). Corequisite: PHYS 2220. FA,SP.

PHYS 2710. Modern Physics I. 3 Hours.
For students majoring in Physics and Physical Science education. Includes a basic study of relativity and wave-particle duality, as well as an introduction to quantum physics, atomic physics, and nuclear physics. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Describe relationships between Newtonian physics with relativity. 2. Demonstrate understanding of quantum mechanics by deriving and applying the Schrodinger Equation. 3. Apply quantum theory to solve problems involving "small" objects, generally atomic size or smaller. Prerequisites: MATH 1220 (Grade C- or higher) AND PHYS 2220 (Grade C- or higher). FA (even).

PHYS 2720. Modern Physics II. 3 Hours.
Second course in a two-semester sequence for students majoring in Physics and Physical Science education. Continuation of Physics 2710 with an emphasis on applications of quantum mechanics and relativity. **COURSE LEARNING OUTCOMES (CLOs)** At the successful conclusion of this course, students will be able to: 1. Have a greater knowledge of the applications of modern physics including spectroscopy, electron conduction in solids, nuclear physics and cosmology. Prerequisites: PHYS 2710 (Grade C- or higher). SP (odd).

PHYS 2990. Seminar in Physics. 0.5-3 Hours.
For students wishing instruction that is not available through other regularly scheduled courses in this discipline. Occasionally, either students request some type of non-traditional instruction, or an unanticipated opportunity for instruction presents itself. This seminar course provides a variable credit context for these purposes. As requirements, this seminar course must first be pre-approved by the department chair; second, it must provide at least nine contact hours of lab or lecture for each credit hour offered; and third, it must include some academic project or paper (i.e., credit is not given for attendance alone). This course may include standard lectures, travel and field trips, guest speakers, laboratory exercises, or other non-traditional instruction methods. Note that this course is an elective and does not fulfill general education or program requirements. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Demonstrate learning through original and creative ideas. 2. Collaborate with others to accomplish a shared purpose or goal. 3. Use appropriate strategies and tools to represent, analyze, and integrate seminar-specific knowledge. 4. Develop the ability to think critically about course content. 5. Apply knowledge from seminar to a range of contexts, problems, and solutions. Prerequisite: Instructor permission.

PHYS 3400. Classical Mechanics. 3 Hours.
Study of Newtonian Mechanics, work and energy, systems of particles, Lagrange's and Hamilton's equations, harmonic oscillators, accelerated reference frames, and rigid body rotations. Offered upon sufficient student need. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Apply Newtonian and Lagrangian formulations and mechanics to various physical systems. 2. Demonstrate understanding of conservation laws, their utility, and their roots in symmetries of variational principles. 3. Map mechanical systems to mathematical representations and analyzing the resulting mathematical model. 4. Demonstrate understanding of basic analytic geometry, vector analysis and ordinary differential equations. Prerequisite: PHYS 2220 (Grade C- or higher).

PHYS 3600. Thermodynamics. 4 Hours.
Fundamentals of thermodynamics required for Mechanical Engineering majors. Students learn to apply the laws of thermodynamics to open and closed systems through lecture and laboratory experiments. Topics include: energy transfer, laws of thermodynamics, power cycles, refrigeration and heat pump cycles, gas mixtures, psychrometrics, combustion, and chemical and phase equilibrium. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Characterize pure substances and obtain their thermodynamic properties using equations of state, charts, tables and/or software. 2. Model and analyze thermodynamic components, such as heaters, coolers, pumps, turbines, and pistons, using the laws of thermodynamics. 3. Model and analyze thermodynamic cycles such as power and refrigeration cycles. 4. Analyze vapor/gas mixtures in HVAC systems and combustion processes. Prerequisites: PHYS 2210 AND MATH 2210 AND CHEM 1210 (All Grade C- or higher). SP.

PHYS 3605. Thermodynamics Lab. 0.5 Hours.
Lab portion of MECH 3600. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Acquire and analyze data from thermodynamic components and/or systems. 2. Evaluate uncertainty and/or error between experimental measurements and analytical/simulated predictions. Corequisite: PHYS 3600. SP.

PHYS 4110. Electromagnetics. 3 Hours.
Advanced classical theory of electric and magnetic fields. Topics include: Vector analysis; electrostatics; calculating electric potentials; solving Laplaces equation; multipole expansions; electrostatic fields in matter; magnetostatics; charges in motion; electrodynamics; Faradays law; Maxwells equations. ***COURSE LEARNING OUTCOMES (CLOs)*** At the successful conclusion of this course students will: 1. Applying the concepts of vector calculus to electromagnetic problems. 2. Integrating over a source distribution to calculate time-independent fields and potentials for both electricity and magnetism. 3. Solving for time-independent electric and magnetic potentials and fields using image charges and image currents. 4. Calculating electric and magnetic fields in the presence of matter which can be electrically and magnetically polarized. 5. Calculating time-dependent electric fields using Faraday's law and time-dependent magnetic fields using Maxwell's displacement current. Prerequisites: (PHYS 2220 AND (MATH 2250 OR MATH 2280)) (all grade C- or higher). SP (even).

PHYS 4800R. Independent Research. 1-3 Hours.
Students will devise and perform original, preferably unique research projects in Physics. The culmination of this project will be a publication-quality paper on their research that uses primary scientific literature pertinent to the student's field and individual projects. Repeatable for a maximum of 6 credits subject to graduation restrictions. Offered upon sufficient student need. **COURSE LEARNING OUTCOMES (CLOs) At the successful completion of this course, students will be able to: 1. Use the Scientific method to develop hypotheses, design experiments, and draw conclusions from results. 2. Design and modify experiments during the process of a research project. 3. Interpret results from experiments, modify the hypothesis. 4. Interact with other students and faculty that are engaged in the project. 5. Utilize outside resources (scientific databases, literature, etc.) to help interpret results and compare to existing and previous work in the field of your research project. Prerequisites: Instructor permission and Junior or Senior standing. FA, SP.