PHYSICS (PHY)

PHY 0--. PHY LOWER DIVISION. (1-10 Credits)
Lower Level Coursework in Physics
Level: Professional Health Care, Undergraduate
Prerequisite(s): None
Corequisite(s): None
Restrictions: None
Primary grade mode: Transfer
Schedule type(s): Lecture
Area(s) of Inquiry: None

PHY 001. INTRODUCTION TO PHYSICS I. (0-4 Credits)
An introduction to the fundamental concepts in classical mechanics. Three hours of lecture and three hours of laboratory per week. PHY 1 or equivalent is prerequisite for PHY 2. Co-req.: MATH 50, for PHY 2 MATH 70.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): MATH 050
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Discussion/Recitation, Independent Study, Lab, Lecture, Web Instructed
Area(s) of Inquiry: Physical Science, Scientific Literacy

PHY 1--. PHY UPPER DIVISION. (1-10 Credits)
Upper Level Coursework in Physics
Level: Professional Health Care, Undergraduate
Prerequisite(s): None
Corequisite(s): None
Restrictions: None
Primary grade mode: Transfer
Schedule type(s): Lecture
Area(s) of Inquiry: None

PHY 002. INTRODUCTION TO PHYSICS II. (0-4 Credits)
An introduction to the fundamental concepts in thermodynamics and electricity and magnetism. Three hours of lecture and three hours of laboratory per week. PHY 1 or equivalent is prerequisite for PHY 2. Prereq.: MATH 50, for PHY2 MATH 70.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 001 and (MATH 070 or MATH 080 or MATH 100)
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Discussion/Recitation, Independent Study, Lab, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 003. CONTEMPORARY TOPICS SEMINAR. (1 Credit)
A seminar course introducing students to contemporary developments and problems in Physics and Astronomy presented by the faculty. The purpose of the course is to share the fascination and excitement of Physics and Astronomy, learn what to anticipate in their studies of these fields and become informed on the professional opportunities. The course also serves as an introduction to scientific presentation and writing.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): None
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 011. GENERAL PHYSICS I. (0-4 Credits)
Mechanics, properties of matter, heat and sound. Emphasis is placed on applications to the medical sciences. Three hours of lecture and three hours of laboratory per week. PHY 11 is a prerequisite for PHY 12. This course is designed primarily for biology majors. Prereq.: MATH 20 or equivalent.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): MATH 020 or MATH 050 or MATH 070
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Discussion/Recitation, Independent Study, Lab, Lecture, Web Instructed
Area(s) of Inquiry: Physical Science, Scientific Literacy

PHY 012. GENERAL PHYSICS II. (0-4 Credits)
Properties of light, magnetism, electricity and modern physics. Emphasis is placed on applications to the medical sciences. Three hours of lecture and three hours of laboratory per week. This course is designed primarily for biology majors. Prereq.: PHY 11 or equivalent.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 011
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Discussion/Recitation, Independent Study, Lab, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 021. INTRO TO METHODS IN PHYSICS. (3 Credits)
This course focuses on the development of analytical skills necessary for advanced study in Physics, pre-Engineering, and other STEM fields, in particular the mathematical modeling of physical systems and practice of mathematical techniques.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 001 and PHY 002 and MATH 050 and MATH 070
Corequisite(s): None
Restrictions:
Students with a classification of Freshman may **not** enroll.

Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture
Area(s) of Inquiry: None

PHY 050. MODERN PHYSICS. (4 Credits)
Historical development of modern physics; wave and particle theories of matter; discussion of origin of quantum theory and development of Schrodinger equation; atomic and nuclear structure. Four hours of lecture per week. Prereq.: PHY 001 and Math 100. Co-requisites courses: PHY 059.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 001 and (MATH 100 (may be taken concurrently) or MATH 101 (may be taken concurrently) or MATH 120 (may be taken concurrently) or MATH 121 (may be taken concurrently))
Corequisite(s): PHY 059
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: Critical Thinking

PHY 059. ADVANCED LAB I & ERROR THEORY. (0,2 Credits)
The course is focused on modern physics experiments elucidating phenomena in quantum mechanics, nuclear physics and related instrumentation, cosmic rays, solid state physics and other contemporary areas. It also includes computational projects. The course introduces the theory of errors and data analysis: random and systematic errors, expectation values, standard deviations of measured quantities, error propagation, Gaussian, Poisson, and student distributions, correlations, chi-squared fitting, confidence level. 3 hours of laboratory plus 1 hour in class per week.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 002
Corequisite(s): PHY 050
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Discussion/Recitation, Independent Study, Lab, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 121. THEORETICAL MECHANICS. (4 Credits)
Conservation laws and conservative systems; the harmonic oscillator, central forces, rotating coordinates, angular momentum, rigid body dynamics and relativity; methods of Lagrange. Four hours of lecture per week. Preq.: PHY 1 or equivalent. Coreq.: MATH 120.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 001 and MATH 120 (may be taken concurrently)
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 122. ELECTROMAGNETIC THEORY. (4 Credits)
Theory of the electric potential, fields and currents; magnetic effects of currents, electromagnetic induction, electric and magnetic fields in matter; Maxwell's equations, applications and solutions. Four hours of lecture per week. Prereq.: PHY 2 or equivalent. Coreq.: MATH 121.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 002 and MATH 121 (may be taken concurrently)
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 132. MEDICAL BIOPHYSICS. (3 Credits)
This course offers a comprehensive introduction to fundamental concepts and methods in medical biophysics, an interdisciplinary field at the interface of physics, biology and medicine. The course will explore the physical and physiological principles underlying the behavior of biological systems, in particular the human body. Concepts from various branches of physics will be introduced in the context of living organisms. Additionally, modern methods from medical physics, including laser surgery, ultrasound imaging, computed tomography, radiation therapy and magnetic resonance imaging, will be investigated. The emphasis will be on the applications of physics in biology and medicine.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 011 and PHY 012
Corequisite(s): None
Restrictions:
Enrollment limited to students with a classification of Junior, Sophomore or Senior.

Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 133. ELECTRONICS. (0-4 Credits)
Intended for advanced undergraduates who desire a comprehensive course in electronic circuits and instrumentation. Two hours of lecture and four hours of laboratory per week. Prereq.: PHY 2 or equivalent.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 002
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lab, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 149. ADVANCED LAB II. (0-2 Credits)
Advanced experiments in physics. Six hours of laboratory per week. Prereq.: PHY 59 or equivalent.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 059
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Discussion/Recitation, Independent Study, Lab, Web Instructed
Area(s) of Inquiry: None

PHY 159. ADVANCED LAB III. (2 Credits)
Advanced experiments in physics and astrophysics. Six hours of laboratory per week. Prereq.: PHY 149 or equivalent.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 149
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lab, Web Instructed
Area(s) of Inquiry: None

PHY 170. HOT TOPICS IN PHYSICS AND ASTRONOMY. (1-3 Credits)
Directed independenty study courses on topics agreed upon between the student and the instructor. Their purpose is to help develop an individualized curriculum that fits the interests and professional objectives of students.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): None
Corequisite(s): None
Restrictions:
Enrollment is limited to students with an major in Astronomy or Physics.

Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 180. COMPUTATIONAL PHYSICS. (3 Credits)
Atomic spectra, spectra of one and two electron systems, structure of diatomic molecules, atomic and molecular processes. Three hours of lecture per week. Prereq.: PHY 50 or equivalent.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 050
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture
Area(s) of Inquiry: None

PHY 181. QUANTUM THEORY. (4 Credits)
The solution of Schrodinger's equation for harmonic oscillator and hydrogen atoms; eigenfunctions and eigenvalues, potential well problems; scattering theory and matrix formulation. Four hours of lecture per week. Prereq.: PHY 50 or equivalent and MATH 120 or consent of instructor.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 050 and MATH 120
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 182. THERMO/STATISTICAL PHYSICS. (4 Credits)
Thermodynamic properties of matter; kinetic theory of gases; introduction to classical and quantum statistical mechanics. Four hours of lecture per week. Prereq.: PHY 50 or equivalent.
Level: Graduate, Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 050
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 183. NUCLEAR AND PARTICLE PHYSICS. (4 Credits)
Properties of nuclei, the nuclear force, the two nucleon problem, complex nuclei, nuclear models, radioactive decay and selection rules, elementary particle production and decay, symmetries and conservation laws. Four hours of lecture per week. Prereq.: PHY 50 or equivalent.
Level: Graduate, Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 050
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 184. MODERN OPTICS. (3 Credits)
Wave theory; interference and diffraction; polarization; interaction of radiation and matter; coherent radiation. Three hours of lecture per week. Prereq.: PHY 50 or equivalent.
Level: Graduate, Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 050
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 186. PLASMA PHYSICS. (3 Credits)
Atomic collisions and kinetic theory; motion of charged particles; continuum magnetohydrodynamics and elementary stability theory; transport processes; waves, oscillations and radiation in plasma. Three hours of lecture per week. Prereq.: PHY 50 or equivalent.
Level: Graduate, Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 050
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 187. SOLID SATE PHYSICS. (3 Credits)
Lattice dynamics and thermodynamics of solids; free electron theory of metals and band structure of solids; electronic structure of conductors, insulators and semiconductors. Three hours of lecture per week. Preq.: PHY 50 or equivalent.
Level: Graduate, Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 050
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 188. ADVANCED CLASSICAL PHYSICS. (4 Credits)
Calculus of variations, Lagrangian and Hamilitorian methods; Hamilton-Jacobi theory, continuum mechanics; Laplace's equation, relativistic electrodynamics, radiation fields and applications. Four hours of lecture per week. Prereq.: PHY 121 and 122; MATH 120 or consent of instructor.
Level: Graduate, Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 121 and PHY 122 and MATH 120
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 189. SELECTED TOPICS. (0-5 Credits)
In-depth study of a special topic or topics in physics. Prereq.: Consent of the department.
Level: Graduate, Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): None
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Discussion/Recitation, Independent Study, Lab, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 190. SELECTED TOPICS. (0-5 Credits)
In-depth study of a special topic or topics in physics. Prereq.: Consent of the department.
Level: Graduate, Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): None
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Discussion/Recitation, Independent Study, Lab, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 191. PHYSICS SEMINAR I. (1 Credit)
Students make seminar presentations on advanced physics and/or astronomy topics. They also critique presentations made by other students. One class hour per week.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): None
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 192. PHYSICS SEMINAR II. (1 Credit)
Students make seminar presentations on advanced physics and/or astronomy topics. They also critique presentations made by other students. One class hour per week.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): None
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 193. PHYSICS SEMINAR III. (1 Credit)
Students make seminar presentations on advances physics and/or astronomy topics. They also critique presentations made by other students. One class hour per week.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): None
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 195. INTRODUCTION TO ASTROPHYSICS II. (3 Credits)
An advanced course that reviews the Milky Way, the nature of galaxies, galactic dynamics (including potential theory, stellar orbits, disk dynamics and spiral structure), galactic evolution, active galaxies, structure of the universe, cosmological models and the early universe. Three hours of lecture per week. Prereq.: PHY 50 or consent of the instructor.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 050
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 197. RESEARCH I. (1-4 Credits)
Students enrolled in these courses work with members of the staff in research projects. Prereq.: Consent of the department.
Level: Graduate, Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): None
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Lab, Lecture, Web Instructed
Area(s) of Inquiry: None

PHY 198. RESEARCH II. (1-4 Credits)
Students enrolled in these courses work with members of the staff in research projects. Prereq.: Consent of the department.
Level: Graduate, Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): None
Corequisite(s): None
Restrictions: None
Primary grade mode: Standard Letter
Schedule type(s): Independent Study, Web Instructed
Area(s) of Inquiry: None

PHY 199. PHYSICS & ASTRONOMY CAPSTONE. (0 Credits)
This course is taken in the student's final semester at Drake after they have completed the required research credits. The student will write a final paper and will present their research work in a seminar type environment.
Level: Non Degree Coursework, Professional Health Care, Undergraduate
Prerequisite(s): PHY 197 and PHY 198 (may be taken concurrently)
Corequisite(s): None
Restrictions:
Enrollment is limited to students with an major in Astronomy or Physics.

Primary grade mode: Credit/No Credit
Schedule type(s): Independent Study, Lecture
Area(s) of Inquiry: None