PHYS - Physics

Courses numbered 100 to 299 = *lower-division*; 300 to 499 = *upper-division;* 500 to 799 = *undergraduate/graduate*.

PHYS 111. Introductory Physics (4).
3 Classroom hours; 3 Lab hours. *General education math and natural sciences introductory course*. A general physics course for liberal arts students and those who have not had physics in high school. Includes mechanics, heat, electricity and magnetism, wave phenomena and modern physics. Not open to students who can meet prerequisites for PHYS 313. Prerequisite: two years of high school algebra or one each of algebra and geometry or equivalent.

PHYS 131. Physics for Health Sciences (3).
General education math and natural sciences introductory course. Background in basic physics for students in health-related professions. The choice of topics, the emphasis on problems, and the detailed applications are directed toward the special uses of physics in the health sciences. Prerequisites: two years of high school algebra or one year each of algebra and geometry or equivalent.

PHYS 151. Preparatory Physics (2).
A general physics course for those who have not had adequate preparation for PHYS 313. Emphasizes problem solving using selected areas of physics, including vectors, one-dimensional motion, rotational motion, equilibrium, elasticity, hydrostatics, thermal effects, lenses and mirrors. Prerequisite: MATH 112.

PHYS 195. Introduction to Modern Astronomy (3).
General education math and natural sciences introductory course. Surveys astronomy for the student with little or no background in science or math. The nature and evolution of the universe and objects in it are considered from the perspective of the question: Why do things happen the way they do? May include comparison of the planets, stars and black holes, galaxies and quasars, and the expansion of the universe.

PHYS 196. Laboratory in Modern Astronomy (1).
3 Lab hours. The application of the techniques and analysis of the data of modern astronomy. For the student with some background in the physical sciences. When PHYS 196 is completed, 195 and 196 count as a laboratory science. Requires field trips. Prerequisites: two semesters of high school algebra or the equivalent, or instructor's consent, and PHYS 195, which may be taken concurrently.

PHYS 199A. Special Topics in Astronomy (0.5).
This course will introduce you to selected topics of our modern view of the universe, its contents, and how particular objects got to be the way they are. Among the topics we will discuss are objects in our solar system; the birth and death of stars; the fate of the universe; and the search for life in the solar system and beyond.

PHYS 210. Physics of Sound (3).
2 Classroom hours; 1 Lab hour. *General education math and natural sciences advanced issues and perspectives course*. Studies the physical nature of sound generation by the human vocal system and musical instruments, including sound propagation and wave properties. Covers sound reception in the human ear, electronic sound generation, recording and measurements. Basic principles of physics are introduced to build a working knowledge of the subject for students in speech-language pathology, audiology, music and related fields.

PHYS 213. General College Physics I (5).
4 Classroom hours; 3 Lab hours. *General education math and natural sciences introductory course*. Mechanics, heat and wave motion. For students with a working knowledge of algebra and trigonometry but who have had no calculus. Credit is given for only one of PHYS 213 or 313. Prerequisite: high school trigonometry or MATH 112. Corequisite: PHYS 213L.

PHYS 214. General College Physics II (5).
4 Classroom hours; 3 Lab hours. *General education math and natural sciences advanced further study course*. Continuation of PHYS 213. Electricity, light and modern physics. Prerequisite: PHYS 213 or 313. Corequisite: PHYS 214L.

PHYS 313. Physics for Scientists I (4).
General education math and natural sciences introductory course. The first semester of a calculus-based physics sequence. Topics include motion, forces, energy, fluids, oscillations, waves and thermodynamics. Natural sciences majors are required to take the lab, PHYS 315, that accompanies this course. Credit is given for only one of PHYS 213 or 313. Pre- or Corequisite: MATH 243 with a grade of C or better.

PHYS 314. Physics for Scientists II (4).
General education math and natural sciences advanced further study course. The second semester of a calculus-based physics sequence. Topics include electricity, magnetism, circuits, EM waves, light and selections from modern physics. Credit is only given for one of PHYS 214 or 314. Natural sciences majors are required to take the lab, PHYS 316, that accompanies this course. Prerequisites: MATH 243 with a grade of C or better and PHYS 313.

PHYS 315. University Physics Lab I (1).
3 Lab hours. *General education math and natural sciences introductory course*. Lab experiments in mechanics, waves and thermodynamics. Required for natural sciences majors enrolled in PHYS 313. Prerequisite: MATH 242. Pre- or corequisite: PHYS 313.

PHYS 316. University Physics Lab II (1).
3 Lab hours. *General education math and natural sciences advanced further study course*. Lab experiments in electricity, magnetism and optics. Required for natural sciences majors taking PHYS 314. Pre- or corequisite: PHYS 314.

PHYS 395. Solar System Astronomy (3).
General education math and natural sciences advanced further study course. Studies the sun, major planets and minor bodies of the solar system, particularly their nature and origin. Discusses classical ground-based observations and the results of satellite investigations. Primarily for students with little prior contact with science.

PHYS 481. Cooperative Education in Physics (1-4).
Complements and enhances the student's academic program by providing an opportunity to apply knowledge gained through coursework to job-related situations. No more than 4 hours earned in PHYS 481 may be applied toward satisfying the requirements for a major in physics. Prerequisite: departmental consent.

PHYS 481N. Internship (1-4).
Complements and enhances the student's academic program by providing an opportunity to apply and acquire knowledge in a workplace environment as an intern. Prerequisite: departmental consent.

PHYS 501. Special Studies in Physics for Educators (1-3).
3 Lab hours. A series of courses covering basic physical concepts which provide a physical science background for teachers. Repeatable for a total of 5 credit hours. Prerequisite: inservice or preservice teacher.

PHYS 501K. Nuclear Concepts (1-3).
Part of a series of courses covering basic physical concepts which provide a physical science background for teachers. Structure of atoms and the experiments that revealed this structure, quantization of matter, electric charge, and light, concepts of quantum mechanics. This course may also include further topics and applications, for example cosmic microwave background radiation or other topics of current interest.

PHYS 502. Science Investigations: Physics (3-5).
Introductory course for prospective teachers. Basic physics concepts in mechanics, heat, and electricity and magnetism developed through laboratory investigations. Emphasizes science process skills and the nature of the scientific endeavor. Prerequisite: MATH 111 or equivalent; inservice or preservice teacher.

PHYS 516. Advanced Physics Laboratory (2).
4 Lab hours. Experiments in classical and modern physics to stress scientific methods and experimental techniques. The experiments are open-ended projects requiring individual study. Repeatable for a total of 8 credit hours. Pre- or corequisite: PHYS 551.

PHYS 517. Electronics Laboratory (2).
1 Classroom hour; 3 Lab hours. Experiments in electronics that treat some of the applications of electronics in scientific physics research. Experiments cover the uses of transistors, op-amps, integrated and digital circuits. Prerequisite: PHYS 314.

PHYS 551. Topics in Modern Physics (3).
An introduction to selected areas of modern physics emphasizing the features of atomic, nuclear and solid state physics that require modifications of classical physics for their explanation. Prerequisite: PHYS 214 or 314, or departmental consent. Pre- or corequisite: MATH 344.

PHYS 555. Modern Optics (3).
Geometrical and physical optics, coherence theory and Fourier optics. Additional topics may include radiation, scattering, optical properties of solids and optical data processing. Prerequisites: PHYS 214 or 314 and MATH 344.

PHYS 595. Astrophysics (3).
Covers the formation, life and death of stars. Topics include: HR-diagrams, atomic and molecular spectra, radiative and convective transfer, the structure and spectra of stellar atmospheres, and stellar evolution. Prerequisite: PHYS 551.

PHYS 600. Individual Readings in Physics (1-3).
Repeatable for a total of 6 credit hours for physics majors. Prerequisite: departmental consent.

PHYS 601. Individual Readings in Astrophysics (1-3).
Studies several topics in astronomy and astrophysics in depth. Lectures, independent readings and student projects may be assigned. Repeatable for credit up to 6 hours. Prerequisite: instructor's consent.

PHYS 616. Computational Physics Laboratory (2).
1 Classroom hour; 2 Lab hours. Provides a working knowledge of computational techniques with applications in both theoretical and experimental physics, including an introduction to the FORTRAN and C++ languages as used in physics. Pre- or corequisite: MATH 555.

PHYS 621. Analytical Mechanics (3).
Motion of a particle or system of particles in one or several dimensions, central forces, rotating coordinate systems, the harmonic oscillator and the Lagrangian and Hamiltonian formulation of mechanics. Prerequisites: PHYS 214 or 314, and MATH 344 with grades of C or better.

PHYS 623. Advanced Mechanics (3).
Continuation of PHYS 621. Covers dynamics of a system of coupled particles, fluid mechanics, systems with continuum distributions of mass, and theory of small oscillations all in a Lagrangian or Hamiltonian formulation. Prerequisite: PHYS 621, or MATH 553 or 555, or instructor's consent.

PHYS 631. Electricity and Magnetism (3).
Electric and magnetic field theory, direct and alternating currents and Maxwell's electromagnetic wave theory. Prerequisites: PHYS 214 or 314, and MATH 344 with grades of C or better.

PHYS 641. Thermophysics (3).
The laws of thermodynamics, distribution functions, Boltzmann equation, transport phenomena, fluctuations, and an introduction to statistical mechanics. Prerequisites: PHYS 214 or 314, and MATH 344.

PHYS 651. Quantum Mechanics I (3).
Introduction to quantum mechanics, the Schrodinger equation, elementary perturbation theory and the hydrogen atom. Prerequisite: PHYS 551.

PHYS 652. Quantum Mechanics II (3).
A continuation of PHYS 651 and covers time dependent perturbation theory, WKB, scattering, Bell's theorem, quantum reality, applications of quantum mechanics, and nanotechnology. Prerequisite: PHYS 651.

PHYS 661. Introduction to Atomic Physics (3).
Quantum mechanics is the basis of all our physical understanding of atomic and molecular spectra. This course uses quantum mechanics to understand the nature and formation of the spectra of one, two and many-electron atoms. A discussion of atomic collisions is included. Corequisite: PHYS 651.

PHYS 675. Nuclear/Particle Physics (3).
Theories of nuclear and particle physics, including experimental techniques and important features of current data. Summary of mesons, baryons and leptons, and their electromagnetic, strong and weak nuclear force interactions. Phenomenological descriptions of nuclear and high-energy scattering and particle production leading to the quark theory of matter and other new exotic particles. Prerequisite: PHYS 551.

PHYS 681. Solid State Physics (3).
A one-semester introduction to solid state physics, which explores and explains-in terms of the microscopic processes that produce them-the thermal, mechanical and electronic properties of solids. Discusses practical applications and interdisciplinary material. Prerequisite: PHYS 551.

PHYS 701F. Astrophysics II (3).
Continuation of PHYS 595. Covers the properties of the solar system and extra-solar planets. Other topics of modern astronomy are included such as the formation of galaxies, cosmology and the Big Bang model. Prerequisite: PHYS 595 or instructor’s consent.

PHYS 701G. Mathematical Methods in Physics (3).
This course is a continuation of PHYS 714, Theoretical Physics. It is a study of mathematical techniques applicable to physics and other sciences. Topics covered in this course include group theory, differential geometry, statistical methods, functional methods, path integrals, renormalization grouping, chaos theory, and string theory. Prerequisite: PHYS 714 or instructor's consent.

PHYS 702. Energy and Sustainability (3).
Cross-listed as ME 702. Introduction to sustainability in a world of increasing population with more energy intensive lifestyles and diminishing resources; anthropogenic global climate change and the engineer's responsibilities; a critical look at the human ecological footprint; survey of alternative energy sources with special emphasis on wind and solar energy; life cycle analysis (LCA) of engineered products; the electric grid; emissions from various transportation modes, and alternatives. Consists of traditional lectures, seminars by invited experts, and the use of case studies. Meets the ME undergraduate curricular requirement for thermal/fluids elective and/or a general ME elective. *Course includes diversity content*. Prerequisite: ME 522 or PHYS 551; or instructor's consent.

PHYS 714. Theoretical Physics (3).
A study of mathematical techniques applicable to physics and other sciences. Instructor selects topics, such as power series, infinite products, asymptotic expansions, WKB method, contour integration and residue methods, integral transforms, Hilbert spaces, special functions and integral equations. Prerequisite: MATH 555 or instructor's consent.

PHYS 730. Principles of Computer Modeling (2).
1 Classroom hour; 2 Lab hours. Essential elements, principles and strategies of forward and inverse numerical computer modeling. Formulation of a qualitative problem (parametrization), model design, implementation, and interpretation of model results. Working knowledge of computational techniques with examples in physics, geology, chemistry and environmental sciences. Prerequisites: PHYS 616 or EEPS 701, plus knowledge of a programming language or numerical or symbolic mathematics package, or instructor's consent.

PHYS 761. Environmental Physics (3).
Covers the application of physics to the environment, including the production and use of energy, the transport of pollutants, and the study of noise. Topics include basic thermodynamics with applications to fossil fuels, hydroelectric, wind, geothermal and solar energies, plus effects on global warming, pollution and climate. Prerequisites: PHYS 313-314 and MATH 242, or EEPS 721, or instructor's consent.

PHYS 795. Earth and Space Physics (3).
Cross-listed as GEOL 795. An introduction to the geosciences and astrophysics of the solar system. Topics include the surface, interior and atmospheres of the planets with a comparative planetology approach, and the sun-planet system including solar physics and the effect of the sun on the earth's environment and geologic history. Prerequisites: PHYS 313-314, and MATH 242, or EEPS 721, or instructor's consent.