

PHYSICS (PHYS)

Courses

PHYS 100 Concepts of Physics-GTSC2 3 Credits

Introduction to physics. Emphasis on basic conceptual aspects described in everyday language. Elementary mathematics introduced when necessary. Survey of topics such as Newtonian mechanics, heat and energy, electricity and magnetism, light, relativity, and quantum theory. The course is designed for majors outside of the sciences.

Essential Learning Categories: Natural Sciences

Colorado Guaranteed Transfer (GT) Pathways General Education Curriculum

Terms Typically Offered: Fall, Spring.

PHYS 101 Elementary Astronomy-GTSC2 3 Credits

Introduction to astronomy. Survey of topics such as observational astronomy, the solar system, stellar astronomy, galaxies and cosmology. Emphasis on basic conceptual aspects of astronomy. Minimal use of elementary mathematics such as basic arithmetic, fractions, square roots, and powers. The course is designed for students in all majors.

Essential Learning Categories: Natural Sciences

Colorado Guaranteed Transfer (GT) Pathways General Education Curriculum

Terms Typically Offered: Fall, Spring.

PHYS 103 General Astronomy-GTSC1 3 Credits

Introductory survey of astronomy, including apparent motions of objects in the sky, light, telescopes, solar system objects, exoplanets, the sun, stars, galaxies, and cosmology. Basic math skills (arithmetic, powers, scientific notation, unit conversions) will be used frequently. This course is designed for students in all majors.

Corequisites: PHYS 103L.

Essential Learning Categories: Natural Science with lab - Both the lab and lecture must be completed

Colorado Guaranteed Transfer (GT) Pathways General Education Curriculum

Terms Typically Offered: Fall, Spring.

PHYS 103L General Astronomy Laboratory-GTSC1 1 Credit

Basics of night sky observing, telescopes and their use. Emphasis on astronomical image acquisition and analysis to a variety of applications, including: asteroid tracking, exoplanet detection, observing motions of orbiting moons and stars to determine properties of planets and stars. This course is designed for students in all majors. Lab component required for PHYS 103.

Corequisites: PHYS 103.

Essential Learning Categories: Natural Science with lab - Both the lab and lecture must be completed

Colorado Guaranteed Transfer (GT) Pathways General Education Curriculum

Terms Typically Offered: Fall, Spring.

PHYS 111 General Physics I-GTSC1 4 Credits

Algebra-based introduction to classical mechanics and thermodynamics. Includes mechanics, energy and momentum conservation, thermodynamics, and statistical mechanics. Extensive use of high school level algebra and trigonometry.

Corequisites: PHYS 111L.

Essential Learning Categories: Natural Science with lab - Both the lab and lecture must be completed

Colorado Guaranteed Transfer (GT) Pathways General Education Curriculum

Terms Typically Offered: Fall, Spring.

PHYS 111L General Physics I Laboratory-GTSC1 1 Credit

Algebra-based introduction to classical mechanics and thermodynamics. Includes mechanics, energy and momentum conservation, thermodynamics, and statistical mechanics. Extensive use of high school level algebra and trigonometry.

Corequisites: PHYS 111.

Essential Learning Categories: Natural Science with lab - Both the lab and lecture must be completed

Colorado Guaranteed Transfer (GT) Pathways General Education Curriculum

Terms Typically Offered: Fall, Spring.

PHYS 112 General Physics II-GTSC1 4 Credits

Algebra-based introduction to classical electromagnetism, optics, and modern physics. Detailed coverage of electrostatics, electric circuits, magnetism, electromagnetic waves, geometrical optics, and wave optics. Topics from modern and atomic physics. Extensive use of algebra and trigonometry.

Prerequisites: PHYS 111/PHYS 111L, or PHYS 131/PHYS 131L.

Corequisites: PHYS 112L.

Essential Learning Categories: Natural Science with lab - Both the lab and lecture must be completed

Colorado Guaranteed Transfer (GT) Pathways General Education Curriculum

Terms Typically Offered: Fall, Spring.

PHYS 112L General Physics II Laboratory-GTSC1 1 Credit

Algebra-based introduction to classical electromagnetism, optics, and modern physics. Detailed coverage of electrostatics, electric circuits, magnetism, electromagnetic waves, geometrical optics, and wave optics. Topics from modern and atomic physics. Extensive use of algebra and trigonometry.

Prerequisites: PHYS 111/PHYS 111L, or PHYS 131/PHYS 131L.

Corequisites: PHYS 112.

Essential Learning Categories: Natural Science with lab - Both the lab and lecture must be completed

Colorado Guaranteed Transfer (GT) Pathways General Education Curriculum

Terms Typically Offered: Fall, Spring.

PHYS 131 Fundamental Mechanics-GTSC1 4 Credits

Calculus-based introduction to classical mechanics. Detailed coverage of the kinematics and dynamics of linear and rotational motion using Newton's Laws, momentum, and energy conservation. The mathematics of calculus and vectors is used throughout.

Prerequisites: MATH 151 or MATH 135 (either may be taken concurrently).

Corequisites: PHYS 131L.

Essential Learning Categories: Natural Science with lab - Both the lab and lecture must be completed

Colorado Guaranteed Transfer (GT) Pathways General Education Curriculum

Terms Typically Offered: Fall, Spring.

PHYS 131L Fundamental Mechanics Laboratory-GTSC1 1 Credit

Calculus-based introduction to classical mechanics. Detailed coverage of the kinematics and dynamics of linear and rotational motion using Newton's Laws, momentum, and energy conservation. The mathematics of calculus and vectors is used throughout.

Prerequisites: MATH 151 or MATH 135 (either may be taken concurrently).

Corequisites: PHYS 131.

Essential Learning Categories: Natural Science with lab - Both the lab and lecture must be completed

Colorado Guaranteed Transfer (GT) Pathways General Education Curriculum

Terms Typically Offered: Fall, Spring.

PHYS 132 Electromagnetism and Optics-GTSC1 4 Credits

Calculus-based introduction to classical electromagnetism and optics. Detailed coverage of electrostatics, electric circuits, magnetism, electromagnetic waves, geometrical optics, and wave optics. The mathematics of calculus and vectors is used throughout.

Prerequisites: PHYS 131/PHYS 131L, and MATH 152 or MATH 136 (either may be taken concurrently).

Corequisites: PHYS 132L.

Essential Learning Categories: Natural Science with lab - Both the lab and lecture must be completed

Colorado Guaranteed Transfer (GT) Pathways General Education Curriculum

Terms Typically Offered: Fall, Spring.

PHYS 132L Electromagnetism and Optics Laboratory-GTSC1 1 Credit

Calculus-based introduction to classical electromagnetism and optics. Detailed coverage of electrostatics, electric circuits, magnetism, electromagnetic waves, geometrical optics, and wave optics. The mathematics of calculus and vectors is used throughout.

Prerequisites: PHYS 131/PHYS 131L, and MATH 152 or MATH 136 (either may be taken concurrently).

Corequisites: PHYS 132.

Essential Learning Categories: Natural Science with lab - Both the lab and lecture must be completed

Colorado Guaranteed Transfer (GT) Pathways General Education Curriculum

Terms Typically Offered: Fall, Spring.

PHYS 196 Topics 1-3 Credits

Course may be taken multiple times up to maximum of 15 credit hours.

PHYS 230 Intermediate Dynamics 3 Credits

Study of introductory fluid dynamics and thermodynamics, relativistic kinematics and dynamics, and intermediate-level classical waves and vibrations.

Prerequisites: PHYS 132/PHYS 132L, and MATH 253 (may be taken concurrently).

Terms Typically Offered: Fall.

PHYS 231 Modern Physics 3 Credits

Introduction to quantum theory. Key phenomena in the early development of quantum theory. Quantization of measurement outcomes, particularly energy. Schrodinger equation in one dimension applied to the infinite well, barriers, and the harmonic oscillator. Schrodinger equation in three dimensions applied to the hydrogen atom. Differential equation techniques introduced where necessary.

Prerequisites: PHYS 132/PHYS 132L, and MATH 253 (may be taken concurrently).

Terms Typically Offered: Spring.

PHYS 251 Electronics for Scientists 3 Credits

Introduction to electric circuits and electronic instrumentation for scientists. Emphasizes a practical approach, with students learning about electronic devices and how they work by building working circuits. Topics explored include: passive circuits with resistors and capacitors, including applications in electric filtering; diodes; transistors; op-amps; timing circuits; feedback and amplification; and digital circuits.

Prerequisites: PHYS 132 or PHYS 112.

Terms Typically Offered: Fall.

PHYS 252 Intermediate Laboratory 3 Credits

Performance of experiments in optics, acoustics, and modern physics. Experiments will include measuring the speed of light, measuring the wavelength of atomic discharge lines, X-ray diffraction, and measuring h/e , among others. Emphasis will be on experimental design, use of modern instrumentation, preparation of lab reports, and data analysis.

Prerequisites: PHYS 231 (may be taken concurrently).

Terms Typically Offered: Spring.

PHYS 296 Topics 1-3 Credits

Course may be taken multiple times up to maximum of 15 credit hours.

PHYS 300 New Directions in Science 3 Credits

A survey of recent developments in science. This course is open to qualified students in liberal arts as well as the sciences. Faculty from various disciplines will participate. Topics will be drawn from astronomy, biology, chemistry, geology, physics, engineering, and applied mathematics.

Prerequisites: Permission of instructor.

PHYS 301 Introduction to Space Science 3 Credits

The history and technology of space and space exploration. Designed for all non-science majors, particularly prospective K-12 teachers. Topics include: the solar system, space environments, space travel, satellite communication and design.

Prerequisites: Junior or senior status, or permission of instructor.

PHYS 311 Electromagnetic Theory I 3 Credits

Mature study of electromagnetic fields. Electrostatics and magnetostatics presented. Special techniques, including multipole expansion of fields, analyzed. Electrodynamics introduced leading to Maxwell's equations.

Prerequisites: MATH 253; and PHYS 230 or PHYS 231.

Terms Typically Offered: Fall.

PHYS 312 Electromagnetic Theory II 3 Credits

Applications of Maxwell's equations to electromagnetic phenomena. Electric and magnetic fields in matter. Conservation laws in electromagnetism. Electromagnetic waves, reflection, and transmission. Electromagnetic fields produced by non-stationary sources. Electromagnetic radiation.

Prerequisites: PHYS 311.

Terms Typically Offered: Spring.

PHYS 321 Quantum Theory I 3 Credits

Foundations and applications of quantum physics. Fundamental descriptions of quantum states, measurements, and time evolution for general quantum systems. Applications to particles in one or more spatial dimensions, harmonic oscillators, angular momentum, and the hydrogen atom. May also include spin-1/2 particles, photons, multiple quantum systems, and quantum paradoxes. Introduces linear algebra and solving differential equations for quantum physics.

Prerequisites: PHYS 231; and MATH 260 or MATH 236.

Terms Typically Offered: Spring.

PHYS 331 Advanced Laboratory I 3 Credits

Exploration of experimental design and technique. Laboratory investigations provide experience in instrumental methods, planning of laboratory experiments, data analysis, preparation of reports according to professional standards, and training in the use of computers for data acquisition and processing. The experiments to be performed are selected from electromagnetism, atomic, nuclear, and solid-state physics.

Prerequisites: PHYS 252.

Terms Typically Offered: Spring.

PHYS 342 Advanced Dynamics 3 Credits

In-depth survey of classical mechanics, including: advanced treatment of Newtonian dynamics, conservation laws, gravitation, and the Lagrangian and Hamiltonian formulations of dynamics. Topics may include central force motion, systems of particles, non-inertial reference frames, rigid bodies, oscillating systems, coupled oscillations, and waves on a string.

Prerequisites: PHYS 230; and MATH 260 or MATH 236.

Terms Typically Offered: Fall.

PHYS 352 History and Philosophy of Physics 3 Credits

Material varies from year-to-year. The course addresses problems in the interpretation and development of physics. Case studies of crucial experiments are analyzed. The interaction of physics with other philosophical and cultural pursuits is discussed.

Prerequisites: One year of physics or permission of instructor.

PHYS 362 Statistical and Thermal Physics 3 Credits

Study of the physics of bulk matter. Fundamental principles of quantum mechanics, statistical methods employed to explain macroscopic laws of thermodynamics to make detailed predictions about the large-scale behavior of solids, liquids, and gases. Applications include specific heat of solids, thermal radiation, magnetic susceptibilities, stellar equilibrium, and chemical reactions.

Prerequisites: CHEM 321 or PHYS 230; and MATH 253.

Terms Typically Offered: Spring.

PHYS 372 General Relativity 3 Credits

Introduction to Einstein's theory of general relativity. Newtonian gravitation and Einstein's theory of special relativity are reviewed. Topics may include spherically symmetric stars, static and rotating black holes, FRW cosmologies, gravitational waves, and wormholes.

Prerequisites: PHYS 230; and MATH 236 or MATH 260.

Terms Typically Offered: Fall, Spring.

PHYS 395 Independent Study 1-3 Credits

Course may be taken multiple times up to maximum of 6 credit hours.

PHYS 396 Topics 1-3 Credits

Course may be taken multiple times up to maximum of 15 credit hours.

PHYS 422 Quantum Theory II 3 Credits

Continuation of PHYS 321. Central forces, complete derivation of hydrogen atom energy levels and eigenstates. Perturbation theory and other approximately techniques. Other selected topics include: multiple quantum systems, scattering, quantum foundations.

Prerequisites: PHYS 321.

PHYS 441 Solid State Physics 3 Credits

Structure and properties of solids. This course is a study of the crystalline state of matter, including crystal classifications, vibrational specific heats, electronic structures and conductivities, cohesive energies, magnetic susceptibility, and optical properties.

Prerequisites: PHYS 321.

Terms Typically Offered: Fall, Spring.

PHYS 471 Computational Physics I 3 Credits

Application of computational techniques to solving and visualizing physical problems. Numerical integration, differentiation, and matrix methods covered. Techniques of solving various regular and partial differential equations studied. Prior programming experience is not required.

Prerequisites: MATH 260 or MATH 236; and PHYS 132.

Terms Typically Offered: Fall.

PHYS 472 Computational Physics II 3 Credits

A continuation of PHYS 471. Advanced topics in solving partial differential equations and simulating physical systems using modern parallel computing covered. MPI, Open MP, and their applications to physical phenomenon on Linux workstations covered. Introduction to translating analytical problems to parallel computational problems

Prerequisites: PHYS 471.

PHYS 473 Modern Optics 3 Credits

Modern principles and applications of optics. Optical models including ray and wave optics presented. Laws of reflection and refraction studied within the context of both ray and wave optics. Reflectivity and transmissivity analyzed. Superposition and wave interference discussed. Diffraction theory used in a number of applications. Concludes with an introduction to lasers and quantum optics.

Prerequisites: PHYS 311.

PHYS 482 Senior Research 1 Credit

An individual research project, supervised by a faculty advisor. The project may be selected from experimental or theoretical topics. The research concludes with a formal report written in accordance with The American Institute of Physics Style Manual. This course is normally taken twice in the senior year.

Course may be taken 2 times for credit.

PHYS 487 Structured Research 1-3 Credits

Physics research under the direct guidance of a faculty member.

Designed for advanced junior and senior level students.

Prerequisites: Permission of instructor.

PHYS 494 Physics Seminar 1 Credit

Seminars covering selected topics relevant to physics or closely related fields. Weekly presentations by faculty, students, and outside guests.

Prerequisites: Upper division standing.

Terms Typically Offered: Fall, Spring.

Course may be taken 4 times for credit.

PHYS 495 Independent Study 1-3 Credits

Course may be taken multiple times up to maximum of 6 credit hours.

PHYS 496 Topics 1-3 Credits

Course may be taken multiple times up to maximum of 15 credit hours.

PHYS 596 Topics: 1-3 Credits

Course may be taken multiple times up to maximum of 15 credit hours.