

PHYSICS (PHYS)

undefined

PHYS Courses

PHYS 100. Introduction to the Physics Major. 1 unit

Term Typically Offered: F

CR/NC

Introduction to the skills, tools, and habits-of-mind physicists use to approach and investigate physical phenomena. Exploration of possible careers for physics majors and issues of diversity and representation in physics. Includes community building activities. Designed for new physics majors. 1 activity. Credit/No credit grading only.

PHYS 104. Introductory Physics. 4 units

Term Typically Offered: F

2020-21 or later catalog: GE Area B1

2019-20 or earlier catalog: GE Area B3

Prerequisite: Appropriate Math Placement Level; or MATH 115; or MATH 116; or MATH 118.

Elementary introduction to mechanics, gases, liquids and solids, heat, vibrations and waves, light, electricity and magnetism. Intended to provide non-science students with an understanding of basic physical concepts. Not open to students who have credit in a college physics course. 4 lectures. Fulfills GE Area B1 (GE Area B3 for students on the 2019-20 or earlier catalogs).

PHYS 111. Contemporary Physics for Nonscientists. 4 units

Term Typically Offered: F

2020-21 or later catalog: GE Area B1

2019-20 or earlier catalog: GE Area B3

Qualitative exploration of the key concepts of quantum mechanics and Einstein's special and general theories of relativity. Particle-wave duality, Heisenberg's uncertainty principle, Schrodinger's cat, warped spacetime, black holes. 4 lectures. Not open to students with credit in PHYS 211. Fulfills GE Area B1 (GE Area B3 for students on the 2019-20 or earlier catalogs).

PHYS 121. College Physics I. 4 units

Term Typically Offered: F,W,SP,SU

2020-21 or later catalog: GE Area B1

2019-20 or earlier catalog: GE Area B3

Prerequisite: Appropriate Math Placement Level; or MATH 118 and high school trigonometry; or MATH 119.

Introductory course in mechanics emphasizing motion, force, and energy. Not open to students having a grade of C- or better in PHYS 141. Course may be offered in classroom-based or online format. 4 lectures. Fulfills GE Area B1 (GE Area B3 for students on the 2019-20 or earlier catalogs).

PHYS 122. College Physics II. 4 units

Term Typically Offered: F,W,SP,SU

2020-21 or later catalog: GE Area B1

2020-21 or later catalog: GE Area B3

2019-20 or earlier catalog: GE Area B3

2019-20 or earlier catalog: GE Area B4

Prerequisite: PHYS 121 or PHYS 141.

Continuation of PHYS 121. Topics include properties of materials, fluids, waves and vibrations, sound, heat, light and optics. Not open for credit to students having a grade of C- or better in PHYS 132. 3 lectures, 1 laboratory. Fulfills GE Areas B1 and B3 (GE Areas B3 and B4 for students on the 2019-20 or earlier catalogs).

PHYS 123. College Physics III. 4 units

Term Typically Offered: F, W, SP

Prerequisite: PHYS 118, PHYS 121, PHYS 131, or PHYS 141.

Recommended: PHYS 122.

Continuation of PHYS 121 and 122. Electrostatics, electric current, magnetic fields and induction. Elements of modern physics. Not open for credit to students having a grade of C- or better in PHYS 133 or PHYS 143. 3 lectures, 1 laboratory.

PHYS 125. College Physics I Laboratory. 1 unit

Term Typically Offered: F, W, SP

Prerequisite: Consent of the College of Science and Mathematics

Advising Center. Co-requisite: PHYS 121.

Laboratory experiments to complement introductory course in mechanics, emphasizing experiments on motion, force, and energy. Not open to students with a grade of C- or better in PHYS 131 or PHYS 141. 1 laboratory.

PHYS 141. General Physics I. 4 units

Term Typically Offered: F,W,SP,SU

2020-21 or later catalog: GE Area B1

2019-20 or earlier catalog: GE Area B3

Prerequisite: MATH 141 with grade C- or better. Corequisite: MATH 142 or MATH 182. Recommended: High School Physics.

Fundamental principles of mechanics. Vectors, particle kinematics. Equilibrium of a rigid body. Work and energy, linear momentum, rotational kinematics and dynamics. Primarily for engineering and science students. Course may be offered in classroom-based or online format. 4 lectures. Crosslisted as HNRS 134/PHYS 141. Fulfills GE Area B1 (GE Area B3 for students on the 2019-20 or earlier catalogs).

PHYS 142. General Physics II. 4 units

Term Typically Offered: F,W,SP,SU

2020-21 or later catalog: GE Area B1

2020-21 or later catalog: GE Area B3

2019-20 or earlier catalog: GE Area B3

2019-20 or earlier catalog: GE Area B4

Prerequisite: PHYS 141; and MATH 142 or MATH 182.

Oscillations, waves in elastic media, sound waves. Temperature, heat and the first law of thermodynamics. Kinetic theory of matter, second law of thermodynamics. Geometrical and physical optics. 3 lectures, 1 laboratory. Crosslisted as HNRS 132/PHYS 142. Fulfills GE Areas B1 and B3 (GE Areas B3 and B4 for students on the 2019-20 or earlier catalogs). Formerly PHYS 132.

PHYS 143. General Physics III. 4 units

Term Typically Offered: F,W,SP,SU
 2020-21 or later catalog: GE Area B1
 2020-21 or later catalog: GE Area B3
 2019-20 or earlier catalog: GE Area B3
 2019-20 or earlier catalog: GE Area B4
 Prerequisite: MATH 142 and PHYS 141. Recommended: MATH 241.

Charge and matter, electric field, electric potential, dielectrics, capacitance, current and resistance, electromotive force and circuits, magnetic fields, magnetic field of a moving charge, induced emf. 3 lectures, 1 laboratory. Fulfills GE Areas B1 and B3 (GE Areas B3 and B4 for students on the 2019-20 or earlier catalogs). Formerly PHYS 133.

PHYS 200. Special Problems for Undergraduates. 1-2 units

Term Typically Offered: F, W, SP
 Prerequisite: Consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

PHYS 202. Physics on the Computer. 4 units

Term Typically Offered: SP
 Prerequisite: PHYS 133 or PHYS 143; and MATH 241 or MATH 244.

Introduction to using computers for solving problems in physics: differential equations, matrix manipulations, simulations and numerical techniques, nonlinear dynamics. 4 lectures.

PHYS 206. Electronics and Instrumentation. 4 units

Term Typically Offered: W
 Prerequisite: PHYS 133 or PHYS 143 and MATH 143.

L-R-C circuits and electronic circuit elements emphasizing the applications of analog and digital electronics to instrumentation in modern physics. 3 lectures, 1 laboratory.

PHYS 211. Modern Physics I. 4 units

Term Typically Offered: F, W, SP
 Prerequisite: PHYS 132 or PHYS 142; PHYS 133 or PHYS 143; and MATH 241. Recommended: MATH 242 or MATH 244.

Special relativity, fundamental principles of quantum mechanics, emphasizing the modern description of atomic phenomena. Wave-particle duality, Bohr theory, Schroedinger equation, elementary atomic structure. Course may be offered in classroom-based or online format. 4 lectures.

PHYS 212. Modern Physics II. 4 units

Term Typically Offered: SP
 Prerequisite: PHYS 211.

Applications of quantum physics to atoms, molecules, solid state systems, nuclei, and elementary particles including angular momentum and spin. Topics may include applications of statistical mechanics, principles of the laser, cooling and trapping of atoms, Bose-Einstein condensates, semiconductors, superconductors, heavy ion physics, and other topics of current interest. 4 lectures.

PHYS 220. Introduction to Physics Research. 1 unit

Term Typically Offered: F
 CR/NC
 Prerequisite: PHYS 132 or PHYS 133 or PHYS 142 or PHYS 143.

Introduction to the research programs of faculty in the department and opportunities for research. Survey of departmental facilities and procedures related to research. Overview of external research programs/ internships. Credit/No Credit grading. 1 lecture.

PHYS 270. Selected Topics. 1-4 units

Term Typically Offered: TBD
 Prerequisite: Consent of instructor.

Directed group study of selected topics. The Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

PHYS 301. Thermal Physics I. 4 units

Term Typically Offered: W
 Prerequisite: PHYS 211.

Thermodynamics and statistical mechanics. Entropy, temperature, ensembles, partition functions, chemical potential, free energy. Selected applications including paramagnetism, ideal gas, Fermi-Dirac and Bose-Einstein distributions. 4 lectures.

PHYS 305. Classical Mechanics I. 4 units

Term Typically Offered: F
 2020-21 or later: Upper-Div GE Area B
 Prerequisite: Junior standing; completion of GE Area A with grades of C- or better; and one course in GE Area B4 with a grade of C- or better (GE Area B1 for students on the 2019-20 or earlier catalogs); PHYS 141; MATH 241; and MATH 242 or MATH 244.

Laws of motion, kinematics and dynamics of a particle. Oscillations. Work and energy. Linear and angular momentum. Lagrange's and Hamilton's equations and the calculus of variations. Newton's Law of gravity, Kepler's laws of orbital motion, and central force problems. Use of numerical methods for solving problems. Not open to students with credit in PHYS 302. 4 lectures. Fulfills GE Area Upper-Division B (GE Areas B5, B6, or B7 for students on the 2019-20 catalog).

PHYS 306. Classical Mechanics II. 3 units

Term Typically Offered: W
 Prerequisite: PHYS 305.

Mechanics in non-inertial reference frames. Dynamics of a rigid bodies. Coupled oscillators and normal modes. Use of numerical methods for solving problems. 3 lectures. Formerly PHYS 303.

PHYS 310. Physics of Energy. 3 units

Term Typically Offered: SP
 Sustainability Focused
 Prerequisite: PHYS 132 or PHYS 142.

Physics and mathematics applied to broad energy topics. Efficient usage, transportation, solar energy, nuclear fission and fusion. Plasma, hydrogen economy, fuel cells, wind wave, tidal, and geothermal energy. Transmission, storage, fossils. National planning, and energy economics. 3 lectures.

PHYS 313. Introduction to Atmospheric Physics. 3 units

Term Typically Offered: SP

Prerequisite: PHYS 132 or PHYS 142 or PHYS 122, and MATH 241.

Recommended: MATH 304.

Properties of the atmosphere, atmospheric motions, solar and terrestrial radiation. Emphasis on conservation laws of momentum, energy and mass applied to understanding the Earth's atmospheric motions. 3 lectures.

PHYS 314. Ocean Dynamics. 3 units

Term Typically Offered: SP

Sustainability Focused

Prerequisite: PHYS 122 or PHYS 132 or PHYS 142; and MATH 241.

Recommended: MATH 304 or PHYS 320.

Physics governing ocean circulation and transport processes. Physical environment, dynamics of fluid motion in the presence of rotation and stratification, balanced flows, heat budgets, ocean waves, mixing/transport, and applications to climate processes and the biological environment. 3 lectures.

PHYS 315. Lasers. 3 units

Term Typically Offered: SP

Prerequisite: PHYS 211 and MATH 143.

Interaction of light with matter, theory of laser action, characteristics and modification of laser output, types of lasers. Laser applications. Topics may include interferometry, fiber optics, holography. 3 lectures.

PHYS 318. Special Theory of Relativity. 3 units

Term Typically Offered: W

Prerequisite: PHYS 211.

Fundamental experiments and basic postulates of special relativity. Simultaneity, length and time measurements. Lorentz transformations. Four-Vectors. Space-time diagrams. Relativistic mechanics and electromagnetism. 3 lectures.

PHYS 320. Methods of Theoretical Physics I. 4 units

Term Typically Offered: F

Prerequisite: PHYS 211; MATH 242 or MATH 244; and Physics major.

Introduction to the mathematical techniques of theoretical physics with applications from classical mechanics, optics, electromagnetism and quantum mechanics. Maxwell's equations and vector calculus. Waves, the wave equation and Fourier analysis. Green's functions. Physics applications of complex contour integration and series. Not open to students with credit in PHYS 322 or PHYS 424. 4 lectures.

PHYS 321. Methods of Theoretical Physics II. 4 units

Term Typically Offered: W

Prerequisite: PHYS 320; and Physics major.

Continuing study of the mathematical techniques of theoretical physics. Methods for solving differential equations in classical mechanics, electromagnetism and quantum mechanics. Problems involving the heat equation, the wave equation and the Schrodinger equation in one, two and three dimensions. 4 lectures.

PHYS 323. Optics. 4 units

Term Typically Offered: W

Prerequisite: MATH 241; PHYS 133 or PHYS 143; and one of the following: PHYS 320, PHYS 322, EE 228, EE 201, or ME 318.

Ray optics, lens systems, optical instruments, wave optics, and polarization of light. 3 lectures, 1 laboratory.

PHYS 330. Teaching Physics. 4 units

Term Typically Offered: SP

Prerequisite: one of the following: PHYS 122, PHYS 123, PHYS 132, PHYS 133, PHYS 142, PHYS 143, PSC 102, or PSC 103.

Inquiry approaches to teaching physics incorporating insights from physics education research and the use of computer technology. Emphasis on pedagogical approaches and assessment that engage learners in scientific discourse and the development of basic models of physics phenomena such as motion, forces, energy, and momentum through experimentation. 2 lectures, 2 activities.

PHYS 340. Quantum Physics Laboratory I. 2 units

Term Typically Offered: F

Prerequisite: PHYS 206; PHYS 212; and one of the following: PHYS 202, CSC 101, CSC 231, or CSC 234.

Experimental studies of the quantum properties of atoms and nuclei. Measurements of fundamental constants. Statistics and data analysis. 1 lecture, 1 laboratory.

PHYS 341. Quantum Physics Laboratory II. 2 units

Term Typically Offered: W

Prerequisite: PHYS 340.

Experimental studies of quantum properties of atoms and nuclei. Interactions of radiation, particles and fields. 2 laboratories.

PHYS 342. Quantum Physics Laboratory III. 1 unit

Term Typically Offered: SP

Prerequisite: PHYS 341.

Advanced experimental studies of quantum properties of atoms and nuclei. Interactions of radiation, particles and fields emphasizing spectroscopic techniques. 1 laboratory.

PHYS 345. Quantum Computing. 4 units

Term Typically Offered: SP

Prerequisites: MATH 206 or MATH 244; and CHEM 353 or PHYS 211.

Quantum mechanical wave functions. Principle of superposition and entanglement. States of one or more quantum bits. Quantum gates and circuits. Application of quantum gates on simulators and quantum computers. Quantum computer architectures. Quantum algorithms. Ethics of quantum computing. 3 lectures, 1 activity. Crosslisted as CPE/PHYS 345.

PHYS 357. Advanced Instrumentation in Experimental Physics. 3 units

Term Typically Offered: SP

Prerequisite: PHYS 206.

Advanced analog and digital electronics, computer interfacing to experiments, robotics. 2 lectures, 1 laboratory.

PHYS 400. Special Problems for Advanced Undergraduates. 1-2 units

Term Typically Offered: F, W, SP

Prerequisite: Consent of department chair.

Individual investigations, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

PHYS 401. Thermal Physics II. 3 units

Term Typically Offered: SP

Prerequisite: PHYS 301.

Additional topics in thermodynamics and statistical physics, including chemical equilibrium, phase transitions, transport processes, and cryogenics. 3 lectures.

PHYS 403. Particle and Nuclear Physics. 3 units

Term Typically Offered: SP

Prerequisite: PHYS 212 and PHYS 405.

Elementary particles and their interactions, fundamental forces, the Standard Model of particle physics. Symmetries and conservation laws including parity, charge conjugation, and time reversal invariance, as well as charge-parity violation. Dirac equation, quantum electrodynamics, and Feynman diagrams. Advanced nuclear physics. Topics may include decays, symmetries of the quark model, neutrinos, nucleosynthesis, and the quark-gluon plasma. 3 lectures.

PHYS 404. Research Experience for Advanced Undergraduates. 1-2 units

Term Typically Offered: F, W, SP

CR/NC

Prerequisite: Consent of department chair.

Individual investigations, research, studies, or surveys of selected problems. Credit/No Credit grading only. Total credit limited to 4 units, with a maximum of 2 units per quarter.

PHYS 405. Quantum Mechanics I. 4 units

Term Typically Offered: SP

Prerequisite: PHYS 212; PHYS 302 or PHYS 305; PHYS 320 or PHYS 322; MATH 241; and MATH 242 or MATH 244. Recommended: MATH 344 or PHYS 321.

Wave nature of matter and the basic postulates of quantum mechanics. The wave function, operators, and their interpretation. Schrodinger's equation and its solutions in one and more dimensions. The hydrogen atom and the periodic table. 4 lectures.

PHYS 406. Quantum Mechanics II. 3 units

Term Typically Offered: F

Prerequisite: PHYS 405.

Angular momentum operators and problems in three dimensions including the hydrogen atom. Elements of matrix mechanics and properties of spin state vectors. Time-independent and time-dependent perturbation theory. Topics may include variational principle, WKB approximation. 3 lectures.

PHYS 408. Electromagnetic Fields and Waves I. 4 units

Term Typically Offered: F

Prerequisite: PHYS 133 or PHYS 143; and MATH 304 or PHYS 320.

Electric and magnetic field theory using vector analysis. Electric fields, dielectric materials, magnetic fields, induced emf, magnetic materials, Maxwell's equations, wave equation. 4 lectures.

PHYS 409. Electromagnetic Fields and Waves II. 3 units

Term Typically Offered: W

Prerequisite: PHYS 408. Recommended: PHYS 320 or PHYS 322.

Wave equation, plane electromagnetic waves, guided waves. Dipole radiation, radiation from an accelerated charge. Special relativity. 3 lectures.

PHYS 410. Physics of Solid Earth. 3 units

Term Typically Offered: W

Prerequisite: PHYS 133 or PHYS 143; MATH 241; and MATH 242 or MATH 244.

Gravity and the figure of the Earth. Body wave seismology, structure and composition of the Earth, heat flow and heat sources, Earth tides, rotational dynamics, the geomagnetic field and its source, paleomagnetism. 3 lectures.

PHYS 418. Introduction to General Relativity. 3 units

Term Typically Offered: SP

Prerequisite: PHYS 211; and PHYS 302 or PHYS 305.

Introduction to Einstein's theory of gravity: general relativity. Geometric description of special relativity as flat spacetime. Extension to curved spacetimes and description of gravity. Topics include solar system tests of relativity, black holes, gravitational waves, and applications to astronomy and cosmology. 3 lectures.

PHYS 422. Polymer Electronics Laboratory. 1 unit

Term Typically Offered: SP

Prerequisite: EE 347 or MATE 340 or CHEM 319 or PHYS 340.

Experimental procedures in polymer electronics. Investigation of the characteristics of a polymer electronic device. 1 laboratory. Crosslisted as EE/PHYS 422.

PHYS 423. Advanced Optics. 4 units

Term Typically Offered: SP

Prerequisite: PHYS 323.

Advanced topics of modern optics. May include: fiber optics, Fourier optics, quantum optics, lasers, holography, non-linear optics. 3 lectures, 1 laboratory.

PHYS 425. Solid State Physics. 3 units

Term Typically Offered: F

Prerequisite: PHYS 211; and MATH 242 or MATH 244.

Physics of solids including the structural, mechanical, thermal, and electronic properties, energy band theory and the properties of metals and semiconductors. 3 lectures.

PHYS 426. Solid State Physics Laboratory. 1 unit

Term Typically Offered: SP

Prerequisite or concurrent: PHYS 412 or PHYS 425.

Selected experiments on X-ray diffraction, Hall effect, optical absorption, thermo-electric effect, photovoltaic cells, diode characteristics, and superconductivity. 1 laboratory.

PHYS 427. Advanced Topics in Solid State Physics. 3 units

Term Typically Offered: SP
Prerequisite: PHYS 412 or PHYS 425.

Semiconducting devices, including junction and field-effect transistors, LED's, and diode lasers. Magnetic properties of solids. Superconductivity, including discussion of high-temperature superconductors. Other topics of current interest in solid state physics. 3 lectures. Formerly PHYS 413.

PHYS 428. Nonlinear Dynamical Systems. 4 units

Term Typically Offered: SP
Prerequisite: PHYS 122, PHYS 132, or PHYS 142; and PHYS 123, PHYS 133, or PHYS 143; and MATH 241; and MATH 242 or MATH 244.
Recommended: Junior standing.

Analysis of linear and nonlinear dynamical systems with emphasis on geometrical methods and visualization techniques. Fixed points, phase plane analysis, bifurcations and limit cycles. Laboratory component includes data acquisition and analysis using computers, numerical simulations of dynamical systems, and analysis of discrete systems. 3 lectures, 1 laboratory.

PHYS 461. Senior Project I. 2 units

Term Typically Offered: F,W,SP,SU
Prerequisite: Consent of instructor.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 60 hours total time.

PHYS 462. Senior Project II. 2 units

Term Typically Offered: F,W,SP,SU
Prerequisite: Consent of instructor.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 60 hours total time.

PHYS 470. Selected Advanced Topics. 1-4 units

Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

PHYS 471. Selected Advanced Laboratory. 1-4 units

Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 laboratories.

PHYS 485. Cooperative Education Experience. 6 units

Term Typically Offered: TBD
CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Total credit limited to 12 units; major credit limited to 2 units. Credit/No Credit grading only.

PHYS 495. Cooperative Education Experience. 12 units

Term Typically Offered: TBD
CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Total credit limited to 12 units; major credit limited to 2 units. Credit/No Credit grading only.