PHYSICS

http://physics.calpoly.edu/

The department provides a solid grounding in fundamental physics through theoretical courses in Classical and Modern Physics, Quantum Mechanics, Electromagnetism, and Statistical Mechanics. These are supported by a comprehensive laboratory program in experimental techniques and electronics and quantum physics. Required subjects are complemented by a wide range of elective courses including optics, particle/nuclear and solid-state physics, nonlinear dynamics, astronomy, and geophysics. Facilities include specialized laboratories in electrical measurements, optics, solid state physics, and nuclear and atomic physics. Majors are prepared to attend graduate school, work in technical fields, or pursue a teaching credential. Student activities include a chapter of the national Society of Physics Students and a chapter of the national physics honor society, Sigma Pi Sigma. All physics students are admitted under the BS Program. Beginning in the second quarter of enrollment students may elect to change to the BA program. Consult your academic advisor.

Undergraduate Programs

- Physics (BA) (https://catalog.calpoly.edu/science-mathematics/physics/physics-ba/)
- Physics (BS) (https://catalog.calpoly.edu/science-mathematics/physics/physics-bs/)

Undergraduate Minors

- Astronomy Minor (https://catalog.calpoly.edu/science-mathematics/physics/astronomy-minor/)
- Geology Minor (https://catalog.calpoly.edu/science-mathematics/physics/geology-minor/)
- Physics Minor (https://catalog.calpoly.edu/science-mathematics/physics/physics-minor/)

ASTR Courses

ASTR 1101 Introduction to the Solar System (3 units)
Term Typically Offered: F, SP, SU
2026-28 or later catalog: GE Area 5A
2020-26 catalogs: GE Area B1

Descriptive astronomical properties of the Earth, Moon, other planets and their satellites. Comets, asteroids and other members of the Solar System. Theories of the formation of the Solar System. Opportunities for astronomical observations. Intended for non-engineering and non-science majors. Not open to students with credit in ASTR 301, ASTR 302, ASTR 326, ASTR 3301, or ASTR 3302. Course may be offered in classroom-based or online format. 3 lectures. Fulfills GE Area 5A (GE Area B1 for students on the 2020-26 catalogs). Formerly ASTR 101.

ASTR 1102 Introduction to Stars and Galaxies (3 units)
Term Typically Offered: F, SP, SU
2026-28 or later catalog: GE Area 5A
2020-26 catalogs: GE Area B1

Descriptive astronomical properties of the Sun, stars, galaxies and interstellar material. Expanding universe and cosmological models. Opportunities for astronomical observations. Intended for non-engineering and non-science majors. Not open to students with credit in ASTR 301, ASTR 302, ASTR 326, ASTR 3301, ASTR 3302, PHYS 141, PHYS 143, PHYS 1141, or PHYS 1143. Course may be offered in classroom-based or online format. 3 lectures. Fulfills GE Area 5A (GE Area B1 for students on the 2020-26 catalogs). Formerly ASTR 102.

ASTR 2200 Special Problems for Undergraduates (1-2 units)
Term Typically Offered: F, SP
Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Repeatable up to 4 units. Formerly ASTR 200.

ASTR 2270 Special Topics (1-3 units)
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group study of special topics. The Class Schedule will list topic selected. Repeatable up to 6 units. 1 to 3 lectures. Formerly ASTR 270.

ASTR 3301 Stars and Planetary Systems (3 units)
Term Typically Offered: F
Prerequisite: One of the following: PHYS 122, PHYS 132, PHYS 142, PHYS 1121, or PHYS 1141; and one of the following: MATH 121, MATH 141, MATH 1261, or DATA/MATH 1264.

Quantitative and descriptive properties of stars, the interstellar medium, planets, moons, and planetary systems. The Sun and the Solar System, planetary formation and exoplanets, and stellar atmospheres. The structure, formation, evolution, and death of stars. 3 lectures. Formerly ASTR 301.

ASTR 3302 Galaxies and Cosmology (3 units)
Term Typically Offered: SP
Prerequisite: ASTR 301 or ASTR 3301.

Quantitative and descriptive properties of the structure and evolution of galaxies. Introduction to modern cosmology from the Big Bang to the ultimate fate of the universe. Relativity, curvature of space, dark matter, cosmic microwave background, and open questions in cosmology. 3 lectures. Formerly ASTR 326.

ASTR 3324 Longitude, Navigation, and Timekeeping (3 units)
Term Typically Offered: SP
2026-28 or later: Upper-Div GE Area 2/5
2020-26 catalogs: Upper-Div GE Area B
Prerequisite: Junior standing; completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs); and completion of MATH 119, MATH 1005, or MATH 1007 with a grade of C- or better.

Evolution of navigational science from 1700 to today, covering the 'longitude problem' to the Global Positioning System. Emphasizes celestial navigation, timekeeping, and science, technology and mathematics to address a societal problem. 3 lectures. Fulfills GE Areas Upper-Division 2 or Upper-Division 5 (GE Area Upper-Division B for students on the 2020-26 catalogs). Formerly ASTR 324.

ASTR 4400 Special Problems for Advanced Undergraduates (1-2 units)
Term Typically Offered: F, SP
Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Repeatable up to 4 units. Formerly ASTR 400.

ASTR 4404 Research Experience for Advanced Undergraduates (1-2 units)
Term Typically Offered: F, SP
CR/NC
Prerequisite: Consent of instructor.

Individual investigations, research, studies, or surveys of selected problems. Credit/No Credit grading only. Repeatable up to 4 units. Formerly ASTR 404.

ASTR 4444 Observational Astronomy (4 units)
Term Typically Offered: F
Prerequisite: ASTR 301 or ASTR 302; or ASTR 3301.

Introduction to observational astronomy. Coordinate systems, telescopes and observational instruments (CCDs, filters, spectrographs), observational methods and techniques, data reduction and analysis. Laboratory activities include use of telescope, CCD camera for data acquisition, data reduction and analysis, and presentation of results. 3 lectures, 1 laboratory. Formerly ASTR 444.

ASTR 4470 Special Advanced Topics (1-3 units)
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group study of special topics for advanced students. The Class Schedule will list topic selected. Repeatable up to 6 units. 1 to 3 lectures. Formerly ASTR 470.

ASTR 4471 Special Advanced Laboratory (1-2 units)
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group laboratory study of special topics for advanced students. The Class Schedule will list topic selected. Repeatable up to 6 units. 1 to 2 laboratories. Formerly ASTR 471.

GEOL Courses

GEOL 2200 Special Problems for Undergraduates (1-2 units)
Term Typically Offered: F, SP
Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Repeatable up to 4 units. Formerly GEOL 200.

GEOL 2203 The Geologic Record: Fossils and the History of Life (3 units)
Term Typically Offered: F
2026-28 or later catalog: GE Area 5A
2020-26 catalogs: GE Area B1

A historical account of life on Earth interpreted from the fossil record. Paleoenvironmental controls on the rise and decline of lineages of organisms deduced from stratigraphy, and from the composition, character, and geochemistry of sedimentary rocks. Identification of fossils. 2 lectures, 1 discussion. Fulfills GE Area 5A (GE Area B1 for students on the 2020-26 catalogs). Formerly GEOL 203.

GEOL 2206 Geologic Excursions (1 unit)
Term Typically Offered: F, SP
CR/NC

Field trips to places of geologic interest. Students must provide their own transportation, food, and camping equipment. Field trip required. Credit/No Credit grading only. 1 laboratory. Formerly GEOL 206.

GEOL 2240 Physical Geology (3 units)
Term Typically Offered: F, SP
Prerequisite: MATH 118, MATH 119, or MATH 1007.

Processes responsible for the Earth's minerals, rocks, structural, and surface features. Volcanism, mountain building, plate tectonics, and weathering. Erosion and deposition by streams, glaciers, wind, and waves. Geological resources, earth hazards, and interaction of man with global processes. 2 lectures, 1 discussion. Formerly GEOL 201.

GEOL 2241 Physical Geology Laboratory (1 unit)
Term Typically Offered: F, SP
Corequisite: GEOL 201 or GEOL 2240.

Properties and identification of minerals and rocks. Topographic maps and landform analysis. Geologic maps and interpretation of rock structure. Field trip required. 1 laboratory. Formerly GEOL 241.

GEOL 2270 Special Topics (1-3 units)
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group study of special topics. The Class Schedule will list topic selected. Repeatable up to 6 units. 1 to 3 lectures. Formerly GEOL 270.

GEOL 3301 Computation in the Geosciences: Time Series and Statistical Methods (3 units)
Term Typically Offered: F
Prerequisite: GEOL 301 or GEOL 2240; PHYS 141 or PHYS 1141; one of the following: MATH 143, MATH 121, MATH 1262, MATH 1263, or DATA/MATH 1264; and one of the following: STAT 217, STAT 218, STAT 301, STAT 312, STAT 321, STAT 1110, STAT 1510, or STAT 3210.

Introduction to scientific programming, frequency domain analysis of sampled data, statistical description and analysis, and physical models in the geosciences. Content drawn from geodynamics, environmental geology, geochemistry, and hydrology. 2 lectures, 1 laboratory. Formerly GEOL 303.

GEOL 3305 Seismology and Earth Structure (3 units)
Term Typically Offered: SP
Prerequisite: GEOL 303 or GEOL 3301; or PHYS 141 or PHYS 1141 and one of the following: MATH 242, MATH 244, MATH 2341, or MATH 2343.

Elastic wave propagation in layered media. Inference of structure and composition of the Earth with special emphasis on crustal structure. Magnitude calculation. Earthquake source mechanics applied to problems in tectonics. Major California faults and paleoseismology. Field trip required. 2 lectures, 1 laboratory.

GEOL 3310 Igneous and Metamorphic Petrology (4 units)
Term Typically Offered: F
Prerequisite: GEOL 201 or GEOL 2240; and GEOL 241 or GEOL 2241.

Characterization and genesis of igneous and metamorphic minerals, textures and fabrics. Processes associated with igneous melt generation, evolution and crystallization. Principles of metamorphic reactions in rocks with different initial compositions. Special attention to relationships with tectonic settings. Field trip required. 3 lectures, 1 laboratory. Formerly GEOL 309.

GEOL 3330 Principles of Stratigraphy (3 units)
Term Typically Offered: SP
Prerequisite: GEOL 201 or GEOL 2240; and GEOL 241 or GEOL 2241.

Description and analysis of stratified rock and sediment. Sedimentology, diagenesis, transgressive/regressive sequences, bedform interpretation, marine and terrestrial sediment and sedimentary-rock sequence interpretation, and sequence stratigraphy. Field trip required. 2 lectures, 1 laboratory. Formerly GEOL 330.

GEOL 4400 Special Problems for Advanced Undergraduates (1-2 units)
Term Typically Offered: F, SP
Prerequisite: Consent of instructor.

Individual investigations, research, studies, or surveys of selected problems. Repeatable up to 4 units. Formerly GEOL 400.

GEOL 4404 Research Experience for Advanced Undergraduates (1-2 units)
Term Typically Offered: F, SP
CR/NC
Prerequisite: Consent of instructor.

Individual investigations, research, studies, or surveys of selected problems. Credit/No Credit grading only. Repeatable up to 4 units. Formerly GEOL 404.

GEOL 4415 Structural Geology (3 units)
Term Typically Offered: F
Prerequisite: GEOL 309 or GEOL 3310.

Methods for the representation and quantification of stress in the Earth's lithosphere. Recognition, depiction and interpretation of geologic structures including faults, folds, and foliation, and their relationship to different tectonic settings. Field trip required. 2 lectures, 1 laboratory. Formerly GEOL 415.

GEOL 4417 Field Geology Methods and Mapping (5 units)
Term Typically Offered: SP
Prerequisite: GEOL 330 or GEOL 3330; and GEOL 415 or GEOL 4415.

Collecting and interpreting geologic field data. Structural, bedrock, and surficial geology mapping on topographic maps. Igneous rock fabrics. Description of sedimentary rocks. Construction of stratigraphic columns. Reconstructing geologic events and processes. Communication and interpretation of field results. Field trip required. 2 lecture, 3 activities. Formerly GEOL 417.

GEOL 4420 Field Geophysics (3 units)
Term Typically Offered: F
Prerequisite: GEOL 201 or GEOL 2240; and one of the following: PHYS 121, PHYS 141, PHYS 1121 or PHYS 1141.

Geophysical exploration of the shallow subsurface: seismic refraction, seismic reflection, and electrical resistivity methods. Application of near-surface geophysical data to determination of geological structure, hydrogeology, and mineral resources. Field trip required. 2 lectures, 1 laboratory. Formerly GEOL 420.

GEOL 4470 Special Advanced Topics (1-3 units)
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group study of special topics for advanced students. The Class Schedule will list topic selected. Repeatable up to 6 units. 1 to 3 lectures. Formerly GEOL 470.

GEOL 4471 Special Advanced Laboratory (1-3 units)
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group laboratory study of special topics for advanced students. The Class Schedule will list topic selected. Repeatable up to 6 units. 1 to 3 laboratories. Formerly GEOL 471.

PHY Courses

PHY 1100 General Physics I (3 units)
Term Typically Offered: F, SP
2026-28 or later catalog: GE Area 5A
2020-26 catalogs: GE Area B1
Prerequisite: MTH 100 or MTH 1100. Concurrent: PHY 100L or PHY 1100L.

Offered at Solano Campus. Vectors and scalars, Newton's laws, statics and dynamics, translational and rotational kinematics, rotational dynamics, work and energy, momentum, conservation principles, equilibrium and elasticity, gravitation, periodic motion and, fluids and buoyancy. 3 lectures. Fulfills GE Area 5A (GE Area B1 for students on the 2020-26 catalogs). Formerly PHY 100 at Cal Maritime.

PHY 1100L General Physics I Laboratory (1 unit)
Term Typically Offered: F, SP
2026-28 or later catalog: GE Area 5C
2020-26 catalogs: GE Area B3
Prerequisite: MTH 100 or MTH 1100. Concurrent: PHY 100 or PHY 1100.

Offered at Solano Campus. Explores fundamental principles of kinematics, dynamics, work and energy, momentum, gravitation, simple harmonic motion, and other concepts studied in PHY 100 through experimentation. 1 laboratory. Fulfills GE Area 5C (GE Area B3 for students on the 2020-26 catalogs). Formerly PHY 100L at Cal Maritime.

PHY 1105 General Physics II (3 units)
Term Typically Offered: SP
2026-28 or later catalog: GE Area 5A
2020-26 catalogs: GE Area B1
Prerequisite: PHY 100 or PHY 1100. Concurrent: PHY 105L or PHY 1105L.

Offered at Solano Campus. Fundamental principles of electrostatics, direct and alternating currents, electromagnetism, optics, electromagnetic waves, and quantum physics. 3 lectures. Fulfills GE Area 5A (GE Area B1 for students on the 2020-26 catalogs). Formerly PHY 105 at Cal Maritime.

PHY 1105L General Physics II Laboratory (1 unit)
Term Typically Offered: SP
2026-28 or later catalog: GE Area 5C
2020-26 catalogs: GE Area B3
Prerequisite: PHY 100 or PHY 1100; and PHY 100L or PHY 1100L. Concurrent: PHY 105 or PHY 1105.

Offered at Solano Campus. Explores fundamental principles of electrostatics, direct and alternating currents, electromagnetism, optics, electromagnetic waves, and quantum physics through experiments. Experiments correspond to the theory learned in General Physics II. 1 laboratory. Fulfills GE Area 5C (GE Area B3 for students on the 2020-26 catalogs). Formerly PHY 105L at Cal Maritime.

PHY 1120 Physics for Future Leaders (3 units)
Term Typically Offered: SP
2026-28 or later catalog: GE Area 5A
2020-26 catalogs: GE Area B1

Offered at Solano Campus. Intended primarily for nonscientists, covers topics relevant to leaders, policy makers, and citizens confronted with science and technology issues. Energy production and utilization. Atoms and heat. Radioactivity and nuclear reactions. Nuclear bombs. Light and radio waves for communication and navigation. Climate change. Quantum physics. 3 lectures. Fulfills GE Area 5A (GE Area B1 for students on the 2020-26 catalogs). Formerly PHY 120 at Cal Maritime.

PHY 1120L Physics for Future Leaders Laboratory (1 unit)
Term Typically Offered: SP
2026-28 or later catalog: GE Area 5C
2020-26 catalogs: GE Area B3
Corequisite: PHY 120 or PHY 1120.

Offered at Solano Campus. Laboratory that is paired with the lecture series Physics for Future Leaders. Intended primarily for nonscientists, covers topics relevant to leaders, policy makers, and citizens confronted with science and technology issues. Energy production and utilization. Atoms and heat. Radioactivity and nuclear reactions. Nuclear bombs. Light and radio waves for communication and navigation. Climate change. Quantum physics. 1 laboratory. Fulfills GE Area 5C (GE Area B3 for students on the 2020-26 catalogs). Formerly PHY 120L at Cal Maritime.

PHY 2200 Engineering Physics I (3 units)
Term Typically Offered: F, SP
2026-28 or later catalog: GE Area 5A
2020-26 catalogs: GE Area B1
Prerequisite: MTH 210 or MTH 2210. Concurrent: PHY 200L or PHY 2200L.

Offered at Solano Campus. Vectors and scalars, motion, Newton's laws, statics and dynamics, translational and rotational kinematics, rotational dynamics, work and energy, momentum, conservation principles, equilibrium and elasticity, gravitation, periodic motion and fluid mechanics. 3 lectures. Fulfills GE Area 5A (GE Area B1 for students on the 2020-26 catalogs). Formerly PHY 200 at Cal Maritime.

PHY 2200L Engineering Physics I Laboratory (1 unit)
Term Typically Offered: F, SP
2026-28 or later catalog: GE Area 5C
2020-26 catalogs: GE Area B3
Prerequisite: MTH 210 or MTH 2210. Concurrent: PHY 200 or PHY 2200.

Offered at Solano Campus. Explores fundamental principles of kinematics, dynamics, work and energy, momentum, gravitation, simple harmonic motion, circular motion, and other subjects studied in Engineering Physics I through experimentation. 1 laboratory. Fulfills GE Area 5A (GE Area B1 for students on the 2020-26 catalogs). Formerly PHY 200L at Cal Maritime.

PHY 2205 Engineering Physics II (3 units)
Term Typically Offered: F, SP
2026-28 or later catalog: GE Area 5A
2020-26 catalogs: GE Area B1
Prerequisite: MTH 211 or MTH 2211; and PHY 200 or PHY 2200. Concurrent: PHY 205L or PHY 2205L.

Offered at Solano Campus. Electrostatics and electromagnetic fields and forces, electric potential, Gauss' law, capacitance, resistance and inductance, direct and alternating currents circuits and instruments, R-L-C exponential circuits, Faraday's and Lenz's laws, Ampere's law, and Maxwell's equations. 3 lectures. Fulfills GE Area 5A (GE Area B1 for students on the 2020-26 catalogs). Formerly PHY 205 at Cal Maritime.

PHY 2205L Engineering Physics II Laboratory (1 unit)
Term Typically Offered: F, SP
Prerequisite: MTH 211 or MTH 2211. Concurrent: PHY 205 or PHY 2205.

Offered at Solano Campus. Explores fundamental principles of electrostatics, direct and alternating currents circuits and instruments, electromagnetism, and other concepts studied in Engineering Physics II through experimentation. 1 laboratory. Formerly PHY 205L at Cal Maritime.

PHYS Courses

PHYS 1100 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 investigate physical phenomena. Exploration of possible careers and issues of diversity and representation in physics. Introduction to the research programs and opportunities in the department. Credit/No credit grading only. 1 activity. Formerly PHYS 100.

PHYS 1104 Introductory Physics (3 units)
Term Typically Offered: F
2026-28 or later catalog: GE Area 5A
2020-26 catalogs: GE Area B1
Prerequisite: Appropriate Math Placement; or one of the following: MATH 118, MATH 1004, or MATH 1006.

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. 3 lectures. Fulfills GE Area 5A (GE Area B1 for students on the 2020-26 catalogs). Formerly PHYS 104.

PHYS 1111 Contemporary Physics for Nonscientists (3 units)
Term Typically Offered: SP
2026-28 or later catalog: GE Area 5A
2020-26 catalogs: GE Area B1

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. Not open to students with credit in PHYS 211 or PHYS 2211. 3 lectures. Fulfills GE Area 5A (GE Area B1 for students on the 2020-26 catalogs). Formerly PHYS 111.

PHYS 1121 College Physics I (4 units)
Term Typically Offered: F, SP, SU
2026-28 or later catalog: GE Area 5A
2026-28 or later catalog: GE Area 5C
2020-26 catalogs: GE Area B1
2020-26 catalogs: GE Area B3
Prerequisite: Appropriate Math Placement; or one of the following: MATH 118, MATH 119, MATH 1006, or MATH 1007.

Introduction to mechanics emphasizing motion, force, energy, and fluids. Waves and vibrations, sound, thermodynamics, and heat. Not open to students with a grade of C- or better in PHYS 141 or PHYS 1141. 3 lectures, 1 laboratory. Fulfills GE Area 5A and 5C (GE Areas B1 and B3 for students on the 2020-26 catalogs). Formerly offered as part of the PHYS 121, 122, 123 series, students may not earn credit for both PHYS 121 and PHYS 1121.

PHYS 1123 College Physics II (4 units)
Term Typically Offered: F, SP, SU
Prerequisite: One of the following: PHYS 121, PHYS 122B, PHYS 141, PHYS 1121, or PHYS 1141.

Continuation of two course college physics series. Electrostatics, electric current, magnetic fields and induction. Light and optics. Elements of modern physics. Not open to students with a grade of C- or better in PHYS 143 or PHYS 1143. 3 lectures, 1 laboratory. Formerly offered as part of the PHYS 121, 122, 123 series, students may not earn credit for both PHYS 123 and PHYS 1123.

PHYS 1141 General Physics I (4 units)
Term Typically Offered: F, SP, SU
2026-28 or later catalog: GE Area 5A
2026-28 or later catalog: GE Area 5C
2020-26 catalogs: GE Area B1
2020-26 catalogs: GE Area B3
Corequisite: MATH 141 or MATH 1261.

Fundamental principles of mechanics. 1D and 2D particle kinematics and vectors. Newton's laws. Work and energy, and momentum. Equilibrium of a rigid body, rotational kinematics and dynamics. Simple harmonic motion. Gravitation. Kinetic theory and laws of thermodynamics. Primarily for engineering and science students. 3 lectures, 1 laboratory. Crosslisted as HNRS/PHYS 1141. Fulfills GE Areas 5A and 5C (GE Areas B1 and B3 for students on the 2020-26 catalogs). Formerly offered as part of the PHYS 141, 142, 143 series, students may not earn credit for both PHYS 141 and PHYS 1141.

PHYS 1143 General Physics II (4 units)
Term Typically Offered: F, SP, SU
2026-28 or later catalog: GE Area 5A
2026-28 or later catalog: GE Area 5C
2020-26 catalogs: GE Area B1
2020-26 catalogs: GE Area B3
Prerequisite: PHYS 142C or PHYS 1141. Corequisite: MATH 143 or MATH 1262.

Wave optics, geometrical optics, lenses, mirrors, and optical instruments. Charge and matter, electric force, field and potential, capacitance. Current and resistance, circuits, magnetic field and force, induced emf, Maxwell's equations, and AC circuits. 3 lectures, 1 laboratory. Crosslisted as HNRS/PHYS 1143. Fulfills GE Areas 5A and 5C (GE Areas B1 and B3 for students on the 2020-26 catalogs). Formerly offered as part of the PHYS 141, 142, 143 series, students may not earn credit for both PHYS 143 and PHYS 1143.

PHYS 2200 Special Problems for Undergraduates (1-2 units)
Term Typically Offered: F, SP
Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Repeatable up to 4 units. Formerly PHYS 200.

PHYS 2211 General Physics III: Modern Physics (4 units)
Term Typically Offered: F, SP
Prerequisite: PHYS 143, PHYS 143C, or PHYS 1143; and MATH 241 or MATH 2263. Recommended: One of the following: MATH 242, MATH 244, MATH 2341, or MATH 2343.

Introduction to modern physics. Special relativity, quantum mechanics, and statistical mechanics. Application to atoms, molecules, crystalline solids, nuclei, and elementary particles. 4 lectures. Formerly PHYS 211.

PHYS 2270 Special Topics (1-3 units)
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group study of special topics. The Class Schedule will list topic selected. Repeatable up to 6 units. 1 to 3 lectures. Formerly PHYS 270.

PHYS 3301 Statistical Mechanics (3 units)
Term Typically Offered: F, SP
Prerequisite: PHYS 211 or PHYS 2211; and MATH 143 or MATH 1262. Recommended: CSC 101, CSC 1001, or other programming experience.

Introduction to statistical mechanics and thermodynamics. Entropy, temperature, ensembles, partition functions, chemical potential, free energy. Applications include paramagnetism, ideal gas, Fermi-Dirac and Bose-Einstein distributions. 3 lectures. Formerly PHYS 301.

PHYS 3305 Classical Mechanics I (3 units)
Term Typically Offered: F, SP
2026-28 or later: Upper-Div GE Area 2/5
2020-26 catalogs: Upper-Div GE Area B
Prerequisite: Junior standing; completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs); completion of GE Area 2 with a grade of C- or better (GE Area B4 for the 2020-26 catalogs); MATH 242, MATH 244, MATH 2341, or MATH 2343; and PHYS 141 or PHYS 1141.

Laws of motion, kinematics and dynamics of a particle. Oscillations. Work and energy. Linear and angular momentum. Lagrange's and Hamilton's equations. Kepler's laws of orbital motion and central force problems. Use of numerical methods for solving problems. 3 lectures. Fulfills GE Areas Upper-Division 2 or Upper-Division 5 (GE Area Upper-Division B for students on the 2020-26 catalogs). Formerly PHYS 305.

PHYS 3306 Classical Mechanics II (3 units)
Term Typically Offered: SP
Prerequisite: PHYS 305 or PHYS 3305.

Mechanics in non-inertial reference frames. Dynamics of rigid bodies. Coupled oscillators and normal modes. Nonlinear Mechanics and Chaos. Collision Theory and Continuum Mechanics. Use of numerical methods for solving problems. 3 lectures. Formerly PHYS 306.

PHYS 3310 Physics of Energy (2 units)
Term Typically Offered: F
Sustainability Related
Prerequisite: PHYS 143, PHYS 143C, or PHYS 1143.

Physics and mathematics applied to broad energy concepts and interplay of these technologies with society and government policy. Efficient usage, transportation, transmission, storage, planning and public policy. Concepts may include fossil fuels, solar, nuclear fission and fusion, fuel cells, wind, wave, tidal, and geothermal energy. 2 lectures. Formerly PHYS 310.

PHYS 3314 Ocean Dynamics (3 units)
Term Typically Offered: SP
Sustainability Focused
Prerequisite: One of the following: PHYS 123, PHYS 123C, PHYS 143, PHYS 143C, PHYS 1123, or PHYS 1143; and MATH 241 or MATH 2263. Recommended: One of the following: MATH 242, MATH 244, MATH 2341, or MATH 2343.

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 and turbulence, and applications to climate processes and the biological environment. 3 lectures. Formerly PHYS 314.

PHYS 3315 Lasers (2 units)
Term Typically Offered: F
Prerequisite: PHYS 211 or PHYS 2211.

Interaction of light with matter, theory of laser action, laser beam characteristics, continuous and pulsed output, types of lasers. Laser applications that may include interferometry, fiber optics, pulsed laser applications, atom trapping, nonlinear optics. 2 lectures. Formerly PHYS 315.

PHYS 3316 Instrumentation and Techniques of Experimental Physics (4 units)
Term Typically Offered: F
Prerequisite: CSC 101 or CSC 1001; and PHYS 143, PHYS 143C, or PHYS 1143.

Statistical data analysis. Introduction to laboratory test and measurement equipment. Basic analog and digital electronic circuits emphasizing applications in experimental physics. Computer based data acquisition, data analysis and control. 3 lectures, 1 laboratory. Replaced PHYS 206.

PHYS 3320 Methods of Theoretical Physics (4 units)
Term Typically Offered: F, SP
Prerequisite: Physics majors; PHYS 211 or PHYS 2211; and one of the following: MATH 244, MATH 2341, MATH 242, or MATH 2343.

Mathematical techniques of theoretical physics with applications from classical mechanics, optics, electromagnetism, and quantum mechanics. Maxwell's equations and vector calculus. Fourier analysis. Series solutions. Partial differential equations with problems involving the heat equation, the wave equation, and the Schroedinger equation. 4 lectures. Formerly PHYS 320.

PHYS 3323 Optics (4 units)
Term Typically Offered: SP
Prerequisite: MATH 241 or MATH 2263; PHYS 143, PHYS 143C, or PHYS 1143; and one of the following: PHYS 320, PHYS 3320, EE 2328, EE 201, EE 2201, ME 318, or ME 3318.

Ray optics, lens systems, optical instruments, wave optics, interference, diffraction, polarization of light, wave propagation in media and at interfaces, waveguides, optical fiber. 3 lectures, 1 laboratory. Formerly PHYS 323.

PHYS 3330 Teaching Physics (2 units)
Term Typically Offered: SP
Prerequisite: One of the following: PHYS 123, PHYS 123C, PHYS 1123, PHYS 143, PHYS 143C, PHYS 1143, PSC 103, or PSC 1102.

Inquiry approaches to teaching physics incorporating insights from physics education research and computer technology. Pedagogical approaches and assessment that engages learners in scientific discourse and development of basic models of physics phenomena such as motion, forces, energy, and momentum through experimentation. 1 lectures, 1 activity. Formerly PHYS 330.

PHYS 3339 Communicating Physics (1 unit)
Term Typically Offered: SP
GWR
Prerequisite: Junior standing and completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs). Concurrent: PHYS 3340.

Communication techniques for physics. Critical study of scientific literature, creation of lab reports, oral presentations, posters, outreach, with peer-review. 1 activity. Fulfills GWR.

PHYS 3340 Quantum Physics Laboratory I (1 unit)
Term Typically Offered: SP
Prerequisite: PHYS 206 or PHYS 3316; and PHYS 211 or PHYS 2211. Concurrent: PHYS 3339.

Experimental studies of quantum properties of atoms and nuclei. Measurements of fundamental constants. Use of modern laboratory instruments in physical measurements. Overview of skills needed in a working physics laboratory. Rigorous computer-based statistical and error analysis of data. 1 laboratory. Formerly PHYS 340.

PHYS 3341 Quantum Physics Laboratory II (1 unit)
Term Typically Offered: F
Prerequisite: PHYS 340; or PHYS 3339 and PHYS 3340.

Second semester of the advanced lab experience. Advanced experimental physics techniques, instrumentation, data acquisition and analysis. Quantum experimental studies of atoms, molecules and nuclei, and their interactions with light, other forms of radiation, and static electric and magnetic fields. 1 laboratory. Formerly PHYS 341.

PHYS 3345 Quantum Computing (3 units)
Term Typically Offered: SP
Prerequisite: One of the following: MATH 206, MATH 244, MATH 1151, or MATH 2341; and one of the following: CHEM 353, CHEM 3392, PHYS 211, or PHYS 2211.

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. 2 lectures, 1 activity. Crosslisted as CPE/PHYS 3345. Formerly CPE/PHYS 345.

PHYS 4202 Computational Physics (4 units)
Term Typically Offered: F
Prerequisite: CSC 101 or CSC 1001; and one of the following: MATH 242, MATH 244, MATH 2341, or MATH 2343.

Applications of computational methods in physics. Concepts may include data selection and feature extraction with machine learning, finite difference methods in calculus, Monte-Carlo simulations, and spectral methods. 2 lectures, 2 activities.

PHYS 4400 Special Problems for Advanced Undergraduates (1-2 units)
Term Typically Offered: F, SP
Prerequisite: Consent of instructor.

Individual investigations, research, studies, or surveys of selected problems. Repeatable up to 4 units. Formerly PHYS 400.

PHYS 4403 Particle and Nuclear Physics (3 units)
Term Typically Offered: F
Prerequisite: PHYS 211 or PHYS 2211; and one of the following: MATH 242, MATH 244, MATH 2341, or MATH 2343. Recommended: CSC 101, CSC 1001, or other programming experience.

Comprehensive exploration of particle and nuclear physics, including the Standard Model, neutrinos, heavy ion collisions, and nuclear structure and reactions. Instructors may choose to emphasize theoretical and/or experimental treatments of contemporary research concepts. 2 lectures, 1 activity. Formerly PHYS 403.

PHYS 4404 Research Experience for Advanced Undergraduates (1-2 units)
Term Typically Offered: F, SP
CR/NC
Prerequisite: Consent of instructor.

Individual investigations, research, studies, or surveys of selected problems. Repeatable up to 4 units. Credit/No Credit grading only. Formerly PHYS 404.

PHYS 4405 Quantum Mechanics I (3 units)
Term Typically Offered: F, SP
Prerequisite: PHYS 305 or PHYS 3305; and PHYS 320 or PHYS 3320.

The postulates and interpretation of quantum mechanics. Wave functions. The Schroedinger equation and its solutions in one and more dimensions. The hydrogen atom. Discrete problems, including spin. 3 lectures. Formerly PHYS 405.

PHYS 4406 Quantum Mechanics II (3 units)
Term Typically Offered: SP
Prerequisite: PHYS 405 or PHYS 4405.

Symmetries and conservation laws. Time-independent and time-dependent perturbation theory. Variational principle and WKB approximation. Scattering and the Born approximation. Quantum dynamics. 3 lectures. Formerly PHYS 406.

PHYS 4408 Electromagnetic Fields and Waves I (3 units)
Term Typically Offered: F, SP
Prerequisite: PHYS 320 or PHYS 3320.

Electric and magnetic field theory using vector analysis. Electric fields, dielectric materials, magnetic fields, magnetic materials. Induced emf, Maxwell's equations, wave equation, plane electromagnetic waves. 3 lectures. Formerly PHYS 408.

PHYS 4409 Electromagnetic Fields and Waves II (3 units)
Term Typically Offered: F
Prerequisite: PHYS 408 or PHYS 4408.

Wave equation, plane electromagnetic waves, guided waves. Dipole radiation, radiation from an accelerated charge. Special relativity. 3 lectures. Formerly PHYS 409.

PHYS 4410 Physics of Solid Earth (3 units)
Term Typically Offered: SP
Prerequisite: PHYS 143, PHYS 143C, or PHYS 1143; MATH 241 or MATH 2263; and one of the following: MATH 242, MATH 244, MATH 2341, or MATH 2343.

Methods of body wave seismology applied to determination of interior structure and composition of the Earth. Planetary seismology. The geomagnetic field and its source. Application of earthquake seismology, paleomagnetism, heat flow, and gravity to plate tectonics and geodynamics. 3 lectures. Formerly PHYS 410.

PHYS 4418 Introduction to Special and General Relativity (3 units)
Term Typically Offered: SP
Prerequisite: PHYS 211 or PHYS 2211; and PHYS 305 or PHYS 3305.

Introduction to the theory of special and general relativity. Simultaneity, length and time measurements. Space-time diagrams. Lorentz transformations. Four-Vectors and Relativistic mechanics. Gravity as curved spacetime. Solar system tests of relativity. Black holes, gravitational waves, and cosmology. 3 lectures. Formerly PHYS 418.

PHYS 4425 Solid State Physics (4 units)
Term Typically Offered: SP
Prerequisite: One of the following: PHYS 211, PHYS 2211, CHEM 353, or CHEM 3392; and one of the following: MATH 242, MATH 244, MATH 2343, or MATH 2341.

Physics of solids including structural, mechanical, thermal, electronic, and magnetic properties, and additional selected concepts. Introduction to the description of electrons and phonons in crystalline solids, including the properties of metals, semiconductors, and superconductors. 3 lectures, 1 laboratory. Formerly PHYS 425.

PHYS 4428 Nonlinear Dynamics and Chaos (4 units)
Term Typically Offered: F
Prerequisite: PHYS 143, PHYS 143C, or PHYS 1143; MATH 241 or MATH 2263; and one of the following: MATH 242, MATH 244, MATH 2341, or MATH 2343. Recommended: Junior standing.

Analysis of linear and nonlinear dynamical systems with emphasis on geometrical methods and visualization techniques. Fixed points, phase plane analysis, bifurcations, limit cycles, chaos, and fractals. Laboratory component includes data acquisition and analysis, numerical simulations of dynamical systems, and analysis of discrete systems. Not open to students with credit in MATH 416 or MATH 4342. 3 lectures, 1 laboratory. Formerly PHYS 428.

PHYS 4461 Senior Project I (1-2 units)
Term Typically Offered: F, SP, SU
Prerequisite: Senior standing and consent of instructor.

Selection and completion of a project under faculty supervision. Projects typical of the type of topics graduates may encounter in graduate study or field of employment. Project results culminate in appropriate deliverable. Formerly PHYS 461.

PHYS 4462 Senior Project II (1-2 units)
Term Typically Offered: F, SP, SU
Prerequisite: PHYS 461 or PHYS 4461; and consent of instructor.

Continuation of project under faculty supervision. Projects typical of the type of topics graduates may encounter in graduate study or field of employment. Project results culminate in appropriate deliverable. Formerly PHYS 462.

PHYS 4470 Special Advanced Topics (1-3 units)
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group study of special topics for advanced students. The Class Schedule will list topic selected. Repeatable up to 6 units. 1 to 3 lectures. Formerly PHYS 470.

PHYS 4471 Special Advanced Laboratory (1-3 units)
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group laboratory study of special topics for advanced students. The Class Schedule will list topic selected. Repeatable up to 6 units. 1 to 3 laboratories. Formerly PHYS 471.

PSC Courses

PSC 1101 Physical Science for Elementary Educators I (4 units)
Term Typically Offered: F
2026-28 or later catalog: GE Area 5A
2026-28 or later catalog: GE Area 5C
2020-26 catalogs: GE Area B1
2020-26 catalogs: GE Area B3

Introduction to the basic principles of physical science, including observation, description, modeling, and the application of physical phenomena. Emphasis on interactions as described by energy, forces, and fields, as well as physical changes and chemical reactions, and the periodic table. 3 lectures, 1 laboratory. Fulfills GE Areas 5A and 5C (GE Areas B1 and B3 for students on the 2020-26 catalogs). Formerly PSC 101.

PSC 1102 Physical Science for Elementary Educators II (4 units)
Term Typically Offered: SP
Prerequisite: Liberal Studies major; and PSC 101 or PSC 1101.

Introduction to the basic principles of physical science with emphasis on Earth and space sciences. Waves, sound, and light. Structure and formation of Earth, earthquakes, weather, and oceanography. Naked eye astronomy, and the structure of the solar system. Field trip may be required. 3 lectures, 1 laboratory. Formerly PSC 103.

PSC 2201 Physical Oceanography (3 units)
Term Typically Offered: F, SP
2026-28 or later catalog: GE Area 5A
2020-26 catalogs: GE Area B1
Sustainability Related

Introduction to motions of the ocean. Physical environment and sea floor features. Seawater properties, atmosphere and ocean interactions, ocean currents and circulation. Waves and tides, the El Nino cycle, coastal ocean processes, climate change and ocean stressors, ocean resources and marine life. 3 lectures. Fulfills GE Area 5A (GE Area B1 for students on the 2020-26 catalogs). Formerly PSC 201.

PSC 3320 Energy, Society, and the Environment (3 units)
Term Typically Offered: SP
2026-28 or later: Upper-Div GE Area 2/5
2020-26 catalogs: Upper-Div GE Area B
Sustainability Focused
Prerequisite: Junior standing; completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs); and completion of GE Area 2 with a grade of C- or better (GE Area B4 for the 2020-26 catalogs).

Science and technology of current and future energy sources along with associated environmental problems and societal response. Energy production, consumption, efficient usage, fossil fuels, nuclear, solar, other renewables. Risks, benefits, planning, economics. 2 lectures, 1 activity. Fulfills GE Areas Upper-Division 2 or Upper-Division 5 (GE Area Upper-Division B for students on the 2020-26 catalogs). Formerly PSC 320.

PSC 3335 Physics of Music (3 units)
Term Typically Offered: F
2026-28 or later: Upper-Div GE Area 2/5
2020-26 catalogs: Upper-Div GE Area B
Prerequisite: Junior standing; completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs); and completion of GE Area 2 with a grade of C- or better (GE Area B4 for the 2020-26 catalogs).

Explores connections between science and music, highlighting the role of music in motivating and inspiring scientific progress. Physical principles of music, instruments, and wave phenomena, associated quantum physics and present-day scientific applications. Principles of scientific reasoning. 2 lectures, 1 activity. Fulfills GE Areas Upper-Division 2 or Upper-Division 5 (GE Area Upper-Division B for students on the 2020-26 catalogs).

PSC 3391 Engaging in Sustainable Global Development (3 units)
Term Typically Offered: F
2026-28 or later: Upper-Div GE Area 4
2020-26 catalogs: Upper-Div GE Area D
Sustainability Focused
Prerequisite: Completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs); completion of GE Area 2 with a grade of C- or better (GE Area B4 for the 2020-26 catalogs); and completion of one lower-division course in GE Area 4 (GE Areas D1 or D2 for the 2020-26 catalogs).

Examines some important perspectives on international development, studying successes and failures. Student teams address real-world problems by organizing, publicizing, learning, educating, and connecting support to needs. Collaboration with mentors from university, private sector, nonprofits provides diverse background and project mentorship. 3 lectures. Crosslisted as HNRS/PSC/UNIV 3391. Fulfills GE Upper-Division 4 (GE Area Upper-Division D for students on the 2020-26 catalogs). Formerly HNRS/PSC/UNIV 391.

PSC 3392 Collaboratively Developing Sustainable Technologies Globally (3 units)
Term Typically Offered: SP
2026-28 or later: Upper-Div GE Area 2/5
2020-26 catalogs: Upper-Div GE Area B
Sustainability Focused
Prerequisite: Junior standing; completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs); completion of GE Area 5 (GE Areas B1 to B3 for the 2020-26 catalogs); and completion of GE Area 2 with a grade of C- or better (GE Area B4 for the 2020-26 catalogs). Recommended: PSC/UNIV 391 or PSC/UNIV 3391; and completion of GE Area 4B (GE Area D2 for the 2020-26 catalogs).

Mechanical design and international collaboration with underserved communities. We explore how to design creatively. While addressing cultural challenges, student teams solve real-world problems with a community; designing and building a prototype that is inexpensive, ecologically sustainable, and socially appropriate. 2 lectures, 1 laboratory. Crosslisted as HNRS/PSC/UNIV 3392. Fulfills GE Areas Upper-Division 2 or Upper-Division 5 (GE Area Upper-Division B for students on the 2020-26 catalog). Formerly HNRS/PSC/UNIV 392.

PSC 4424 Teaching Science in Secondary Schools (4 units)
Term Typically Offered: F
Prerequisite: Admission into Cal Poly's Single-Subject Credential Program or Liberal Studies Science concentration.

Research-based methods of teaching life and physical sciences in secondary schools, with an emphasis on planning instruction and designing learning experiences for all students using inclusive instructional strategies. 4 lectures. Crosslisted as BIO/PSC 4424. Formerly BIO/PSC 424.

PSC 4425 Science Teaching Clinical Experience Seminar (2 units)
Term Typically Offered: SP
CR/NC
Prerequisite: Admission into Cal Poly's Single Subject Credential Program in Science. Corequisite: EDUC 469 or EDUC 4469.

Principles and practices in effective teaching of science at the middle and high school level, learning theories, curriculum structure, classroom issues, and the teaching profession. 2 seminars. Credit/No Credit grading only. Crosslisted as BIO/PSC 4425. Formerly BIO/PSC 425.