### PHIL 495 Special Studies (1-3)

Advanced individualized instruction and research with one or more members of the philosophy faculty. The course is designed to provide advanced students with an opportunity to do specialized research and study under strict faculty supervision. Prerequisite: consent of the instructor.

### PHIL 499 Internship (1-4)

Supervised training and experience in applied philosophy for advanced students in community organizations. Internship contracts are required. Cr/NC only. Prerequisite: consent of the instructor.

### PHIL 595 Special Studies in Philosophy (1-6)

Advanced research and writing. Students work under close supervision of faculty members. Subject matter variable. May be repeated for credit.

## Physics (PHYS)

### PHYS 100 Descriptive Physics (3)

Lecture, 3 hours. A descriptive survey of the important principles of physics. Satisfies GE, category B1 or B3 (Physical Sciences).

### PHYS 102 Descriptive Physics Laboratory (1)

Laboratory, 3 hours. Experimental demonstrations, exercises and field trips illustrating the methods by which physicists have learned what they claim to know about the world. Instruction is at the PHYS 100 level. Satisfies GE, category B1 or B3 (Physical Sciences) and GE laboratory requirements. Prerequisite: previous or concurrent enrollment in PHYS 100 or ASTR 100, or consent of instructor.

### PHYS 114 Introduction to Physics I (4)

Lecture, 4 hours. The first of three basic sequential courses in physics for science and mathematics majors. Introduction to vectors; classical mechanics, including particle dynamics and fluid mechanics; simple harmonic motion; thermodynamics and kinetics. Satisfies GE, category B1 or B3 (Physical Sciences). Prerequisite: MATH 161.

### PHYS 116 Introductory Laboratory Experience (1)

Laboratory, 3 hours. Demonstrations and participatory experiments are used to increase the student's familiarity with gravitational, electromagnetic and nuclear forces in nature. Applications include biological, geophysical, medical and environmental phenomena. Satisfies GE, category B1 or B3 (Physical Sciences) and GE laboratory requirements. Prerequisite: previous or concurrent enrollment in PHYS 114.

### PHYS 209A General Physics Laboratory (1)

Laboratory, 3 hours. Laboratory experiments to accompany PHYS 210A and develop the student's ability to perform measurements of physical phenomena and to increase their appreciation of the sense of the physical universe gained through experimentation. 209A satisfies GE, category B1 or B3 (Physical Sciences) and GE laboratory requirements. Prerequisites: high school algebra and trigonometry and a high school physical science and previous or concurrent enrollment in PHYS 210A

### PHYS 209B General Physics Laboratory (1)

Laboratory, 3 hours. Laboratory experiments to accompany PHYS 210B and develop the student's ability to perform measurements of physical phenomena and to increase their appreciation of the sense of the physical universe gained through experimentation. Prerequisites: PHYS 209A or PHYS 116.

### PHYS 210A General Physics (3)

Lecture, 3 hours. A basic course in physics for students majoring in biology, geology or preprofessional programs. Fundamentals of kinematics, Newton's laws, work, momentum, harmonic motion, and an introduction to fluids and concepts of temperature. Registration by mathematics majors requires Physics and Astronomy Department approval. 210A satisfies GE, category B1 or B3 (Physical Sciences) requirement. Prerequisites: high school algebra and trigonometry or MATH 107.

### PHYS 210B General Physics (3)

Lecture, 3 hours. A basic course in physics for students majoring in biology, geology or preprofessional programs. Topics include: electric charges, potentials, fields and currents, magnetism, electromagnetic waves, and optics. Registration by mathematics majors requires Physics and Astronomy Department approval. Prerequisites: PHYS 210A or PHYS 114.

**PHYS 214 Introduction to Physics II (4)**

Lecture, 4 hours. The continuation of PHYS 114. Electrostatics, quasistatic fields and currents, magnetostatics; electromagnetic induction; waves; physical and geometric optics. Prerequisites: PHYS 114; previous or concurrent enrollment in MATH 211.

**PHYS 216 Introductory Laboratory (1)**

Laboratory, 3 hours. Selected experiments to increase the student's working physical knowledge of the natural world. Prerequisites: PHYS 114 and 116. Concurrent enrollment in PHYS 214 is strongly recommended.

**PHYS 300 Physics of Music (3)**

Lecture, 3 hours. Introduction to physical principles encountered in the study of music; applicable laws of mechanics and acoustics; harmonic analysis; musical scales; sound production in musical instruments; elements of electronic music.

**PHYS 313 Electronics (3)**

Lecture, 3 hours. A comprehensive review of DC and AC circuit theory, applications of diodes, transistors and operational amplifiers, electronic test instruments; electronic transducers; waveform generators; noise; logic gates and Boolean algebra; number systems and codes; combinational logic circuits; applications of circuit simulation programs. Concurrent enrollment in PHYS 313L is mandatory. Prerequisites: MATH 107, PHYS 210B or 214; or consent of instructor.

**PHYS 313L Electronics Laboratory (1)**

Laboratory, 3 hours. Laboratory to accompany PHYS 313. Experiments in this lab are designed to address the major topics of PHYS 313 lecture course. Students will experiment with physical and simulated circuits. Concurrent enrollment in PHYS 313 is mandatory. Prerequisites: MATH 107, PHYS 209B or 216; or consent of instructor.

**PHYS 314 Introduction to Physics III (4)**

Lecture, 4 hours. The continuation of PHYS 214. Special relativity; elementary quantum mechanics; the Bohr atom and deBroglie waves; the Schrödinger wave equation with applications to simple one-dimensional problems and to atomic structure; elementary nuclear physics; introduction to equilibrium statistical mechanics; the partition function, Boltzmann statistics. Prerequisites: PHYS 214; previous or concurrent enrollment in MATH 261.

**PHYS 320 Analytical Mechanics (3)**

Lecture, 3 hours. This course is an exploration into the principles of Newtonian, Lagrangian, and Hamiltonian mechanics. It also includes a treatment of noninertial reference frames, rigid body rotation, central force problems, and the dynamics of a system of particles. Prerequisites: PHYS 114 and previous or concurrent enrollment in PHYS 325.

**PHYS 325 Introduction To Mathematical Physics (3)**

Lecture, 3 hours. This course examines advanced mathematical methods and serves as a foundation for future courses. Topics include coordinate systems and vectors; vector calculus; series expansions; differential equations; orthonomal functions; solutions of systems of linear equations; matrices and tensors; complex numbers; eigenvalues and eigenfunctions; Fourier series and Fourier integrals; use of mathematical symbolic processing software. Prerequisites: PHYS 214 and MATH 261 or consent of instructor.

**PHYS 340 Light and Optics (3)**

Lecture, 3 hours. An examination of the properties of light from geometric and physical optics perspectives. Topics include: ray optics, refraction, diffraction, coherence, interference, and polarization. The course will present Fermat's principle, Huygens' principle and Fourier optics. Prerequisite: PHYS 314 or 325.

**PHYS 342 Light and Color (3)**

Lecture, 3 hours. A descriptive, non-mathematical, but analytical treatment of the physical properties of light, the camera, telescope, microscope and laser; holography, mirages, rainbows and the blue sky; colors in flowers, gems and pigments; human and animal vision and visual perception. Satisfies GE, category B3 (Specific Emphasis in Natural Sciences). Prerequisite: any physical science course or consent of instructor.

**PHYS 366 Intermediate Experimental Physics (3)**

Lecture 2 hours; laboratory 3 hours. An introduction to contemporary techniques and problems in physics. Selected topics in lasers and photonics, materials science (including high-magnetic field measurements and surface analysis using scanning electron and atomic force microscopy), X-ray analysis, applied nuclear physics, adaptive optics. Prerequisites: PHYS 314 and 216, or consent of instructor.

**PHYS 381 Computer Applications for Scientists (2)**

Lecture, 1 hour; laboratory, 3 hours. A survey of problem solving techniques including computer modeling and simulation for the physical sciences. The student is introduced to high-level programming languages such as C++ and various mathematical tools such as Excel, Mathematica and MatLab. Topics include modern programming techniques, use of graphics and mathematical function libraries, linear least squares data fitting techniques, numerical solution of algebraic and differential equations and error analysis. Prerequisites: PHYS 114 and MATH 211.

**PHYS 395 Community Involvement Program (1-2)**

CIP involves students in basic community problems related to physics and astronomy-performing such tasks as tutoring, reading to the blind, service to local, county and state agencies, and service as teacher aides to elementary schools. Students receive 1-2 units, depending on the specific task performed. Not more than 4 CIP units will be applicable to the physics major requirements. May be taken by petition only.

**PHYS 396 Selected Topics in Physics (1-4)**

A course of lectures on a single topic or set of related topics not ordinarily covered in the physics curriculum. The course may be repeated for credit with a different topic. Prerequisite: consent of instructor.

**PHYS 430 Electricity and Magnetism (3)**

Lecture, 3 hours. An investigation into the fundamentals of electromagnetic theory and its applications. Topics include vector analysis, electrostatics, method of images, magnetostatics, electric currents, electromagnetic induction, electric and magnetic fields in matter, Maxwell's equations, electromagnetic waves, potentials and fields. Prerequisites: PHYS 214 and previous or concurrent enrollment in PHYS 325.

**PHYS 445 Photonics (3)**

Lecture, 3 hours. A practical examination of Gaussian beams; guided-wave optics; fiber optics; optical resonators; resonant cavities; laser oscillation and amplification; laser excitation; optical pumping; solid state, gas, dye, chemical, excimer and free electron lasers; semiconductor lasers; laser spectroscopy; fiber optic communication; photomultiplier and semiconductor radiation detectors including photoconductors, junction photodiodes; p-i-n diodes, avalanche photodiodes; detector noise. Prerequisite: PHYS 314 or consent of instructor. (Cross-listed as CES 430 and ES 445).

**PHYS 450 Statistical Physics (2)**

Lecture, 2 hours. An introduction to statistical methods. Topics include ideal gas, heat capacities, entropy, enthalpy, the laws of thermodynamics: Boltzmann, Bose and Fermi statistics; applications such as engines and refrigerators. Prerequisite: PHYS 314.

### PHYS 460 Quantum Physics (3)

Lecture, 3 hours. This course examines the Schrödinger equation and its solution for free particles, potential wells, harmonic oscillators, central potentials, and the hydrogen atom. Other topics may include Hilbert space; Hermitian operators; Dirac notation; angular momentum and spin; scattering; wave function symmetry; and elementary perturbation theory. Prerequisites: PHYS 314 and 325.

### PHYS 466 Advanced Experimental Physics (3)

Lecture 2 hours; laboratory 3 hours. Advanced topics in lasers and photonics, materials science (including high-magnetic field measurements and surface analysis using scanning electron and atomic force microscopy), X-ray analysis, applied nuclear physics, adaptive optics. Prerequisites: PHYS 314 and 216, or consent of instructor.

### PHYS 475 Physics of Semiconductor Devices (3)

Lecture, 3 hours. A detailed study of semiconductors and their applications. Topics include semiconductor materials, crystal structure and growth; energy bands and charge carriers, conductivity and mobility; metal-semiconductor and p-n junctions; p-n junction diodes, bipolar junction transistors, field-effect transistors, CCDs, photonic devices and integrated circuits. Conductivity and contact resistance measurements; I-V and C-V characteristics of diodes; characterization of transistors. Prerequisite: PHYS 314 or consent of instructor. (Cross-listed as CES 432 and ES 432).

### PHYS 492 Instructional Design Project (2)

A directed project to develop at least one laboratory experiment and/or classroom activity that teaches basic concepts in undergraduate physics. Both written and oral presentations (including a demonstration of the experiment or activity) will be required. Prerequisite: Physics 214 and 216 or Physics 210B and 209B.

### PHYS 493 Senior Design Project (2)

A directed project to develop either a working prototype or a detailed conceptual design for an operational laboratory device. Both written and oral presentations (including a demonstration) will be required. Prerequisites: PHYS 313L. Application form required prior to enrollment.

### PHYS 494 Physics Seminar (1)

A series of lectures on topics of interest in physics, astronomy and related fields. May be repeated for credit up to 3 units maximum. Prerequisite: consent of instructor.

### PHYS 495 Special Studies (1-4)

The Physics and Astronomy Department encourages independent study and considers it to be an educational undertaking. Students wishing to enroll for special studies are required to submit proposals to their supervising faculty members that outline their projects and exhibit concrete plans for their successful completion.

### PHYS 497 Undergraduate Research in Physics (2)

Supervised research in an area of physics that is currently under investigation by one or more members of the Physics and Astronomy Department's faculty. This course may be repeated for up to 6 units of credit. Both written and oral presentations will be required. Prerequisites: junior-level standing and consent of instructor.

## Political Science (POLS)

### POLS 151 Credit by Exam: California Government (1)

The state code requirement in California state and local government may be satisfied by passing an examination in the political science department.

### POLS 199 Media: Contemporary Issues (2)

### POLS 200 American Political System (3)

An examination of American politics and governmental institutions. Introduces students to the political system and how to participate in it, should the need arise. Satisfies the code requirements in American Constitution and California state and local government. Satisfies GE, category D4 (U.S. Constitution and State and Local Government).

### POLS 201 Ideas and Institutions (4)

An analysis of the basic political values and their impact on society. Students will be introduced to the relationship between values, ideology and the political process. Political science majors are expected to take this course, which stresses written expression, during their first year in the department. Satisfies GE, category D5 (Contemporary International Perspectives).

### POLS 202 Issues in Modern American Politics (4)

Leaders and issues in American political life considered in relation to major policies and movements, e.g., progressivism, isolationism, the New Deal, containment. Open to majors and minors in political science. Meets code requirements in American Constitution and California state and local government. Satisfies GE, category D4 (U.S. Constitution and State and Local Government).

### POLS 292 Social Science Library Research (1)

A basic introduction to social science library research sources, with special emphasis on political science. Course includes learning library research skills and practice with print resources and electronic sources.

### POLS 302 Social Science Research Methods (4)

Social science research and statistical methods, which includes as a significant component computer-based data analysis using the SPSS (Statistical Package for the Social Sciences) programs. It may include building data files and data analysis using multivariate tables, correlations, and regression techniques in a directed research project. The course includes a two-hour laboratory.

### POLS 303 Introduction to Comparative Government (4)

Reviews the principal concepts and theories of comparative politics, and assesses the institutions that comprise varied systems of government. Concrete examples taken from modern systems will be applied throughout the course. Special attention is focused on the political systems of Britain, France, Japan, Russia and China. Students are assigned research projects on political systems of developing nations.

### POLS 304 Introduction to International Relations (4)

An introductory analysis of the dynamics of the international political system, stressing the roles of supranational organizations, internal and external factors in foreign policy formulation by nation-states. Review of traditional and contemporary theories of international interaction.

### POLS 310 Classical Political Thought (2-4)

A comprehensive look at the foundations of Western political thought, with particular attention to the theories of Plato, Aristotle and Thomas Aquinas.

### POLS 311 Modern Political Thought: Machiavelli to Obama (4)

Examination of the major writings from Machiavelli to the present. Emphasis on original sources and development of student opinions on ideas discussed.