
Physical Science — Physics

Faculty

Chair:.....James Rynd, Ph.D.

Professors:.....Bloom, Rynd

Associate Professor:.....Lee

Instructor:.....Pichaj

Objectives

The physical science major is an interdisciplinary major designed to provide the student with a solid foundation in chemistry, physics and mathematics. The program offers four emphases. As well as providing the necessary prerequisites for professional programs such as engineering, medicine and education, the major allows one to qualify for many graduate programs related to the physical sciences. The knowledge and skills provided in the program make the graduate much sought after by technically-oriented business, industry and government agencies.

Upon completion of the physical science major, the student will be able to express an understanding of the basic laws and theories of physics and chemistry, demonstrate an ability to do quantitative problem solving, demonstrate good laboratory technique, acquire several technical skills, apply scientific methodology to a research problem and integrate scientific knowledge and theories with the Christian faith.

Degree Program

A Bachelor of Science degree in Physical Science is offered upon completion of the university baccalaureate requirements and the physical science departmental requirements in one of the following emphases.

CHEMISTRY (60 UNITS)

Chemistry 105, 106, 301, 302, 311, 312, 350; Computer Science 105; Physics 124, 132, 233, 234, 460; Math 105, 106; the remaining 14 units are taken in chemistry, physics and math, of which 10 units must be upper division. Three units of computer science may be counted toward the 14 units of electives in chemistry, physics or math.

PHYSICS (65 UNITS)

Physics 124, 132, 233, 234, 318, 321, 460, 480; Chemistry 105, 106; Math 105, 106, 205, 291, 435; Computer Science 105; and 13 units of upper division courses in physics, chemistry or math, with at least 6 units in physics. To continue in this program a student is expected to have a GPA of 2.5 in PHSC 132, 233; MATH 105, 106 and CHEM 105.

TEACHING CREDENTIAL IN THE SCIENCES

While this is not a specific emphasis in the major, students preparing to obtain a secondary teaching credential in any of the physical sciences need to be aware of the requirements of the California Commission on Teacher Credentialing. These include a variety of education courses and a demonstration of competence in the subject area to be taught. A set of examinations called California Subject Exams

for Teachers (CSET) is offered depending on the subject areas to be taught. These include a general science exam in biology, chemistry, physics and earth science as well as the more in depth single subject exams. See the California Commission on Teacher Credentialing web site or Biola's Department of Education for more details.

ENGINEERING (46 PRE-ENGINEERING UNITS)

Biola University, in cooperation with the University of Southern California, offers a five-year, dual-degree program in liberal arts / sciences and engineering. Students attend Biola for three years taking courses in physics, chemistry, biblical studies and the liberal arts. The final two years are taken in the University of Southern California School of Engineering. Upon successful completion of the five-year program, a student receives a B.S. degree with a major in Physical Science from Biola and a B.S. degree in Engineering from the USC. A similar agreement exists with Boston University. Students interested in these programs must plan their course of study under the supervision of the engineering advisor and with the approval of the departments.

A student who chooses to attend an accredited engineering school other than University of Southern California may also be awarded a degree from Biola University. The student should be aware that engineering schools often have a minimum GPA requirement for application. The program at USC currently requires a 3.0 GPA in core Math and Science courses. The required pre-engineering courses taken at Biola for most engineering programs are: Physical Science 121, 124; Math 105, 106, 205, 435; Chemistry 105; Physics 132, 233, 234, 311, 313, 321, and 318 or 352; Computer Science 105. Other courses may be required for specific engineering programs.

Note: Students in the engineering 3/2 program sequence are exempt from general education requirements in literature (3) and World Civilization (3). The student is also exempt from the last semester residency requirement.

Note: Physical Science majors automatically meet the general education requirement of eight units of science and mathematics. The foreign language requirement is met by two years in high school or first four units in college.

Minors

A Physical Science Minor is offered with the completion of 22 units of Chemistry 105, 106; Physics 132, 233 and six units of upper division Physical Science or Chemistry electives.

A Physics Minor is offered with the completion of 18 units consisting of Physics 132, 233, 234 and six upper division units in Physics.

Courses (PHSC)

PHYSICAL SCIENCE / PHYSICS

PHSC 101 Physical Science Survey — Lecture.....4

A course designed for the non science major. A survey of the basic principles of physics, chemistry, geology, meteorology and astronomy. Either semester.

- PHSC 102 Physical Science Survey — Laboratory1**
A laboratory experience to accompany the lecture course. Must be taken concurrently or subsequent to the lecture. Three hours lab. Either semester. Lab fee: \$40.
- PHSC 103 Geology3**
An introduction to earth science including: processes that shape the earth's surface, oceans and atmosphere; plate tectonics, earth history and the fossil record, natural resources and environmental concerns.
- PHSC 105 Topics in Physical Science 1-2**
A course designed to allow students to select specific modules from PHSC 101 which include physics, chemistry, geology or astronomy and weather. Prerequisite: department approval, signature required.
- PHSC 107 Physics of Sound2**
The basic concepts of sound wave mechanics, the mechanism of tone production in musical instruments, principles of acoustics and an overview of the technology used in the electronic recording. Lab activities include the use of frequency spectrum analyzers. Assumes no science background but will use high school algebra. Lab fee: \$20. Offered alternate years.
- PHSC 110 Astronomy3**
Descriptive general education course, designed to acquaint the student with the current state of knowledge of the solar system, the Milky Way, galaxies, quasars and cosmology. Lab fee: \$40.
- PHSC 111 Physics I4**
A study of mechanics, heat and sound. Intended for non-majors, principles are treated quantitatively but without a calculus requirement. Three hours lecture and three hours laboratory. Prerequisite: MATH 101 or a strong algebra / trigonometry background. Lab fee: \$60
- PHSC 112 Physics II4**
Continued from Physics I; includes electricity, magnetism, elementary circuits and optics. Three hours lecture, three hours laboratory. Prerequisite: PHSC 111. Lab fee: \$60.
- PHSC 115 Physics in Everyday Life3**
This course is intended for non-science majors who are seeking a connection between science and the world in which they live. It is intended to convey an appreciation for the physical sciences through the discovery of principles within objects of everyday experience and to show that science is not something to be feared but is indeed reflective of God's creativity, beauty and provision. 3 hours lecture.
- PHSC 116 Physics in Everyday Life Lab1**
The hands-on component for the lecture course that provides students experience with common laboratory tools for a better understanding and appreciation of the principles behind many of the objects of everyday life. Must be taken concurrently or subsequent to PHSC 115. 3 hour laboratory. Lab fee: \$50.
- PHSC 121 Introduction to Engineering1**
A presentation of the opportunities of the many engineering specialties, historical and current trends, ethical and societal factors in engineering projects and examples of engineering design problems from professionals and through field trips.
- PHSC 124 Data Analysis & Presentation1**
The course is intended for physical science and pre-engineering majors and anyone else interested in learning to develop their intuition for problem-solving using formal and informal techniques. Involves the use of MATLAB, Excel and other computer tools for data analysis. Fee: \$25
- PHSC 132 General Physics I: Mechanics4**
Basic principles of physics emphasizing Newtonian mechanics; conservation of energy and momentum; oscillations and fluids. Primarily for physical science and pre-engineering majors. Three hours lecture, three hours laboratory each week. Prerequisite: Math 105. Lab fee: \$60. Fall term only.
- PHSC 233 General Physics II: Heat, Electricity & Magnetism4**
Introduction to thermodynamics, electrostatics, conductors and currents, magnetic fields, and Maxwell's equations. Primarily for physical science and pre-engineering majors. Three hours lecture, three hours laboratory each week. Prerequisite: Physics 132. Lab fee: \$60. Spring term only.
- PHSC 234 General Physics III: Waves, Optics & Modern Physics4**
Wave theory, sound, geometric optics, interference and diffraction, relativity, wave properties of particles, and introduction to quantum physics. Primarily for physical science and pre-engineering majors. The optics section may be taken for one unit of credit (Physics 450). Prerequisite: Physics 233. Lab fee: \$60. Offered alternate years.
- PHSC 250 Science & Origins3**
A survey of basic scientific theories of origins, their crucial experimental evidences, and background material in physics, chemistry, geology and astronomy. Particular attention will be given to comparison of scientific theories of origins and biblical revelation.

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- PHSC 311 Computer Techniques in Science & Engineering4**
Use of computational tools to solve problems from classical and quantum mechanics, static's, thermodynamics, digital signal analysis and others. Required 233 or CHEM 106, MATH 205 recommended. 2 hours lecture. 2 x 2 hour labs. Lab fee: \$60
- PHSC 313 Statics3**
Statics of particles, rigid bodies in two and three dimensions, centroids and centers of gravity, structures, friction, and inertia. Primarily for pre-engineering majors. Three hours lecture each week. Prerequisite: Physics 132.
- PHSC 318 Classical Mechanics3**
Newtonian mechanics of particles and systems of particles, rigid bodies, oscillating systems, gravitation, moving coordinate systems, Lagrange's and Hamilton's equations. Primarily for physics emphasis majors. Three hours lecture. Prerequisite: 132.
- PHSC 321 Circuits & Instrumentation I5**
An introduction to electronic circuit analysis and design. Three hours lecture, six hours laboratory each week. Prerequisite: 233. Fee: \$100.
- PHSC 331 Thermodynamics3**
Introduction to energy, heat, work, entropy, temperature and states of matter. The first, second and third laws of thermodynamics with an emphasis on applications. Prerequisite: 233.
- PHSC 340 Electrodynamics3**
The application of vector calculus and Maxwell's equations in the analysis of static and dynamic electromagnetic waves in dielectrics and conductors. Prerequisite: 233.
- PHSC 352 Fundamentals of Materials Science.....3**
Introduction to the structure-property relationships of engineering and natural materials including metals, ceramics, polymers and composites. Examines the strength of materials, strengthening mechanisms, diffusion, phase transformations, heat treatment and microstructure control. Considers how materials are selected for design of a product. Prerequisite: One of PHSC 132, or CHEM 106 and MATH 106. Offered alternate years.
- PHSC 412 Introduction to Quantum Mechanics3**
An introduction to quantum mechanics including 1-D potentials, Schrodinger's equation, the hydrogen atom with spin, Dirac notation, operator formalism, bonding, the solid state and interpretation. Prerequisite: 234 and MATH 205.
- PHSC 420 Special Projects 1-3**
Research or industrial internship. To provide practical experience in a field of the student's interest. Designed primarily for students working off campus in a situation where special projects are possible. Prerequisite: junior or senior standing with consent.
- PHSC 450 Special Topics in Physical Science 1-3**
Varying course content. Topics such as optics, special relativity, nuclear and biophysics will be offered. Departmental approval required.
- PHSC 460 Physical Science Seminar1**
A capstone course for all physical science and biochemistry majors that includes: (1) presentation of a seminar, (2) service learning project and, (3) integration readings and discussion.
- PHSC 480 Advanced Physics Laboratory3**
A laboratory course in which selected experiments cover several areas of classical and contemporary physics. Emphasis on data collection and analysis techniques. Prerequisites: PHSC 234, 321; MATH 435. Lab Fee: \$100.