

# PHYSICAL SCIENCE (PHSC)

## Courses

### PHSC 092 - Introduction to Physics

Credits 2

This course is designed for students planning to enroll in Physics I (PHSC 111) or General Physics I (PHSC 132) who did not pass the Physics Placement Exam. **Note(s):** Credits do not count towards graduation requirements; a grade of "C" or better is required to register in PHSC 111, and a grade of "B" or better is required to register in PHSC 132.

**Grade Mode:** A.

**Restriction(s):** Must be Undergraduate Level.

### PHSC 100 - Physics I with Foundations

Credits 0,3

This course focuses on the study of mechanics, heat, and sound. Intended for non-physical science majors. Principles are treated quantitatively but without a calculus requirement. **Lecture/Lab Hours:** Three hours lecture, three hours recitation weekly. Core Curriculum: Approved for Core - Science. **Grade Mode:** A, N.

**Corequisite(s):** PHSC 117.

**Restriction(s):** Must not be Chemistry (CHEM), Physics (PHYS), Engineering Physics (PHEP), Engineering (ENGR), Robotics (ROBO), Physical Science (PHSC), or Applied Physics (PHAP); and must be Undergraduate Level.

### PHSC 101 - Physical Science Survey: Lecture

Credits 3-4

A survey of the basic principles of physics, chemistry, geology, oceanography, meteorology and astronomy. Designed for the non-science major. Core Curriculum: Approved for Core - Science. **Grade Mode:** A.

**Restriction(s):** Must be Undergraduate Level.

### PHSC 102 - Physical Science Survey Laboratory

Credit 1

This laboratory accompanies PHSC 101 and is divided between observational and experimental approaches, with emphasis on the collection and interpretation of quantitative data. Some fieldwork is required. The topics covered in this course include physics, chemistry, geology, oceanography, meteorology, and astronomy. **Lecture/Lab Hours:** Three hour laboratory weekly. Core Curriculum: Approved for Core - Science. **Note(s):** Required for Liberal Studies majors, and optional for others. **Grade Mode:** A.

**Prerequisite(s):** PHSC 101 (may be taken concurrently).

**Restriction(s):** Must be Undergraduate Level.

**Course Fee:** \$130.

### PHSC 103 - Geology

Credits 3

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. Core Curriculum: Approved for Core - Science. **Grade Mode:** A.

**Restriction(s):** Must be Undergraduate Level.

### PHSC 104 - Geology Laboratory

Credit 1

An optional laboratory experience designed to utilize hands-on investigations of geologic materials and processes, including minerals, rocks, topographic and geological maps, in order to support and augment the topics covered in the introductory geology course (PHSC 103). One field trip is required and is credited as one of the lab sessions. **Lecture/Lab Hours:** 3 hours per week. Core Curriculum: Approved for Core - Science. **Grade Mode:** A.

**Prerequisite(s):** PHSC 103 (may be taken concurrently).

**Restriction(s):** Must be Undergraduate Level.

**Course Fee:** \$130.

### PHSC 105 - Topics in Physical Science

Credits 1-3

A course designed to allow students to select specific modules from PHSC 101, Physical Science Survey, which include physics, chemistry, geology, astronomy, and/or meteorology; or from PHSC 111, PHSC 112, PHSC 132, PHSC 233 or PHSC 234. Core Curriculum: Approved for Core - Science. **Note(s):** Students take the final 3-4 weeks of PHSC 132 as an arranged course of PHSC 105. **Grade Mode:** A.

**Restriction(s):** Must be Undergraduate Level.

**Repeat Limit (after first attempt):** 10.

### PHSC 106 - Physics of Superheroes

Credits 3

This course is intended for non-science majors to use physics to examine superheroes from various forms of media. Various topics in mechanics, electricity, magnetism, optics, and more are applied in the context of superheroes, comics, and cinema. The course will also explore contemporary worldview issues of fictional superheroes compared with Christian truth. Core Curriculum: Approved for Core - Science. **Grade Mode:** A.

**Restriction(s):** Must be Undergraduate Level.

### PHSC 109 - Physics of Sound

Credits 3

The basic concepts of sound wave mechanics, the mechanisms of sound and voice, hearing, speech perception, and an overview of the technology used in electronic recording. Lab activities include the use of frequency spectrum analyzers. Assumes no science background but will use high school algebra. Core Curriculum: Approved for Core - Science. **Note(s):** Counts toward the Core Curriculum Science requirement for all majors except Communication Disorders. **Grade Mode:** A.

**Restriction(s):** Must be Undergraduate Level.

### PHSC 110 - Astronomy

Credits 3

A conceptual astronomy course, designed to acquaint the student with the current state of knowledge of the solar system, the Milky Way, galaxies, quasars and cosmology. Core Curriculum: Approved for Core - Science. **Grade Mode:** A.

**Restriction(s):** Must be Undergraduate Level.

**Course Fee:** \$95.

### PHSC 111 - Physics I

Credits 0,3

A study of mechanics, heat and sound. Intended for non-Physical Science majors. Principles are treated quantitatively but without a calculus requirement. **Lecture/Lab Hours:** Three hours lecture, one hour recitation weekly. Core Curriculum: Approved for Core - Science. **Grade Mode:** A, N. **Prerequisite(s):** Passing score on the Physics Placement Exam or 3 or above on any Advanced Placement (AP) Physics.

**Corequisite(s):** PHSC 117.

**Restriction(s):** Must not be Chemistry (CHEM), Physics (PHYS), Engineering Physics (PHEP), Engineering (ENGR), Robotics (ROBO), Physical Science (PHSC), or Applied Physics (PHAP); and must be Undergraduate Level.

### PHSC 112 - Physics II

Credits 0,3

Continued from Physics I; includes electricity, magnetism, elementary circuits, optics, and modern physics. **Lecture/Lab Hours:** Three hours lecture, one hour recitation weekly. **Grade Mode:** A, N.

**Prerequisite(s):** PHSC 100 or PHSC 111; PHSC 117.

**Corequisite(s):** PHSC 118.

**Restriction(s):** Must not be Physics (PHYS), Physical Science (PHSC), Chemistry (CHEM), Engineering Physics (PHEP), Engineering (ENGR), Robotics (ROBO), or Applied Physics (PHAP); and must be Undergraduate Level.

**PHSC 115 - Physics in Everyday Life****Credits 3**

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. Core Curriculum: Approved for Core - Science. **Grade Mode:** A.

**Restriction(s):** Must be Undergraduate Level.

**PHSC 117 - Physics I Laboratory****Credit 1**

Application of the laws and theories of mechanics, heat and sound through experiment. Laboratory to accompany Physics I. **Lecture/Lab Hours:** Three hours laboratory weekly. Core Curriculum: Approved for Core - Science. **Grade Mode:** A.

**Restriction(s):** Must be Undergraduate Level.

**Course Fee:** \$130.

**PHSC 118 - Physics II Laboratory****Credit 1**

Application of the laws and theories of electricity, magnetism, circuits and optics through experiment. Laboratory to accompany Physics II. **Lecture/Lab Hours:** Three hours laboratory weekly. **Grade Mode:** A.

**Corequisite(s):** PHSC 112.

**Restriction(s):** Must be Undergraduate Level.

**Course Fee:** \$130.

**PHSC 119 - Physics in Everyday Life Laboratory****Credit 1**

The optional 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. **Lecture/Lab Hours:** Three hours of laboratory weekly. Core Curriculum: Approved for Core - Science. **Grade Mode:** A.

**Prerequisite(s):** PHSC 115 (may be taken concurrently).

**Restriction(s):** Must be Undergraduate Level.

**Course Fee:** \$70.

**PHSC 121 - Introduction to Engineering****Credit 1**

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. **Grade Mode:** A.

**Restriction(s):** Must be Undergraduate Level.

**PHSC 124 - Data Analysis and Presentation****Credit 1**

This course is intended for Chemistry, Physics and Engineering Department majors or 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. **Grade Mode:** A.

**Restriction(s):** Must be Undergraduate Level.

**Course Fee:** \$130.

**PHSC 132 - General Physics I: Mechanics and Heat****Credits 0,3**

Basic principles of physics emphasizing Newtonian mechanics; conservation of energy and momentum; oscillations, fluids and thermodynamics. **Lecture/Lab Hours:** Three hours lecture, one hour recitation, weekly. Core Curriculum: Approved for Core - Science. **Note(s):** Primarily for Physical Science, Engineering Physics, Engineering, and Robotics majors. **Grade Mode:** A, N.

**Prerequisite(s):** MATH 150 or verified Advanced Placement (AP) Calculus AB or BC exam score of 4 or higher.

**Corequisite(s):** PHSC 134.

**Restriction(s):** Must be Undergraduate Level.

**PHSC 134 - General Physics I Laboratory****Credit 1**

The application of the laws and theories of mechanics and thermodynamics through experiment. **Lecture/Lab Hours:** Three hours of laboratory weekly. Core Curriculum: Approved for Core - Science. **Grade Mode:** A.

**Corequisite(s):** PHSC 132.

**Restriction(s):** Must be Undergraduate Level.

**Course Fee:** \$130.

**PHSC 233 - General Physics II: Electricity and Magnetism****Credits 0,3**

Introduction to electrostatics, conductors and currents, magnetic fields, and Maxwell's equations. **Lecture/Lab Hours:** Three hours lecture, one hour recitation, weekly. **Note(s):** Primarily for Physical Science, Engineering Physics, Engineering, and Robotics majors. **Grade Mode:** A, N.

**Prerequisite(s):** PHSC 132, PHSC 134.

**Corequisite(s):** PHSC 237.

**Restriction(s):** Must be Undergraduate Level.

**PHSC 234 - General Physics III: Waves, Optics and Modern Physics****Credits 0,4**

Wave theory, sound, geometric optics, interference and diffraction, relativity, wave properties of particles, and introduction to quantum physics. **Lecture/Lab Hours:** Three hours lecture; three hours laboratory, weekly. **Note(s):** Primarily for Physics and Engineering Physics majors; the optics section may be taken for one credit (PHSC 450). **Grade Mode:** A, N.

**Prerequisite(s):** PHSC 233, PHSC 237.

**Restriction(s):** Must be Undergraduate Level.

**Course Fee:** \$130.

**PHSC 237 - General Physics II Laboratory****Credit 1**

The application of the laws and theories of electricity and magnetism through experiment. **Lecture/Lab Hours:** Three hours laboratory weekly. **Grade Mode:** A.

**Corequisite(s):** PHSC 233.

**Restriction(s):** Must be Undergraduate Level.

**Course Fee:** \$130.

**PHSC 250 - Science and Origins****Credits 3**

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. Core Curriculum: Approved for Core - Science. **Grade Mode:** A.

**Restriction(s):** Must be Undergraduate Level.

**PHSC 311 - Computer Techniques in Science and Engineering****Credits 3**

Students will learn computational techniques commonly used by both practitioners and academics in the fields of engineering, physics, and chemistry. These techniques include methods for (a) finding roots of equations, (b) solving simultaneous equations using matrix operations, (c) optimization, (d) curve fitting, and (e) numerical integration and differentiation. MATLAB and Excel will be used to implement the above-mentioned algorithms and methods. **Grade Mode:** A.

**Prerequisite(s):** PHSC 124, PHSC 233, PHSC 237; or CHEM 106; MATH 250 and MATH 291 recommended.

**Restriction(s):** Must be Undergraduate Level.

**Course Fee:** \$130.

<b>PHSC 313 - Statics</b> <b>Credits 3</b> Statics of particles, rigid bodies in two and three dimensions, centroids and centers of gravity, structures, friction, and inertia. <b>Lecture/Lab Hours:</b> Three hours lecture weekly. <b>Note(s):</b> Primarily for Engineering Physics majors. <b>Grade Mode:</b> A. <b>Prerequisite(s):</b> PHSC 132, PHSC 134. <b>Restriction(s):</b> Must be Undergraduate Level.	<b>PHSC 331 - Thermodynamics</b> <b>Credits 3</b> Introduction to energy, heat, work, entropy, temperature and states of matter. The first, second and third laws of thermodynamics with an emphasis on applications. <b>Grade Mode:</b> A. <b>Prerequisite(s):</b> PHSC 132, PHSC 134. <b>Restriction(s):</b> Must be Undergraduate Level.
<b>PHSC 314 - Mechanics of Materials</b> <b>Credits 3</b> Analysis of stress, strain and deflection of mechanical elements due to tension. Shear, bending or torsion, combined stresses, elastic stability and energy methods. <b>Note(s):</b> Primarily for Engineering Physics majors. <b>Grade Mode:</b> A. <b>Prerequisite(s):</b> PHSC 313. <b>Restriction(s):</b> Must be Undergraduate Level.	<b>PHSC 336 - Mathematical Methods in Physics</b> <b>Credits 3</b> This course covers a variety of advanced mathematical techniques essential to the solution of problems in the physical sciences and engineering. Topics include tensors, complex variables, contour integrals, solutions of partial differential equations, boundary-value problems, special functions (such as Bessel functions and Legendre functions), and Fourier series and Fourier and Laplace transforms. <b>Grade Mode:</b> A. <b>Prerequisite(s):</b> MATH 335. <b>Restriction(s):</b> Must be Undergraduate Level.
<b>PHSC 316 - Dynamics</b> <b>Credits 3</b> The concepts of force, mass, and acceleration, of work and energy, and of impulse and momentum as applied to problems involving the motion of particles and rigid bodies in two and three dimensions. <b>Note(s):</b> Primarily for Engineering Physics majors. <b>Grade Mode:</b> A. <b>Prerequisite(s):</b> PHSC 313. <b>Restriction(s):</b> Must be Undergraduate Level.	<b>PHSC 340 - Electrodynamics</b> <b>Credits 3</b> The application of vector calculus and Maxwell's equations in the analysis of static and dynamic electromagnetic waves in dielectrics and conductors. <b>Grade Mode:</b> A. <b>Prerequisite(s):</b> PHSC 233, PHSC 237; MATH 335. <b>Restriction(s):</b> Must be Undergraduate Level.
<b>PHSC 318 - Classical Mechanics</b> <b>Credits 3</b> Newtonian mechanics of particles and systems of particles, rigid bodies, oscillating systems, gravitation, moving coordinate systems, Lagrange's and Hamilton's equations. <b>Lecture/Lab Hours:</b> Three hours lecture. <b>Grade Mode:</b> A. <b>Prerequisite(s):</b> PHSC 132, PHSC 134; MATH 334 or MATH 335. <b>Restriction(s):</b> Must be Undergraduate Level.	<b>PHSC 352 - Fundamentals of Materials Science</b> <b>Credits 3</b> 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. <b>Grade Mode:</b> A. <b>Prerequisite(s):</b> PHSC 112 or PHSC 233; CHEM 105 and MATH 150. <b>Restriction(s):</b> Must be Undergraduate Level.
<b>PHSC 321 - Circuits and Instrumentation I</b> <b>Credits 5</b> Introduction to circuit elements, network theorems, response, semiconductor devices, integrated circuits, and the operation and design of analog DC/AC circuits. Also introduces the fundamentals of Boolean logic and digital design. Laboratory work involves extensive construction and analysis of circuits, as well as introduction of soldering and assembly techniques. <b>Lecture/Lab Hours:</b> Three hours lecture; six hours laboratory, weekly. <b>Grade Mode:</b> A. <b>Prerequisite(s):</b> PHSC 233, PHSC 237. <b>Restriction(s):</b> Must be Undergraduate Level. <b>Course Fee:</b> \$130.	<b>PHSC 401 - History of Science</b> <b>Credits 3</b> A survey of the history of science with analysis of science as a way of knowing the world. Emphasis on how human culture shapes scientific practice. <b>Note(s):</b> Does not count towards the major. <b>Grade Mode:</b> A. <b>Prerequisite(s):</b> PHIL 214; HIST 101; PHSC 111 or PHSC 132; PHSC 112 or PHSC 233. <b>Restriction(s):</b> Must be Undergraduate Level.
<b>PHSC 322 - Circuits and Instrumentation II</b> <b>Credits 3</b> This course is an introduction to the fundamental concepts of microcontrollers and embedded systems. Concepts include information representations, embedded C language constructs, and fundamental circuit analysis. Specific embedded topics will include digital I/O, serial I/O protocols, analog-to-digital conversion, sensor and actuator interfacing, and interrupt mechanisms. A lecture/lab course format will be employed to provide hands-on experience and active learning techniques. <b>Lecture/Lab Hours:</b> Two hours lecture; three hours laboratory, weekly. <b>Grade Mode:</b> A. <b>Prerequisite(s):</b> CSCI 105, PHSC 233, PHSC 237; PHSC 321 or ENGR 321 recommended. <b>Restriction(s):</b> Must be Undergraduate Level. <b>Course Fee:</b> \$130.	<b>PHSC 402 - Philosophy of Science</b> <b>Credits 3</b> A survey and analysis of the philosophical methods that the sciences use as a way of knowing the world. <b>Note(s):</b> Does not count towards the major. <b>Grade Mode:</b> A. <b>Prerequisite(s):</b> PHIL 214; HIST 101; PHSC 111 or PHSC 132; PHSC 112 or PHSC 233. <b>Restriction(s):</b> Must be Undergraduate Level.
<b>PHSC 326 - Sciences CSET Preparation</b> <b>Credit 1</b> Review of the subject matter in the California Subject Examinations for Teachers (CSET) Science subtest exams. Test-taking strategies. <b>Note(s):</b> Does not count toward any major or minor. <b>Grade Mode:</b> A. <b>Restriction(s):</b> Must be Undergraduate Level. <b>Repeat Limit (after first attempt):</b> 2.	<b>PHSC 412 - Introduction to Quantum Mechanics</b> <b>Credits 3</b> 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. <b>Grade Mode:</b> A. <b>Prerequisite(s):</b> PHSC 234; MATH 335. <b>Restriction(s):</b> Must be Undergraduate Level. <b>PHSC 420 - Internship</b> <b>Credits 1-3</b> Internship to provide practical experience in a field of the student's interest. Designed for students working on or off-campus. <b>Note(s):</b> Special approval required; may be taken for a total of 6 credits. <b>Grade Mode:</b> A. <b>Restriction(s):</b> Must be Undergraduate Level. <b>Repeat Limit (total number of credits):</b> 6. <b>Additional Fee(s):</b> May involve lab fees of up to \$185.

**PHSC 460 - Capstone Seminar****Credit 1**

A capstone course for all biochemistry, chemistry, applied physics, physics, and physical science majors that includes: (1) presentation of a seminar, (2) service learning project and, (3) integration readings and discussion. **Grade Mode:** A.

**Restriction(s):** Must be Junior Class, or Senior Class; Biochemistry (BCHM), Chemistry (CHEM), Applied Physics (PHAP), Physics (PHYS), Physical Science (PHSC), Environmental Science (BIES), Human Biology (BIHB), Bio Sci:Secondary Instruction (BISI), or Biological Science (BIOS); and Undergraduate Level.

**PHSC 465 - Special Topics in Physical Science****Credits 1-3**

Varying course content. Topics such as optics, special relativity, nuclear and biophysics will be offered. **Grade Mode:** A.

**Restriction(s):** Must be Junior Class, or Senior Class; Environmental Science (BIES), Human Biology (BIHB), Biological Science (BIOS), Physics (PHYS), Chemistry (CHEM), Applied Physics (PHAP), Engineering Physics (PHEP), Physical Science (PHSC), Biochemistry (BCHM), or Bio Sci:Secondary Instruction (BISI); and Undergraduate Level.

**Repeat Limit (after first attempt):** 10.

**Additional Fee(s):** May involve lab fees of up to \$185.

**PHSC 480 - Advanced Physics Laboratory****Credits 3**

A laboratory course in which selected experiments cover several areas of classical and contemporary physics. Emphasis on data collection and analysis techniques. **Grade Mode:** A.

**Prerequisite(s):** PHSC 234, PHSC 321; MATH 335.

**Restriction(s):** Must be Undergraduate Level.

**Course Fee:** \$130.

**PHSC 490 - Directed Research****Credits 1-3**

Research experience in a field of the student's interest. Designed for students working closely with faculty. **Note(s):** Special approval required; may be taken for a total of 6 credits. **Grade Mode:** A.

**Restriction(s):** Must be Undergraduate Level.

**Repeat Limit (total number of credits):** 6.

**Course Fee:** \$130.