

Area: Science and Engineering  
 Dean: Dr. Rina Roy  
 Phone: (916) 484-8107  
 Counseling: (916) 484-8572

Degree: A.S. - Physical Science/Mathematics  
 A.S. for Transfer Degree - Physics  
 A.S. - General Science

### Physical Science/Mathematics Degree

This program provides a broad study in fields of physical science and mathematics. It provides a good foundation for transfer to a four-year program in science.

#### Student Learning Outcomes

*Upon completion of this program, the student will be able to:*

- recognize and utilize correctly the terminology of math, statistics and/or science.
- analyze and interpret data, charts and graphs using quantitative and qualitative methods.
- recognize and construct valid arguments using deductive and inductive reasoning.
- evaluate new and accepted ideas about the natural universe using testable methodology.

#### Career Opportunities

This program is intended to provide a broad foundation of skills and knowledge to help students succeed in the completion of a bachelor's degree in a variety of science, math or engineering-related areas.

#### Requirements for Degree Major 18 units

A minimum of 18 units from the following: ..... 18<sup>1</sup>  
 Transferable courses must be selected from the following areas:  
 astronomy, chemistry, engineering, geology, mathematics,  
 physical geography, physical science, physics, and statistics.

<sup>1</sup>excludes GIS and cultural geography courses

**Associate Degree Requirements:** The Physical Science/Mathematics Associate in Science (A.S.) Degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

### Physics A.S. for Transfer Degree

The Associate in Science in Physics for Transfer provides students with a major that fulfills the general requirements of the California State University for transfer. Students with this degree will receive priority admission with junior status to the California State University system.

The Associate in Science in Physics for Transfer (A.S.-T) may be obtained by the completion of 60 transferable, semester units with a minimum of a 2.0 GPA, including (a) the major or area of emphasis described in the Required Program outlined below (earning a C or better in these courses), and (b) the Intersegmental General Education Transfer Curriculum (IGETC).

Students interested in transferring to a CSU campus to pursue a bachelor's degree in physics should meet with a counselor to confirm the courses required for lower division preparation in the major. Although additional preparatory courses are not required for this degree, students will be better prepared if they complete differential equations, linear algebra, general chemistry, and at least one computer programming course prior to transferring.

#### Student Learning Outcomes

*Upon completion of this program, the student will be able to:*

- test the validity of a hypothesis using the scientific method.
- identify the basic physical principles that apply in a particular situation.
- solve problems requiring the application of physics and mathematics up through calculus.
- interpret the results of physics calculations.
- define common physics terms and physical laws.
- compose a well-organized and complete lab report.

#### Career Opportunities

This degree is designed to facilitate students' successful transfer to four-year programs that prepare them for advanced study in physics and other related fields, including biophysics, physical chemistry, geophysics, and astrophysics. Physicists with undergraduate and graduate degrees have a broad range of employment opportunities, including high technology, computer programming, research, and teaching.

#### Requirements for Degree 28 Units

MATH 400	Calculus I.....	5
MATH 401	Calculus II.....	5
MATH 402	Calculus III.....	5
PHYS 410	Mechanics of Solids and Fluids.....	5
PHYS 421	Electricity and Magnetism.....	4
PHYS 431	Heat, Waves, Light and Modern Physics.....	4

Associate in Science for Transfer Degree Requirements: The Associate in Science in Physics for Transfer (AS-T) degree may be obtained by completion of 60 transferable, semester units with a minimum 2.0 GPA, including (a) the major or area of emphasis described in the Required Program, and (b) either the Intersegmental General Education Transfer Curriculum (IGETC) or the California State University General Education-Breadth Requirements.

## General Science Degree

This program provides a broad study in the fields of biological and physical sciences in preparation for transfer to a four-year program and continuation of studies in upper division science courses.

### Student Learning Outcomes

Upon completion of this program, the student will be able to:

- evaluate new and accepted ideas about the natural universe using scientific methods.
- analyze a wide variety of natural phenomena using basic definitions and fundamental theories of biological or physical sciences.
- apply appropriate quantitative and qualitative methods to interpret and analyze pertinent data.
- describe the basic definitions and fundamental theories of an introductory natural science.
- articulate orally and/or in writing the importance of continuous examination and modification of accepted ideas as a fundamental element in the progress of science.
- recognize ethical components of scientific decision making and apply personal and social values within the process of decision making in scientific endeavors.

### Requirements for Degree 18 Units

A minimum of 18 units from the following: ..... 18  
 Transfer level science courses including one laboratory course in a physical science and one laboratory course in a biological science. Courses may be selected from anthropology (physical), astronomy, biology, biotechnology, chemistry, geography (physical), geology, natural resources, physical science, physics, and psychology (biological).

**Associate Degree Requirements:** The General Science Associate in Science (A.S.) Degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

## Physical Science

### **PS 300 Introduction to Physical Science 3 Units**

*Advisory: MATH 100 with a grade of "C" or better, AND ENGWR 102 and ENGRD 116 with a grade of "C" or better OR ESLL 320 and ESLR 320 and ESLW 320 with a grade of "C" or better.*

*General Education: AAI/AS Area IV; CSU Area B1; IGETC Area 5A  
 Course Transferable to UC/CSU  
 Hours: 54 hours LEC*

This course covers the fundamental concepts of astronomy, geology, physics, chemistry, and meteorology. It is designed for the student with little or no science background. It is not recommended for science, mathematics, or engineering majors.

### **PS 301 Physical Science Laboratory 1 Unit**

*Corequisite: PS 300*

*Advisory: MATH 100*

*General Education: CSU Area B1; CSU Area B3; IGETC Area 5C  
 Course Transferable to UC/CSU  
 Hours: 54 hours LAB*

This laboratory course provides hands-on experiments in several disciplines in the physical sciences, including physics, chemistry, earth science, and astronomy.

## Physics

### **PHYS 310 Conceptual Physics 3 Units**

*Advisory: MATH 100 with a grade of "C" or better, AND ENGWR 102 and ENGRD 116 with a grade of "C" or better OR ESLL 320 and ESLR 320 and ESLW 320 with a grade of "C" or better.*

*General Education: AAI/AS Area IV; CSU Area B1; IGETC Area 5A  
 Course Transferable to UC/CSU  
 Hours: 54 hours LEC*

This course covers selected topics in motion, gravity, heat, sound, electricity, magnetism, light, and atomic and nuclear physics. It is designed for liberal arts majors and students who have not taken a course in physics.

### **PHYS 311 Basic Physics 3 Units**

*Prerequisite: MATH 330 with a grade of "C" or better*

*Advisory: ENGWR 102 and ENGRD 116 with a grade of "C" or better OR ESLL 320 and ESLR 320 and ESLW 320 with a grade of "C" or better.*

*General Education: AAI/AS Area IV; CSU Area B1; IGETC Area 5A  
 Course Transferable to UC/CSU  
 Hours: 54 hours LEC*

This survey course emphasizes problem solving in physics. Topics include motion in one and two dimensions, forces, energy, and momentum. It is designed for science majors who plan to continue with PHYS 410 or 350.

### **PHYS 312 Conceptual Physics Laboratory 1 Unit**

*Corequisite: PHYS 310*

*General Education: AAI/AS Area IV; CSU Area B1; CSU Area B3; IGETC Area 5C*

*Course Transferable to UC/CSU  
 Hours: 54 hours LAB*

Together with PHYS 310, this course satisfies the UC and CSU general education science lab requirement. Emphasis is placed on scientific observation and measurement and their relationship to physical concepts. This course provides concrete, hands-on observation activities and interpretation of data in a variety of experimental situations.

**PHYS 350 General Physics 4 Units**

*Prerequisite:* MATH 330 with a grade of "C" or better  
*Advisory:* PHYS 311; ENGWR 102 and ENGRD 116 with a grade of "C" or better OR ESLL 320 and ESLR 320 and ESLW 320 with a grade of "C" or better.

*General Education:* AA/AS Area IV; CSU Area B1; CSU Area B3;  
 IGETC Area 5A; IGETC Area 5C  
*Course Transferable to UC/CSU*  
*Hours:* 54 hours LEC; 54 hours LAB

This trigonometry-based physics course covers the mechanics of particles, rigid bodies, and fluids. It also covers mechanical waves, sound, heat, and thermodynamics. The PHYS 350/360 series is designed for biological science students, including those in pre-medical, pre-dental, agricultural, and forestry programs.

**PHYS 360 General Physics 4 Units**

*Prerequisite:* PHYS 350 with a grade of "C" or better  
*Advisory:* ENGWR 102 and ENGRD 116 with a grade of "C" or better OR ESLL 320 and ESLR 320 and ESLW 320 with a grade of "C" or better.

*General Education:* CSU Area B2; CSU Area B3  
*Course Transferable to UC/CSU*  
*Hours:* 54 hours LEC; 54 hours LAB

This trigonometry-based physics course covers electricity, magnetism, basic electric circuit theory, optics, wave behavior, and modern physics. The PHYS 350/360 series is designed for biological science students, including those in pre-medical, pre-dental, agricultural, and forestry programs.

**PHYS 410 Mechanics of Solids and Fluids 5 Units**

*Prerequisite:* MATH 400 with a grade of "C" or better  
*Corequisite:* MATH 401  
*Advisory:* PHYS 311; ENGWR 102 and ENGRD 116 with a grade of "C" or better OR ESLL 320 and ESLR 320 and ESLW 320 with a grade of "C" or better.

*General Education:* AA/AS Area IV; CSU Area B1; CSU Area B3;  
 IGETC Area 5A; IGETC Area 5C  
*Course Transferable to UC/CSU*  
*Hours:* 72 hours LEC; 54 hours LAB

This calculus-based physics course covers the mechanics of particles, rigid bodies, and fluids. The PHYS 410, 421, 431 sequence is required for majors in physics, chemistry, or engineering.

**PHYS 421 Electricity and Magnetism 4 Units**

*Prerequisite:* MATH 401 and PHYS 410 with grades of "C" or better  
*Advisory:* ENGWR 102 and ENGRD 116 with a grade of "C" or better OR ESLL 320 and ESLR 320 and ESLW 320 with a grade of "C" or better.

*Course Transferable to UC/CSU*  
*Hours:* 54 hours LEC; 54 hours LAB

This calculus-based physics course is an in-depth treatment of electricity and magnetism. It involves problem solving with an emphasis on physics problems that require integral calculus.

**PHYS 431 Heat, Waves, Light and Modern Physics 4 Units**

*Prerequisite:* MATH 401 and PHYS 410 with grades of "C" or better  
*Advisory:* ENGWR 102 and ENGRD 116 with a grade of "C" or better OR ESLL 320 and ESLR 320 and ESLW 320 with a grade of "C" or better.

*Course Transferable to UC/CSU*  
*Hours:* 54 hours LEC; 54 hours LAB

This calculus-based physics course explores the fundamental theories of thermodynamics, waves, optics, and modern physics. Topics include heat, temperature, kinetic theory, waves, sound, light reflection and refraction, optics, interference, diffraction, atomic theory, and nuclear physics.