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 - Physics
A.S. - General Science

Physical Science/Mathematics Degree

Major Code: 011228A01

This degree provides a broad study in the fields of physical science and mathematics. It is a good foundation for transfer to a four-year program in science, technology, engineering, or mathematics (STEM).

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		18 Units
A minimum of 18 units from the following:		18
ASTR	300, 310, 320, 330, 400, 481, 495, 499	
CHEM	305, 306, 309, 310, 400, 401, 420, 421, 423, 495, 499	
ENGR	300, 310, 312, 401, 413, 420, 495, 499	
GEOG	300, 301, 305, 306, 307, 308, 309, 391, 392, 393, 394, 495, 499	
GEOL	300, 301, 305, 306, 310, 311, 320, 325, 330, 331, 345, 390, 495, 499	
MATH	300, 310, 311, 320, 325, 330, 336, 340, 342, 355, 356, 370, 372, 373, 400, 401, 402, 410, 420, 480, 495, 499	
PHYS	310, 311, 312, 350, 360, 410, 421, 431, 495, 499	
PS	300, 301, 495, 499	
STAT	300, 305, 495, 499	

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.

This transfer degree can only be awarded using the IGETC pattern:

Physics A.S. for Transfer Degree

Major Code, IGETC: 011972A02

The Associate in Science in Physics for Transfer degree 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 degree (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.

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) the Intersegmental General Education Transfer Curriculum (IGETC) Requirements.

General Science Degree

Major Code: 011229A01

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.
- outline the basic concepts and fundamental theories of a 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.
- discuss 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[1]

Physical Science Courses:

ASTR	300, 310, 320, 330, 400, 481, 495, 499
CHEM	305, 306, 309, 310, 400, 401, 420, 421, 423, 495, 499
GEOG	300, 301, 305, 306, 307, 308, 309, 391, 392, 393, 394, 495, 499
GEOL	300, 301, 305, 306, 310, 311, 320, 325, 330, 331, 345, 390, 495, 499
PHYS	310, 311, 312, 350, 360, 410, 421, 431, 495, 499
PS	300, 301, 495, 499

Biological Science Courses:

ANTH	300, 301, 303, 370, 372, 480, 495, 499
BIOL	300, 301, 303, 305, 310, 322, 332, 342, 352, 370, 375, 390, 400, 410, 415, 420, 430, 431, 440, 442, 482, 495, 499
BIOT	301, 305, 307, 311, 312, 499
NATR	300, 302, 303, 304, 305, 306, 307, 310, 320, 322, 324, 330, 332, 346, 495, 499
PSYC	310, 311, 495, 499

[1]must be transfer-level and must include one laboratory course in a physical science and one laboratory course in a biological science

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.

Physics

PHYS 310 Conceptual Physics **3 Units**

Prerequisite: MATH 32 with a grade of "C" or better, or placement through the assessment process.
Advisory: Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
General Education: AA/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 non-science majors and students who have not taken a course in physics. (Part of C-ID PHYS 140)

PHYS 311 Basic Physics **3 Units**

Prerequisite: MATH 330 or 373 with a grade of "C" or better
Advisory: Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
General Education: AA/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 350 or 410.

PHYS 312 Conceptual Physics Laboratory **1 Unit**

Corequisite: PHYS 310
Advisory: MATH 100, 104, or 132
General Education: AA/AS Area IV; CSU Area B3; IGETC Area 5C
Course Transferable to UC/CSU
Hours: 54 hours LAB

This laboratory course provides hands-on observation activities and interpretation of data in a variety of experimental situations. Topics include motion, sound, light, heat, electricity, and magnetism. (Part of C-ID PHYS 140)

PHYS 350 General Physics **4 Units**

Prerequisite: MATH 330 or 373 with a grade of "C" or better
Advisory: PHYS 311; and eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
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. (C-ID PHYS 105; Part of C-ID PHYS 100S)

PHYS 360 General Physics **4 Units**

Prerequisite: PHYS 350 with a grade of "C" or better
Advisory: Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
General Education: 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 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. (C-ID PHYS 110; Part of C-ID PHYS 100S)

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; and eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
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. (C-ID PHYS 205; Part of C-ID PHYS 200S)

PHYS 421 Electricity and Magnetism 4 Units
Prerequisite: MATH 401 and PHYS 410 with grades of "C" or better
Advisory: Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
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. (C-ID PHYS 210; Part of C-ID PHYS 200S)

PHYS 431 Heat, Waves, Light and Modern Physics 4 Units
Prerequisite: MATH 401 and PHYS 410 with grades of "C" or better
Advisory: Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
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. (C-ID PHYS 215; Part of C-ID PHYS 200S)

PHYS 495 Independent Studies in Physics 1-3 Units
Prerequisite: None
Course Transferable to CSU
Hours: 54-162 hours LAB

Independent Study is an opportunity for the student to extend classroom experience in this subject, while working independently of a formal classroom situation. Independent study is an extension of work offered in a specific class in the college catalog. To be eligible for independent study, students must have completed the basic regular catalog course at American River College. They must also discuss the study with a professor in this subject and secure approval. Only one independent study for each catalog course will be allowed.

Physical Science

PS 300 Introduction to Physical Science 3 Units
Advisory: MATH 100, 104 or 132 with a grade of "C" or better, AND eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
General Education: AA/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, 104, or 132
General Education: 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.

PS 495 Independent Studies in Physical Science 1-3 Units
Prerequisite: None
Course Transferable to CSU
Hours: 54-162 hours LAB

Independent Study is an opportunity for the student to extend classroom experience in this subject, while working independently of a formal classroom situation. Independent study is an extension of work offered in a specific class in the college catalog. To be eligible for independent study, students must have completed the basic regular catalog course at American River College. They must also discuss the study with a professor in this subject and secure approval. Only one independent study for each catalog course will be allowed.