Astronomy
| American River College

Astronomy is part of the general education program at American River College. The astronomy course offerings include Introduction to Astronomy, The Solar System, Stars/Galaxies/Cosmology, Introduction to Astrobiology, Honors Introduction to Astronomy, Independent Studies in Astronomy, and an Astronomy Laboratory. All courses comply with general education transfer requirements.

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Associate Degree

A.S. in General Science

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.

Degree Requirements

COURSE CODE	COURSE TITLE	UNITS
A minimum of 18 units from the following:		18[1]
Physical Science Courses		
ASTR 300	Introduction to Astronomy (3)	
ASTR 310	The Solar System (3)	
ASTR 320	Stars, Galaxies, and Cosmology (3)	
ASTR 330	Introduction to Astrobiology (3)	
ASTR 400	Astronomy Laboratory (1)	
ASTR 481	Honors Astronomy: Stars, Galaxies, and Cosmology (4)	
ASTR 495	Independent Studies in Astronomy (1 - 3)	
ASTR 499	Experimental Offering in Astronomy (0.5 - 4)	
CHEM 305	Introduction to Chemistry (5)	
CHEM 306	Introduction to Organic and Biological Chemistry (5)	
CHEM 309	Integrated General, Organic, and Biological Chemistry (5)	
CHEM 310	Chemical Calculations (4)	
CHEM 400	General Chemistry I (5)	
CHEM 401	General Chemistry II (5)	
CHEM 420	Organic Chemistry I (5)	

COURSE CODE	COURSE TITLE	UNITS
CHEM 421	Organic Chemistry II (5)	
CHEM 423	Organic Chemistry - Short Survey (5)	
CHEM 495	Independent Studies in Chemistry (1 - 3)	
CHEM 499	Experimental Offering in Chemistry (0.5 - 4)	
GEOG 300	Physical Geography: Exploring Earth's Environmental Systems (3)	
GEOG 301	Physical Geography Laboratory (1)	
GEOG 305	Global Climate Change (3)	
GEOG 306	Weather and Climate (3)	
GEOG 307	Environmental Hazards and Natural Disasters (3)	
GEOG 308	Introduction to Oceanography (3)	
GEOG 309	Introduction to Oceanography Lab (1)	
GEOG 391	Field Studies in Geography: Mountain Landscapes (1 - 4)	
GEOG 392	Field Studies in Geography: Coastal Landscapes (1 - 4)	
GEOG 393	Field Studies in Geography: Arid Landscapes (1 - 4)	
GEOG 394	Field Studies in Geography: Volcanic Landscapes (1 - 4)	
GEOG 495	Independent Studies in Geography (1 - 3)	
GEOG 499	Experimental Offering in Geography (0.5 - 4)	
GEOL 300	Physical Geology (3)	
GEOL 301	Physical Geology Laboratory (1)	
GEOL 305	Earth Science (3)	
GEOL 306	Earth Science Laboratory (1)	
GEOL 310	Historical Geology (3)	
GEOL 311	Historical Geology Laboratory (1)	
GEOL 320	Global Climate Change (3)	
GEOL 325	Environmental Hazards and Natural Disasters (3)	
GEOL 330	Introduction to Oceanography (3)	
GEOL 331	Introduction to Oceanography Lab (1)	
GEOL 345	Geology of California (3)	
GEOL 390	Field Studies in Geology (1 - 4)	
GEOL 495	Independent Studies in Geology (1 - 3)	
GEOL 499	Experimental Offering in Geology (0.5 - 4)	
PHYS 310	Conceptual Physics (3)	
PHYS 311	Basic Physics (3)	
PHYS 312	Conceptual Physics Laboratory (1)	
PHYS 350	General Physics (4)	
PHYS 360	General Physics (4)	
PHYS 410	Mechanics of Solids and Fluids (5)	
PHYS 421	Electricity and Magnetism (4)	
PHYS 431	Heat, Waves, Light and Modern Physics (4)	

COURSE CODE	COURSE TITLE	UNITS
PHYS 495	Independent Studies in Physics (1 - 3)	
PHYS 499	Experimental Offering in Physics (0.5 - 4)	
PS 300	Introduction to Physical Science (3)	
PS 301	Physical Science Laboratory (1)	
PS 495	Independent Studies in Physical Science (1 - 3)	
PS 499	Experimental Offering in Physical Science (0.5 - 4)	
Biological Science Courses		
ANTH 300	Biological Anthropology (3)	
ANTH 301	Biological Anthropology Laboratory (1)	
ANTH 303	Introduction to Forensic Anthropology (3)	
ANTH 370	Primatology (3)	
ANTH 372	Primatology Field Studies (2)	
ANTH 480	Honors Biological Anthropology (3)	
ANTH 495	Independent Studies in Anthropology (1 - 3)	
ANTH 499	Experimental Offering in Anthropology (0.5 - 4)	
BIOL 300	The Foundations of Biology (3)	
BIOL 301	Evolution (3)	
BIOL 303	Survey of Biology (4)	
BIOL 305	Natural History (4)	
BIOL 310	General Biology (4)	
BIOL 322	Ethnobotany (3)	
BIOL 332	Introduction to Ornithology (4)	
BIOL 342	The New Plagues: New and Ancient Infectious Diseases Threatening World Health (3)	
BIOL 352	Conservation Biology (3)	
BIOL 370	Marine Biology (4)	
BIOL 375	Marine Ecology (3)	
BIOL 390	Natural History Field Study (0.5 - 4)	
BIOL 400	Principles of Biology (5)	
BIOL 410	Principles of Botany (5)	
BIOL 415	Introduction to Biology: Biodiversity, Evolution, and Ecology (5)	
BIOL 420	Principles of Zoology (5)	
BIOL 430	Anatomy and Physiology (5)	
BIOL 431	Anatomy and Physiology (5)	
BIOL 440	General Microbiology (4)	
BIOL 442	General Microbiology and Public Health (5)	
BIOL 482	Honors Marine Biology (4)	
BIOL 495	Independent Studies in Biology (1 - 3)	
BIOL 499	Experimental Offering in Biology (0.5 - 4)	
BIOT 301	Biotechnology and Human Health (3)	

COURSE CODE	COURSE TITLE	UNITS
BIOT 305	Introduction to Bioinformatics (1)	
BIOT 307	Biotechnology and Society (2)	
BIOT 311	Biotechnology Laboratory Methods - Molecular Techniques (2)	
BIOT 312	Biotechnology Laboratory Methods - Microbial and Cell Culture Techniques (2)	
BIOT 499	Experimental Offering in Biology (0.5 - 4)	
NATR 300	Introduction to Natural Resource Conservation and Policy (4)	
NATR 302	Introduction to Wildlife Biology (4)	
NATR 303	Energy and Sustainability (3)	
NATR 304	The Forest Environment (3)	
NATR 305	Fisheries Ecology and Management (4)	
NATR 306	Introduction to Rangeland Ecology and Management (3)	
NATR 307	Principles of Sustainability (4)	
NATR 310	Study Design and Field Methods (4)	
NATR 320	Principles of Ecology (4)	
NATR 322	Environmental Restoration (2)	
NATR 324	Field Studies: Birds and Plants of the High Sierra (1.5)	
NATR 330	Native Trees and Shrubs of California (4)	
NATR 332	Wildflowers of California (3)	
NATR 346	Water Resources and Conservation (3)	
NATR 495	Independent Studies in Natural Resources (1 - 3)	
NATR 499	Experimental Offering in Natural Resources (0.5 - 4)	
PSYC 310	Biological Psychology (3)	
PSYC 311	Biological Psychology Laboratory (1)	
PSYC 495	Independent Studies in Psychology (1 - 3)	
PSYC 499	Experimental Offering in Psychology (0.5 - 4)	
Total Units:		18

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

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.

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.

Astronomy (ASTR)

ASTR 300 Introduction to Astronomy

Units:	3
Hours:	54 hours LEC
Prerequisite:	None.
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.
Transferable:	CSU; UC (ASTR 300, 310 and 320 combined: maximum credit, two courses)
General Education:	AA/AS Area IV; CSU Area B1; IGETC Area 5A

This course covers topics in modern planetary and stellar astronomy, such as dwarf, jovian, terrestrial, and extrasolar planets and the life cycle of stars, black holes, and supernovae. It also includes topics on cosmology and galactic astronomy, such as dark matter, dark energy, the Big Bang, and the expansion of the Universe.

Student Learning Outcomes

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

- evaluate early models of the solar system using the scientific method and outline the historical events that led to our current model.
- apply theories and models from classical physics and modern physics to explain astronomical observations, such as the motion of objects in the sky, the formation of planets, and the life cycle of stars.
- classify the planets as terrestrial or jovian and list the characteristics of each category.
- discuss the discovery of new Kuiper belt objects and how their existence changed our definition of what a planet is.
- describe how extrasolar planets are detected and discuss their properties.
- describe the structure of the Sun and its source of energy.
- explain how astronomers collect light from distant stars and discuss what can be learned from analyzing that light.
- classify different types of stars and galaxies, and discuss the stellar life cycle in the context of stellar evolution.
- describe the astronomical evidence for dark matter and dark energy, and discuss their implications.
- describe the scientific evidence and models regarding the nature and origin of the Universe, including its evolution from the Big Bang up to today.

ASTR 310 The Solar System

Units:	3
Hours:	54 hours LEC
Prerequisite:	None.
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.
Transferable:	CSU; UC (ASTR 300, 310 and 320 combined: maximum credit, two courses)
General Education:	AA/AS Area IV; CSU Area B1; IGETC Area 5A

This course explores the nature and evolution of the solar system. Topics include the night-time sky, the history of astronomy, the tools of astronomy, and the origins and characteristics of planets, their satellites, and other components of the solar system. Emphasis is placed on how astronomers gain and refine their knowledge of the Universe and interpret the latest results of planetary exploration.

Student Learning Outcomes

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

- describe and explain the apparent motion of stars and planets in the night-time sky over the course of a day, a season, and a year.
- evaluate early models of the solar system using the scientific method, and outline the historical events that led to our current model.
- apply current scientific theories and models from classical and modern physics to explain astronomical observations, such as the motion of objects in the solar system and the formation and evolution of planets and the Sun.
- classify the planets as terrestrial or jovian and list the characteristics of each category.
- describe the role plate tectonics, volcanism, and magnetic fields play in shaping the surfaces, habitability, and other properties of different planetary bodies.
- identify the larger moons in the solar system and describe what makes them unique.
- identify other elements of the solar system, such as comets and asteroids; describe their characteristics and what can be learned from them.
- discuss the discovery of new Kuiper belt objects and how their existence changed our definition of what a planet is.
- describe how extrasolar planets are detected and discuss their properties.
- describe the structure of the Sun and its source of energy.

ASTR 320 Stars, Galaxies, and Cosmology

Units:	3
Hours:	54 hours LEC
Prerequisite:	None.
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.
Transferable:	CSU; UC (ASTR 300, 310, and 320 combined: maximum credit, two courses; ASTR 320 and 480 combined: maximum credit, one course ASTR 320 and 481 combined: maximum credit, one course)
General Education:	AA/AS Area IV; CSU Area B1; IGETC Area 5A

This course explores the nature and evolution of stars, galaxies, and the Universe. Topics include the history of astronomy, the tools of astronomy, star classification, stellar evolution, neutron stars, black holes, and the Big Bang. Emphasis is placed on how astronomers gain and refine their knowledge of the Universe and interpret the latest results of space exploration.

Student Learning Outcomes

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

- evaluate early models of the Universe using the scientific method and outline the historical events that led to our current model.
- explain how astronomers collect light from distant stars and discuss what can be learned from analyzing that light.
- apply theories and models from classical physics and modern physics to explain astronomical observations, such as the formation of black holes, the red-shift of light coming from distant galaxies, and the life cycle of the Sun.
- classify different star types and discuss their life cycles in the context of stellar evolution.

- classify galaxies and describe how they formed and evolved.
- describe the astronomical evidence for dark matter and dark energy, and discuss their implications.
- discuss the scientific evidence and models regarding the nature and origin of the Universe, including its evolution from the Big Bang up to today.

ASTR 330 Introduction to Astrobiology

Units:	3
Hours:	54 hours LEC
Prerequisite:	None.
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.
Transferable:	CSU; UC (ASTR 300, 310 and 320 combined: maximum credit, two courses)
General Education:	AA/AS Area IV; CSU Area B1; IGETC Area 5A

This course explores the possibilities of life beyond Earth and what can we learn from terrestrial life forms surviving in extreme conditions. Topics include the origin, biology, and evolution of life on Earth, habitability and interior energy sources of Earth and other planets in the solar system, the likelihood of life existing on other planets or moons within our solar system, attempts to locate life within our solar system, and attempts to communicate with intelligent life in other parts of the galaxy.

Student Learning Outcomes

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

- discuss the origin of life on Earth and describe the evidence supporting the current models.
- describe how plate tectonics, volcanism, the atmosphere, and magnetic fields influenced the evolution of life on different planetary bodies.
- construct a set of criteria for determining the likelihood of finding life in a particular environment.
- evaluate the evidence for past microbial life on Mars.
- discuss the possibility of finding life on other planets or moons in the solar system.
- assess the chances of communicating successfully with technically advanced civilizations elsewhere in the galaxy.
- describe the nature of life on Earth: from cells to DNA, Darwinism, and the evolution of species.
- discuss topics related to astrobiology, such as the Cambrian explosion, mass extinctions, and genetic engineering of artificial life forms.
- identify different types of extremophiles and discuss how life can exist under such extreme conditions.

ASTR 400 Astronomy Laboratory

Units:	1
Hours:	54 hours LAB
Prerequisite:	None.
Corequisite:	ASTR 300, 310, 320, or 330
Transferable:	CSU; UC
General Education:	CSU Area B3; IGETC Area 5C

This course covers the practical use of a telescope for visual observation of astronomical objects and the analysis of astronomical data. Topics may include constellation identification, stellar spectroscopy, solar and lunar observations, radio-physics and radio-astronomy, image analysis, measuring the properties

of stars, and determining the age of the Universe. Night-time on-campus field trips are required.

Student Learning Outcomes

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

- set up and align a telescope.
- locate constellations and deep sky objects in the night sky with the aid of a telescope and star chart.
- explain the apparent motions of the planets, Sun, and stars.
- explain eclipses and the phases of the Moon.
- explain sunspots and the basic functioning of the Sun.
- analyze astronomical data.
- list different types of spectra used by astronomers and explain what they reveal about the composition and the temperature of stars.
- organize data on stellar properties to create a Hertzsprung-Russell (HR) diagram.
- estimate the age of the Universe based on Hubble's Law and the Hubble time.

ASTR 481 Honors Astronomy: Stars, Galaxies, and Cosmology

Units:	4
Hours:	54 hours LEC; 54 hours LAB
Prerequisite:	Placement into ENGWR 480 through the assessment process.
Advisory:	MATH 100, 104, or 132 with a grade of "C" or better
Transferable:	CSU; UC (UC Credit limitation: ASTR 320 and 481 combined: maximum credit, one course)
General Education:	AA/AS Area IV; CSU Area B1; CSU Area B3; IGETC Area 5A; IGETC Area 5C

This seminar-style course is an in-depth introduction to astronomy, focusing on stars, galaxies, and cosmology. It approaches current topics in astronomy through class discussion and laboratory activities, with an emphasis on critical thinking, problem-solving techniques, and conceptual reasoning.

Student Learning Outcomes

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

- systematize astronomical conceptual knowledge while evaluating current astronomy theories and observations.
- discuss modern topics and problems pertaining to stellar evolution, galactic astronomy, cosmology, and related areas.
- estimate the age of the Universe based on Hubble's Law and the Hubble time.
- explain how astronomers collect light from distant stars and discuss what can be learned from analyzing that light.
- classify different star types and discuss their life cycles in the context of stellar evolution.
- describe the astronomical evidence for dark matter and dark energy, and discuss their implications.
- discuss the scientific evidence and models regarding the nature and origin of the Universe, including its evolution from the Big Bang up to today.
- apply theories and models from classical physics and modern physics to explain astronomical observations, such as the formation of black holes, the red-shift of light coming from distant galaxies, and the life cycle of the Sun.
- conduct optical and radio telescope observations and data analysis.
- set up and align a telescope.

- explain the apparent motions of the planets, Sun, and stars.

ASTR 495 Independent Studies in Astronomy

Units:	1 - 3
Hours:	54 - 162 hours LAB
Prerequisite:	None.
Transferable:	CSU

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.

Faculty

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