ASTR 42 Course Outline as of Summer 2025

CATALOG INFORMATION

Dept and Nbr: ASTR 42 Title: LIFE IN THE UNIVERSE
Full Title: Life in the Universe
Last Reviewed: 5/8/2023

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	3.00	Lecture Scheduled	3.00	17.5	Lecture Scheduled	52.50
Minimum	3.00	Lab Scheduled	0	6	Lab Scheduled	0
		Contact DHR	0		Contact DHR	0
		Contact Total	3.00		Contact Total	52.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 105.00 Total Student Learning Hours: 157.50

Title 5 Category:	AA Degree Applicable
Grading:	Grade or P/NP
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	ASTRON 42

Catalog Description:
This course offers an overview of life in the universe. The students will learn about the universal context of life from the Big Bang to present; the origin, nature, and evolution of life on Earth; habitable zones and the potential habitability of planets; the search for life within and beyond the Solar System; discovery, and nature of exoplanets (extra-solar planets); astronomical signatures and markers of life; and the possibility of interstellar travel and communication. Content will focus primarily on astronomy, but will also include concepts from biology, geology, chemistry, and physics.

Prerequisites/Corequisites:

Recommended Preparation:
Eligibility for ENGL 1A or equivalent

Limits on Enrollment:

Schedule of Classes Information:
Description: This course offers an overview of life in the universe. The students will learn about the universal context of life from the Big Bang to present; the origin, nature, and evolution of life

on Earth; habitable zones and the potential habitability of planets; the search for life within and beyond the Solar System; discovery, and nature of exoplanets (extra-solar planets); astronomical signatures and markers of life; and the possibility of interstellar travel and communication. Content will focus primarily on astronomy, but will also include concepts from biology, geology, chemistry, and physics. (Grade or P/NP)
Prerequisites/Corequisites:
Recommended: Eligibility for ENGL 1A or equivalent
Limits on Enrollment:
Transfer Credit: CSU;UC.
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**		Effective:	Inactive:
	C	Natural Sciences	Fall 2024	
CSU GE:	**Transfer Area**		Effective:	Inactive:
	B1	Physical Science	Fall 2024	
IGETC:	**Transfer Area**		Effective:	Inactive:
	5A	Physical Sciences	Fall 2024	

CSU Transfer:	Transferable	Effective:	Fall 2024	Inactive:
UC Transfer:	Transferable	Effective:	Fall 2024	Inactive:

CID:

Certificate/Major Applicable:
Major Applicable Course

COURSE CONTENT

Student Learning Outcomes:
At the conclusion of this course, the student should be able to:
1. Summarize the environmental requirements for life and the development of life on Earth.
2. Describe the methods used by scientists to discover and characterize extra-solar planets.
3. Critically analyze the potential habitability of planets both within and outside the Solar System using evidence-based reasoning and the scientific method.

Objectives:
At the conclusion of this course, the student should be able to:
1. Identify key events and characteristics that led to the formation of Earth as a habitable planet.
2. Define life and describe the history and nature of life on Earth.
3. Calculate the habitable zone range around various types of stars.
4. Compare and contrast the atmospheric and climate histories of Venus, Earth, and Mars.
5. Summarize the search for life within and beyond the Solar System, including lander, satellite, and flyby missions as well as space- and ground-based telescopes.
6. Synthesize observational data about exoplanets to determine their size, mass, likely composition, and potential habitability.
7. Describe the technical challenges and limitations inherent to the study of distant worlds, interstellar travel, and communication.
8, Analyze spectroscopic markers of extraterrestrial life, and determine the signatures and

markers that would be required for a positive detection of life.

Topics and Scope:

I. The Universal Context of Life
   A. Structures and scale within the universe
      1. Units of measure
      2. Our cosmic address
   B. Timeline of universal history
II. The Physics of Planetary Orbits
   A. The Universal Law of Gravitation
   B. Newton's three laws of motion
   C. Kepler's Laws of planetary motion
III. Chemical Building Blocks of Life
   A. Supernovae and galactic recycling
   B. Composition of nebulae and primordial clouds
   C. Meteorite composition
IV. The Habitability of Earth
   A. Reconstructing the history of Earth and life
   B. The Hadean Earth and the dawn of life
   C. Geology and habitability
   D. Climate regulation and change
V. The Nature of Life on Earth
   A. Defining life
   B. Cells: the basic units of life
   C. Metabolism: the chemistry of life
   D. DNA and heredity
   E. Extremophiles
VI. The Origins and Evolution of Life on Earth
   A. Searching for the origin of life
   B. Evolution
   C. Impacts and extinctions
VII. Habitable Zones
   A. Definitions of “habitable zone”
   B. Habitable zones around stars of varying life stages and mass
   C. Inverse-square law
VIII. Planetary Habitability in the Solar System
   A. Environmental requirements for life
   B. Venus
      1. Potential early placement in habitable zone
      2. Climate history of Venus
   C. Mars
      1. Climate history of Mars
      2. Exploration of Mars
      3. The search for life on Mars
   D. Jovian Satellites
      1. Survey of outer Solar System satellites
      2. Exploration of the outer satellites
      3. The search for life in the outer satellites
IX. Exoplanet Discovery
   A. Transit and eclipse method
      1. Kepler Mission

2. Transiting Exoplanet Survey Satellite (TESS) Mission
B. Radial velocity method
C. Other discovery methods
D. Calculating planetary mass, size, and density

X. Types of Exoplanets
A. Terrestrial planets and “super-Earths”
B. Jovian planets and “hot Jupiters”
C. Other types of planets
D. Survey of discovered potentially habitable planets

XI. Signatures and Markers of Distant Extraterrestrial Life
A. Spectroscopy of exoplanet atmospheres
B. Planetary atmosphere modeling
C. Hunt for radio and laser communication
D. Search for Extraterrestrial Intelligence (SETI) Program

XII. Interstellar Travel
A. Light travel time and communication delays
B. Special relativity and time dilation
C. Transit times with various technologies
D. Interstellar comets and asteroids

XIII. Possibility of Intelligent Life in the Universe
A. Fermi paradox
B. Von Neumann probes and the Great Filter
C. The Drake Equation
D. Sociological implications of extraterrestrial life

Assignment:

1. Weekly reading from the textbook or instructor prepared materials (20-30 pages)
2. Homework assignments (weekly)
3. Research paper(s) (0-2)
4. In-class exercises (weekly)
5. Exam(s) (0-4)
6. Quizzes (6-16)
7. Final exam

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

Written homework assignments; research paper(s)	Writing 10 - 30%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Problem-solving homework assignments; in-class exercises	Problem solving 10 - 30%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

None	Skill Demonstrations 0 - 0%

Exams: All forms of formal testing, other than skill performance exams.

Exam(s); quizzes; final exam	Exams 60 - 80%

Other: Includes any assessment tools that do not logically fit into the above categories.

Participation	Other Category 0 - 10%

Representative Textbooks and Materials:
Life in the Universe. 5th ed. Bennet, J., Shostak, S., Schneider, N., and MacGregor, M. Princeton University Press. 2022.