ASTR 0007 - LIFE IN THE UNIVERSE

Catalog Description

Formerly known as INT 11
Hours: 54 lecture
Description: Study of the emerging discipline of astrobiology. Designed for science and non-science majors. Relevant principles of biology, astronomy, and earth science used in searching for life in the universe. Includes cultural and philosophical implications of life existing elsewhere in the universe. (CSU, UC)

Course Student Learning Outcomes

- CSLO #1: Analyze basic science and core physics, to discover how they apply to astronomy.
- CSLO #2: Apply concepts from planetary astronomy to investigate the types of different planetary classes and other objects in the solar system.
- CSLO #3: Relate core concepts in basic science to stellar astronomy, assessing the various factors that are important to stellar evolution.
- CSLO #4: Investigate astrobiology, and relate concepts of life, evolution, and the universe to what can be observed.

Effective Term

Fall 2019

Course Type

Credit - Degree-applicable

Contact Hours

54

Outside of Class Hours

108

Total Student Learning Hours

162

Course Objectives

Students will:
1. Discuss the parameters that influence habitability of planets and moons in the universe, identifying which known bodies meet these requirements
2. Explain the requirements of life, including how these requirements are met by living things on Earth and what modifications might exist in other life forms
3. Discuss the biological, geological, and astronomical processes which have supported evolution of life on Earth; describe the ways in which these processes may have supported the evolution of life in other parts of the universe
4. Discuss current and past beliefs regarding extraterrestrial life, including references to the scientific community, common culture, and the media
5. Compare and contrast current and past efforts to contact and research extraterrestrial life, including discussion of NASA, SETI, and international space agencies; explain the principles being examined in prior space exploration, such as the Viking missions to Mars
6. Apply scientific methodology to questions that arise within the scope of this course
7. Calculate distances within the universe and traveling times given a number of specific scenarios
8. Evaluate the philosophical implications of the existence of life in the universe

General Education Information

- Approved College Associate Degree GE Applicability
  - AA/AS - Life Sciences
  - AA/AS - Physical Sciences
- CSU GE Applicability (Recommended-requires CSU approval)
  - CSUGE - B1 Physical Science
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)
  - IGETC - 5A Physical Science

Articulation Information

Methods of Evaluation

- Classroom Discussions
  - Example: 1. Many topics raised in Astrobiology are controversial. Students select a topic of their own choosing, and present their opinions on it to the rest of the class. The students support their opinions with appropriate, reasoned arguments. Students defend their opinions in an open class discussion afterwards. Examples: “We should absolutely be concerned about artificial intelligence, as we approach a dangerous technological singularity.” OR, “Our future as a species lies in the development of a space program, with abilities to defend ourselves from cometary/asteroidal impact.” OR “We should absolutely not be beaming ‘Hello’ messages into space.” Assessment of the pieces are based upon clarity of presentation, and how well the student defends the opinion.
- Objective Examinations
  - Example: 1. Standard exams (three) and final exams with a variety of question formats which allow evaluation of all levels of performance according to Bloom's taxonomy, such as "Discuss the implication that life's existence in extreme environments on Earth has on the potential for existence of life elsewhere in the universe." Answers will be assessed based upon accuracy and development of ideas. Example: In an extrasolar planetary system containing a single planet, the parent star is measured to move about its center of mass every 24 years. Given this, what is the orbital period of the planet?
- Problem Solving Examinations
  - Example: 1. In class problems are given after a discussion of a main topic is covered in class. Example: After a discussion of radiometric dating, everyone in the class is given a coin to flip. All the students are parent, radioactive elements. The students then calculate how many half-lives will be required for the classroom of radioactive elements to decay to one student remaining. We flip coins repeated until one person remains. We analyze the accuracy of our predictions. Then we use classroom exhibits to further this analysis. Students hand in their analysis forms for grading.
- Projects

- Example: 1. Projects to demonstrate application of concepts learned in classroom to current research in astronomy, biology, and earth science. For example, students are tasked to attend a seminar or watch a televised program and summarize and critique the content provided. Student will be assessed using an instructor-developed rubric. Example: Astrobiology treats many profound topics relating to the Universe, life, humanity, and our future as a species. As a possible extra credit activity, students are encouraged to create original art based upon a class topic. Such artists meet with the instructor, develop a project outline with approximate time expectations (artists tend to underestimate the time projects take to complete), and artistic statement. Criteria are developed during these sessions, which will be used to grade the piece. Students complete the project, then present the completed piece to the class. A question and answer session follows. Evaluation is based upon the targets decided upon by the student and instructor.

Repeatable

No

Methods of Instruction

- Lecture/Discussion
- Distance Learning

Lecture:

1. The instructor will provide the students with a list of extreme environments on Earth and the requirements that living things must meet to survive in these environments. The instructor will also provide information about extremophilic organisms that live in these environments. Groups of students will then be asked to assess how these extremophiles meet the requirements previously formulated. (Objective 1)
2. The instructor will provide more detailed information on a specific extreme condition on Earth and possible strategies an organism may adopt for survival. In particular, the instructor will give information about thermophilic bacteria that thrive in hot springs. Student groups will then be asked to assess the applicability of these strategies by an organism attempting to survive in the very high temperature environment of Venus. The instructor will then mediate a "conference" in which each group reports its findings and critiques the findings of the other groups. (Objective 2)
3. The instructor will direct students to a variety of resources on the Internet which compile the latest discoveries of extra-solar planets. Students will report back as to the percentage of extra-solar planets that are roughly Earth-sized. (Objective 3)
4. The instructor will identify a set of movies or television programs which depict the first contact between extraterrestrial species and humanity. The students will be tasked to analyze the depiction of the species, based upon concepts discussed in class, such as anthropomorphic prejudices, scientific plausibility, and the likelihood that the social ramifications of such contact are reasonably depicted. (Objective 4)

Distance Learning

1. Instructor will create a discussion board prompt concerning the value of expending social resources on space exploration. Students are pre-framed with the reminder that space exploration is expensive and risky, both in terms of human life and resources, yet can have significant payoff both scientifically and technologically. Students are asked to provide arguments either for or against continued space research efforts. Students are also asked to comment and interact upon at least two other's postings, in a productive and collegiate manner. (Objective 5)
2. Students are to watch a video, created by the instructor, in which the instructor explores their neighborhood, looking at life forms (plants, animals, fungi, symbionts), and interprets them from the lens of astrobiology. Students are then encouraged to repeat this exercise themselves, and report back with observations on trophic interactions and biological adaptations they observed, in their own neighborhood. (Objective 6)

Typical Out of Class Assignments
Reading Assignments

1. Read from assigned text on life in our solar system and be prepared to discuss in class. 2. Reading assignments from other sources, such as periodicals and government and academic websites on topics related to astrobiology followed by classroom discussion.

Writing, Problem Solving or Performance

1. Practice essay questions (for exams), such as "Discuss the historical conditions on Mars and whether these conditions would have been suitable for life". 2. Regular homework assignments will include problems from the textbook and analysis of lectures. 3. In-class presentation on a controversial, relevant topic of the student's choice.

Other (Term projects, research papers, portfolios, etc.)
Required Materials

- Life in the Universe
  - Author: Bennett, J.O., and S. Shostak
  - Publisher: Pearson Education
  - Publication Date: 2016
  - Text Edition: 4th
  - Classic Textbook?: No
  - OER Link:
  - OER:

Other materials and-or supplies required of students that contribute to the cost of the course.