

LAST REVIEW: 2008-2009

NEXT REVIEW: 2013-2014

STATUS: A

COURSE TITLE: The Scientific Search for Life in the Universe

COMMON COURSE NUMBER: AST 1037

CREDIT HOURS: 3

CONTACT HOUR BREAKDOWN

(per 16 week term)

CLOCK HOURS:

(Voc. Course ONLY)

Lecture: 48 Lab:

Clinic: Other:

PREREQUISITE(S): None

COREQUISITE(S): None

PRE/COREQUISITE(S):

COURSE DESCRIPTION *(750 characters, maximum):*

This interdisciplinary course examines the nature and history of life on earth, possible life favoring environments within the solar system and in detecting life in the universe at large. Topics of discussion include the evolution and biochemistry of terrestrial life, the formation of organic compounds in the solar system and other extraterrestrial environments, physical constraints, equipment, and strategies for detecting intelligent life in the universe.

General Education Requirements – Associate of Arts Degree (AA), meets Area(s):

Area

General Education Requirements – Associate in Science Degree (AS), meets Area(s):

Area

UNIT TITLES

1. What is life?
2. Where do we find life?
3. Life in our Solar System
4. Life beyond our Solar System
5. How do we look for life?

EVALUATION:

Please provide a brief description (250 characters maximum) that details how students will be evaluated on the course outcomes. Upon successful completion of this course, the students should be able to demonstrate some general knowledge and information about environments that might plausibly support extraterrestrial life and about scientific technologies that might detect such life.

**** Complete the following only if course is seeking general education status ****

GENERAL EDUCATION Competencies and Skills*:

Please highlight in green font all Competencies/Skills from the list below that apply to this course. In the box to the right of the Competency/Skill, enter all specific learning outcome numbers (i.e. 1.1, 2.7, 5.12) that apply.

1. Read with critical comprehension	
2. Speak and listen effectively	
3. Write clearly and coherently	
4. Think creatively, logically, critically, and reflectively (analyze, synthesize, apply, and evaluate)	
5. Demonstrate and apply literacy in its various forms: (highlight in green ALL that apply) (1. technological, 2. informational, 3. mathematical, 4. scientific, 5. cultural, 6. historical, 7. aesthetic and/or 8. environmental)	
6. Apply problem solving techniques to real-world experiences	
7. Apply methods of scientific inquiry	
8. Demonstrate an understanding of the physical and biological environment and how it is impacted by human beings	
9. Demonstrate an understanding of and appreciation for human diversities and commonalities	
10. Collaborate with others to achieve common goals.	
11. Research, synthesize and produce original work	
12. Practice ethical behavior	
13. Demonstrate self-direction and self motivation	
14. Assume responsibility for and understand the impact of personal behaviors on self and society	
15. Contribute to the welfare of the community	

* General Education Competencies and Skills endorsed by '05-'06 General Education Task Force

UNITS

Unit 1 What is life?

General Outcome:

- 1.0 The student shall:** be able to demonstrate an understanding of life on earth with special emphasis upon general physical, chemical, and biological constraints.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 1.1 Discuss the primary chemical and physical characteristics of known terrestrial life forms.
- 1.2 Discuss the shared metabolic strategies of all terrestrial life as well as the distinguishing cellular morphologies and metabolic processes of the primary kingdoms, phyla, and classes.
- 1.3 Describe the chemical characteristics and biochemical roles of the most abundant biologically essential elements (e.g. carbon, nitrogen, oxygen, hydrogen, sulfur, and phosphorus).
- 1.4 Describe the primary divisions of biological evolution (e.g. domains of the *Eukarya*, *Eubacteria*, and *Archaea*) as revealed by the molecular genetics of RNA and DNA.

Unit 2 Where do we find life?

General Outcome:

- 2.0 The student shall:** be able to demonstrate an understanding of the history and evolution of life on earth with special emphasis upon general physical, chemical, and biological constraints.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 2.1** Recognize the primary divisions of geologic time (e.g. the Phanerozoic, Proterozoid, and Archean eons) including a familiarity with important characteristics of the fossil record and other tracers of past terrestrial conditions.
- 2.2** Describe range of environments where life has been successfully maintained.
- 2.3** Describe a variety of extremophiles, organisms adapted to living in conditions of extreme temperature, pressure, or chemical concentration, as in highly acidic or salty environments.
- 2.4** Recognize major stages in evolution and its corresponding environment, from a primordial soup to anaerobic and aerobic bacteria to multicelled organisms, etc.

Unit 3 Life in our Solar System

General Outcome:

- 3.0 The student shall:** be able to demonstrate an understanding of the variety of environments within our solar system, and the potential for life.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 3.1** Describe the process of stellar birth and planet formation.
- 3.2** Describe various environments of the moons and planets of the solar system
- 3.3** Demonstrate an understanding of extraterrestrial environments within our solar system that are known to contain complex organic molecules that are plausible precursors of life, and to characterize the most abundant organic compounds, their physical environment and the biological relevance, with particular attention to the following regions:
- 3.3.1** Carbonaceous chondrites and their amino acids
 - 3.3.2** Mars and its history of water
 - 3.3.3** Titan and its organic-rich atmosphere
 - 3.3.4** Europa and its ice covered ocean
 - 3.3.5** Comets

Unit 4 Life beyond our Solar System

General Outcome:

- 4.0 The student shall:** be able to demonstrate general understanding of the known extent, age, and environmental diversity of the Universe.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 4.1** Describe the origin and distribution of elements.
- 4.2** Describe the chemical makeup of stars, their life cycle, and the creation of heavy elements.
- 4.3** Demonstrate an understanding of the range of possible and plausible life sustaining environments within the known physical universe.
- 4.4** Discuss the basis and limitations of the Drake Equation.
- 4.5** Demonstrate an understanding of extraterrestrial environments beyond our solar system that are known to contain complex organic molecules that are plausible precursors of life, including interstellar clouds and their long chained carbon compounds.
- 4.6** Discuss the discovery of extrasolar planets, with a description of the major types currently known.
- 4.7** Discuss the concept of habitable zones within a solar system and within the galaxy.

Unit 5 How do we look for life?

General Outcome:

- 5.0 The student shall:** be able to demonstrate an understanding of the methods used to explore, examine environments for suitability of life, and to look for signs of life.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 5.1** Describe the development and utilization of remote sensing techniques as used to examine the earth.
- 5.2** Describe the use of telescopes across the electromagnetic spectrum, including:
- 5.2.1** The spectral characteristics of radio waves, the energy requirements for transmission, and the distance of detectability (the range) for reception by radio telescopes, and strategies for distinguishing intelligent signals from noise.
 - 5.2.2** The concept of frequencies with low incidences of natural occurrences as a logical place to look for artificial signals, such as the “Microwave Hole” and also between the spectral presence of Hydrogen and Oxygen, i.e. the “Water Hole.”
- 5.3** Describe spectroscopy/spectrometry as used to identify elements in planets in our solar system and in extrasolar planets.
- 5.4** Explain the significance of detecting oxygen and hydrogen in extrasolar atmospheres.
- 5.5** Recognize the significance of past, current and future missions to objects within our solar system, and the types of experiments that look for life or its significant precursors.