

Syllabus for AST 2037: Life in the Universe (Fall 2009) v0.9

Basic Information:

Course website: <http://www.astro.ufl.edu/~eford/teach/ast2037/>

Classroom: Little Hall 0121 (LIT 121)

Class Meeting Times: Monday, Wednesday & Friday 11:45am-12:35pm (5th period)

Section Number: 1713

Instructor: Prof. Eric Ford

Office: 212 Bryant Space Science Center

Office hours: Fridays 4:00pm-5:00pm or by appointment

Email: eford+ast2037@astro.ufl.edu (please write AST2037 in the subject line)

Phone: 392.2052 ext. 209 (I check email much more frequently.)

Text Books: The primary textbook for readings will be *The Search for Life in the Universe* by Donald Goldsmith & Tobias Owen (3rd edition; required). Additional readings will be provided via the course web site and/or Ares, the UF Libraries' online course reserves service. Both Goldsmith & Owen and *Life in the Universe* by Bennett & Shostak will be held in reserve at the Marston Science Library. I suggest that students make a visit to the library to read the relevant sections of Bennett & Shostak anytime that they would benefit from further reading on a subject.

Prerequisites: None. This is essentially a non-mathematical science course. However, just as a knowledge of English is necessary to read the text and understand the discussion, a basic knowledge of grade school level mathematics is often required to engage in significant scientific discussions.

Course Goals & Objectives: In this class we will consider the origin of life on Earth and the possibility of life existing beyond Earth from a multidisciplinary and scientific perspective. The greater purpose is to help you to appreciate the scientific process and to build scientific reasoning skills that are applicable beyond this course. Science plays an increasingly important role in our daily lives and modern society. You will find yourself reading about, voting on, and using the products of scientific research in many aspects of your life. Therefore, it is crucial that you understand how science and scientists actually work. I hope to stimulate your appreciation for science and your curiosity to learn about our universe. Fortunately, much of this course content is quite fascinating, and I definitely enjoy sharing my knowledge and experiences with students.

Course objectives for you to achieve during this semester are:

- *Knowledge & Comprehension:* Define vocabulary. List facts and observational data that enable you to participate in scientific discussions of the potential for life beyond Earth.
- *Application & Analysis:* Describe the purpose and implications of scientific experiments and observations. Explain how the results have led to the current state of scientific understanding. Apply scientific reasoning to deduce the implications of hypothetical experiments and observations.
- *Synthesis:* Explain how future experiments or observations could address open questions about the origins of life and potential for life beyond Earth.
- *Evaluation:* Critically evaluate claims and identify the extent to which data is inconclusive.

Special Accommodations: If you have a documented disability and anticipate needing accommodations in this course, please see me as soon as possible. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation

Copyright: You may not distribute or reproduce copyright materials. Note that course materials (textbook, slides, online readings, other online content) often contain copyright material that is provided to you for educational purposes under the “fair use doctrine” of copyright law. More information about copyright law is available at <http://www.uflib.ufl.edu/admin/Copyright.htm>.

UF Grading Policies (<http://www.registrar.ufl.edu/catalog/policies/regulationgrades.html>)

UF Student Honor Code (<http://www.dso.ufl.edu/studentguide/studenthonorcode.php>)

UF Student Conduct Code (<http://www.dso.ufl.edu/studentguide/studentconductcode.php>)

Course Policies & Student Obligations:

Submit all assignments via ELS and on time – Students are required to have internet access using a computer and browser that are compatible with the online E-Learning System (ELS). If you have not used ELS yet, you may need to install or upgrade your browser, Java and/or Flash software. There are online tutorials and tips available at <http://lss.at.ufl.edu>. If you need technical assistance, contact the UF HelpDesk directly (HUB, 352-392-4357, helpdesk@ufl.edu). You should log into ELS and attempt the first quiz well before the deadline, so that any technical difficulties can be resolved well before the first graded assignments are due. All assignments should be submitted online via ELS by the specified due date and time. Late submissions will not be accepted. Assignment can not be “made up”. The only possibility of being excused is if there is some rare, extenuating, and officially documented circumstance that is beyond the student's control (i.e., documented medical or family emergency). Following up with a letter from the Dean of Students Office may be required to grant such requests. Note that online assignments (homework and quizzes) can be submitted on time, even if you miss class, travel for an athletic event, etc. The best way to avoid being late due to computer problems is to submit assignments well before the deadline and while the UF Computing HelpDesk is open to help you with any technical difficulties. A problem with your computer or your network connection is not an acceptable excuse. If problems with the UF network or the ELS server prevent you from submitting on time, then you should contact the UF Computing HelpDesk to attempt to resolve the problem. Be sure to send me an email with the “ticket number” assigned to you by the HelpDesk. I will excuse assignments, if the HelpDesk concurs that the UF network or the ELS server prevented submission.

Prepare for and Participate in each class – Reading assignments will be given for each class (see page 5). You should complete the reading assignment before each class. Attendance and active participation in the lectures are required, as previous students report that they are very important for being successful in this course. I recommend that you take written notes during class. Educational research has shown that taking notes helps most students maintain focus on class and reinforces concepts in their memory. It will also help you identify key concepts to review for exams. Always bring to class at least one extra blank 8½”x11” sheet of paper specifically for answering a “concept test question”. I will ask concept test questions about the lessons to engage students in learning and to identify misconceptions. The more you think about these, the more you will benefit. A few classes will be delivered online via ELS. You should test that you are able to view one of the sample online presentations (covering the first week of class) early in the semester. If you have technical problems, request assistance from the UF HelpDesk well before any online classes.

Respect other students – After the first day, I will aim to begin and end class on time. You should arrive on time and not get ready to leave until the class session is completed. If we run over time, please raise your hand promptly and let me know. For your own benefit, you should devote your full attention to the class. Do not distract other students by talking out of turn, reading, eating, etc. In particular, mute all cell phones and other electronic devices before the start of class and leave them in your backpack, purse, briefcase, etc. No phone calls, texting, email, or games during class! Laptops may only be used during class, if they are used exclusively for taking notes and do not distract other students. You are to have read and to follow the UF Student Conduct Code (<http://www.dso.ufl.edu/studentguide/studentconductcode.php>).

Take responsibility for your learning – It is your responsibility to let me know when a certain concept or idea has not been clearly understood. Don't be afraid to raise your hand to ask questions during class. Your questions will often provide a valuable service to your fellow classmates. In addition, please consider meeting with me during office hours (or make an appointment if necessary). During this course, each lesson will build upon the foundational concepts from previous lessons. If you fall behind on understanding material early in the semester, it can be very hard to catch up. The sooner in the semester you talk to me, the better the chance that we can clarify any confusion.

Academic Honesty – You are expected to be familiar with and to follow the UF Student Honor Code (<http://www.dso.ufl.edu/studentguide/studenthonorcode.php>). You will often be encouraged to discuss concept test questions and homework with other students. However, you are expected to submit only your own solutions to the exams, homeworks, quizzes, and the optional term paper. There are severe penalties for academic dishonesty and plagiarism, so it is not worth taking any risk. If there is any doubt as to whether something is acceptable for any assignment, then you should ask *first*.

Grading Policies & Performance Evaluation Criteria:

Final Grades: Numerical grades for individual assignments will be made available shortly after grading is completed via the online ELS. Final numerical grades will be based on the weighted average of: three in-class exams (50%), on-line quizzes (15%, excluding your lowest quiz score), homework assignments (30%, excluding your lowest homework score), and in-class concept tests (5%; excluding your lowest concept test score). Up to 10% extra credit may be awarded to students based on an optional term paper. Final letter grades are to be based on the absolute scale below. Information on UF grading policies for for assigning grade points is available online (<http://www.registrar.ufl.edu/catalog/policies/regulationgrades.html>).

A -:	85% - 89.9 %	A :	90% - 100 %		
B -:	70% - 74.9%	B :	75% - 79.9%	B+:	80% - 84.9 %
C -:	55% - 59.9%	C :	60% - 64.9%	C+:	65% - 69.9 %
D :	40% - 45.9%	D :	45% - 49.9%	D+:	50% - 54.9 %
E :	0% - 39.9%				

Exams (50% of grade): Three written exams will be given during the semester on: 1) **Wednesday, September 23, 2009**, 2) **Wednesday, October 21, 2009**, and 3) **Wednesday, December 2, 2009**. Note that these are “in class” exams, and there will not be a final exam during the official finals’ week period. Each exam will focus on material from recent readings, lectures, and discussions, but may also incorporate material from previous units. Remember to arrive on time and to bring #2 pencils and your UF ID card.

If you are unable to attend an exam, then you must inform me as soon as possible. IF YOU MISS AN EXAM, IT CAN NOT BE “MADE UP”! Only extenuating circumstances (e.g., documented medical, family emergency, jury duty) can excuse you from them, but only if you provide timely written notification from an appropriate authority. The exams will not be curved. However, I reserve the right to discard a few questions from the exam (or treat them as a bonus) based on the results of the exam and/or student feedback pointing out a potential ambiguity in a question or response.

Quizzes (15% of grade): Generally, there will be a short quiz administered online via ELS due before class *each Friday*, primarily based on factual information contained in the reading assignment for the week (including the upcoming class). When Friday is a university holiday, the quiz due date will be deferred until the following Monday. The online quizzes are to be submitted via ELS *before 9:00am* on the specified due date. The first quiz (due on Aug. 28) is due during drop/add period, and will not be included in your quiz average. These are a relatively easy way to earn high scores that will average. You may refer to your textbook and notes for the online quizzes, but you may not to give or receive assistance from other students for answering quiz questions. If you feel a question or response is unclear, please ask well before the deadline. Quizzes will not be curved.

When calculating your quiz average, I will drop your lowest quiz score. This should take care of the vast majority of unfortunate circumstances (e.g., minor illnesses, computer problems), so there is no need to provide explanation or documentation for a single isolated missed quiz. If you have *extended extenuating* circumstances (e.g., documented extended medical or family emergency, jury duty), you can be excused from a specific quiz (i.e., the quiz is ignored when calculating your quiz average), but only if you provide timely written notification from an appropriate authority.

Homework (30% of grade): Homework assignments will be based on materials covered in both the textbook and the class discussions. These problems will require significantly more thought than the quiz questions and previous students report that the homework is both challenging and very valuable preparation for the exams. Homework assignments will be administered via ELS and are to be submitted via ELS *before 9:00am* on the specified due date. I encourage you to print the questions near the beginning of the unit and keep the questions in mind during your reading and class. You may use your notes, the textbook, online readings, and a calculator to help you complete the homework. You may discuss *how to solve* the homework problems with other students, but you are not allowed to give or receive answers. If you feel a question or response is unclear, please ask well before the deadline.

In many cases, there will be multiple correct responses to a question. You will earn points for each correct response, but lose points for each incorrect response. If ELS did not grades questions this way, students could get a perfect score without thinking by simply selecting all responses. The number of positive (negative)

points per correct (incorrect) response is based on the total number of correct (incorrect) responses. For example, if there are 3 correct response options and 2 incorrect response options, and if a student selected two correct responses and one incorrect response, then they would receive $+2/3-1/2=1/6$ of the total points for that question. (But in no case will a student receive less than zero points on a question.) I realize this can seem harsh. Therefore, each homework scores will be rescaled (i.e., “graded on a curve”).

The homework scores used for computing your homework average and your final grade will be the greater of: 1) your raw percentage scores for each homework assignment, and 2) your rescaled scores for each homework assignment. The rescaling will be computed such that the median and standard deviation of the class's rescaled homework scores are approximately equal to the median and standard deviation of the class's scores on the exam. This system means that if most students earn A's on the exam, then most students will be awarded A's for their rescaled homework scores. The rescaled homework scores will be posted online via ELS shortly after the exams are graded.

When calculating your homework average, I will drop your lowest homework score. This should take care of the vast majority of unfortunate circumstances (e.g., minor illnesses, computer problems), so there is no need to provide explanation or documentation for a single isolated missed homework. If you have *extended extenuating* circumstances (e.g., documented extended medical or family emergency, jury duty), you can be excused from a specific homework assignment, but only if you provide timely written notification from an appropriate authority.

Concept Test Questions (5% of grade): During selected classes, I will ask concept test questions. After you write down your answer, I will typically ask you to discuss the question among yourselves. For concept tests, you are welcome to change your answer, as long as you circle a large and neatly printed final answer and write a short explanation of why your old answer was incorrect. Be sure to print your full name using large easy to read characters in the upper right of a 8½”x11” page that you turn in, so that you can receive credit. Some concept test questions may be ungraded, but will still help you to learn important concepts and help me to identify when additional discussion would help. If you must miss a class due to illness, serious family emergency, special curricular requirement, military obligation, religious holidays, jury duty, or participation in certain *official* university activities (e.g., music performance, athletic competition, or debate), then it is possible to be excused, *if* you provide written notification from an appropriate authority. When calculating your concept test average, I will drop your lowest concept test score. This should take care of the vast majority of unfortunate circumstances (e.g., minor illnesses, oversleeping), so there is no need to provide explanation or documentation for a single isolated missed concept test.

Term Paper/Extra Credit Opportunity: You may write an individual, analytic research paper presenting a more in depth discussion of one question related to life in the universe. In order to earn extra credit, you should submit a title, abstract, detailed outline, and preliminary list of at least five references by November 13. Only term papers based on approved proposals will earn extra credit (up to 10%). If your proposal is not approved, you will have a chance to revise it for up to 3% extra credit by December 9. If your proposal is approved, you may submitted a paper *both* in paper and online via ELS no later than December 9 (5-10 pages, typed, double-spaced, 11pt font, and 1 inch margins). To earn extra credit term papers will need to: 1) identify one interesting question relevant to the course, 2) cite and explain scientific data (e.g., results of scientific experiments or observations) that helps to address the question posed and goes well beyond what was included in the textbooks or class discussion, 3) demonstrate solid scientific reasoning by critically evaluating the scientific data, 4) identify the limitations of current scientific knowledge, *and* 5) be based on appropriate published references, including at least one article from a refereed scientific journal (e.g., *Science*, *Nature*, or *Astrobiology*). Such articles typically include technical language and methods that we will not discuss in class. You will have to devote considerable time studying additional references, just to understand the articles. Only then can you begin to synthesize the information, critically evaluate it, and come to a conclusion. This will not be a quick or easy way to improve your grade. The primary purpose is to give motivated students an opportunity to have some fun exploring a topic in depth and a very rewarding educational experience. In particular, it will provide an opportunity for you to demonstrate that you have accomplished the final course objective of being able to critically evaluate claims and identify the extent to which data is inconclusive. I will provide further details and a grading rubric shortly after the second exam.

Topical Outline & Course Assignment Schedule

Unit 1: Introduction to Science and Life on Earth

- 08/24 M: Course Overview and Goals (Ch 1)
- 08/26 W: Scales of Length & Time
- 08/28 F: Introduction to Science and Astronomy (Ch 2); **Quiz #1**
- 08/31 M: Modern Life on Earth (Ch 7)
- 09/02 W: continued
- 09/04 F: Geological History (Ch 8, p 187-196); **Quiz #2**
- 09/09 W: continued; **HW #1**
- 09/11 F: Origins of Life on Earth (Ch 8, p 196-210); **Quiz #3**
- 09/14 M: Evolution of Life on Earth (Ch 9)
- 09/16 W: Extreme Life on Earth
- 09/18 F: Relationships between the Earth and Biology (Ch 10, p 237-248); **Quiz #4**
- 09/21 M: Review (*Online*); **HW #2**
- 09/23 W: **Exam #1**

Unit 2: Life in the Solar System

- 09/25 F: The Sun (Ch 4, p 69-78, 82-88); **Quiz #5**
- 09/28 M: Origins of the Solar System (Ch 11)
- 09/30 W: Requirements for Habitability & Habitable Zone (Ch 16, p393-409)
- 10/02 F: continued; **Quiz #6**
- 10/05 M: Introduction to Mars (Ch 13)
- 10/07 W: Possibility of Life on Mars (Ch 14); **HW #3**
- 10/09 F: continued; **Quiz #7**
- 10/12 M: Possibility of Life on Venus (Ch 12)
- 10/14 W: Possibility of Life on Giant Planets (Ch 15)
- 10/19 M: Possibility of Life on Moons (Supplemental Reading #1) **HW #4 ; Quiz #8**
- 10/21 W: **Exam #2**

Unit 3: Life Beyond the Solar System

- 10/23 F: Origins of Stars (Ch 3); **Quiz #9**
- 10/26 M: Stellar Evolution (Ch 5, p 91-105)
- 10/29 W: Properties of Nearby Stars
- 10/30 F: Searching for Other Solar Systems: Radial Velocity Technique (Ch 17, p 417-426); **Quiz #10**
- 11/02 M: Orbital Properties of Other Solar Systems (Ch 17, p 427-435)
- 11/04 W: Searching for Other Solar Systems: Transit Technique
- 11/06 F: Physical Properties of Extrasolar Planets; **Quiz #11**
- 11/09 M: Searching For Another Earth (Ch 16, p 409-415; Ch 17, p 435-438); **HW #5**
- 11/13 F: How to Write an Analytical Research Paper; **Quiz #12**
- 11/16 M: Searching for Other Solar Systems: Direct Imaging (Supplemental Reading #2)
- 11/18 W: Characterizing Extrasolar Planets (Supplemental Reading #3)
- 11/20 F: Recognizing Life on a Distant Planet (Supplemental Reading #4); **Quiz #13**
- 11/23 M: How Common Is Life? (Ch 18, p 441-461)
- 11/25 W: continued; **HW #6**
- 11/30 M: Review (*online*); **Quiz #14**
- 12/02 W: **Exam #3**

Unit 4: Philosophical Questions

- 12/04 F: Searching for Extraterrestrial Intelligence (Ch 20); **Quiz #15**
- 12/07 M: Interstellar Communications & Travel (optionally & just for fun Ch 19)
- 12/09 W: Fermi Paradox (Ch 22); **HW #7**

Other Important Dates:

- Proposal for Optional Analytic Research Paper due on or before **Friday, November 13.**
- Optional Analytic Research Paper due on or before **Wednesday, December 9.**