AST309L: SCHEDULE OF TOPICS, READINGS, AND EXAM DATES

I will list topics according to the organization of the textbook (e.g. 5.2 means section 5.2 in Bennett and Shostak's book). A section in parentheses (e.g. (3.1)) means "Skim, but not covered on exam." Although I like the clarity and production of our textbook, the one poor feature, in my opinion, is the order of presentation of the topics. For that reason we are covering the material in a different order than presented in the textbook. I have gone through this before and am sure there is very little confusion caused by (say) terminology in Ch. 10 that depends on Ch. 7 (which you won't have read yet). However *this re-ordering does make it very important for you to keep a copy of this reading list handy.*

A table giving the lecture topics and reading assignments for each class day will be made available online, separately.

The course is divided into five sections, with an exam after each section. There are about 8-9 lectures between each exam, except for Exam III, for which we will only spend about 5 lectures. I will distribute a more detailed list of readings and corresponding lecture dates during the second week of classes.

I. Background, Exoplanets, Habitable Planets (8 lectures)

Ch. 1. Sections 1.1-1.4. Overview by topic—Basically "What is astrobiology?" Brief (11 pages) but important.
Reading Chapter 1 will help you understand what this course is about.

Section 12.1. Overview in terms of the "Drake equation" (**12.1**) Don't worry about math, just try to get the main ideas. We will spend about two entire lectures on this topic.

[You can skip Ch. 2 if you have had an astronomy class recently, although you might be interested in the history of the subject (2.1). None of this material will directly appear on the exam.]

Ch. 3. **(3.1), 3.2** (sizes, distances, elements from stars, time),
3.3 (objects in our solar system, EZ introduction to disk and planet formation theories,
3.4 (review of background physics—light, phase changes.

Ch. 10 Habitability.
→Read pp. 241-243 in sec. 7.1 on "Does life need liquid water?"
10.1 Habitable zone, **10.2** Venus as example, **10.3** Surface habitability, **10.4** Future of life on Earth.
Skip 10.5.

Ch. 11 Extrasolar planets—search, detection results, and biosignatures. Really "The search for Earth II."
11.1 Phases of stellar evolution, properties, spectral types, stellar masses and lifetimes. *Which stars would make suitable stars for planets with life?*
11.2 Extrasolar planets (lots of material here). [we *may* postpone spectral biomarkers, pp. 381-382, and
11.3 The possibility that Earth is rare to next exam]
Skip 11.4 (classifying stars). *We will spend most time on 11.2.*

.....*Our first exam will occur here (Wed, Feb 6)* .....

II. Origin of life by chemical evolution (8 lectures)

Ch.11.2 pp. 381-382: How could we detect life on extrasolar planets? (Spectral biomarkers)

Ch.11.3 The possibility that Earth is rare (["Rare Earth?" First examples of "contingency."]

Ch. 5. The nature of life on earth—characteristics of life, cells, metabolism, genomes, extremophiles.
Read **5.1** (defining life; possible outside articles), **5.2** (cells), **5.**3 (metabolism), **5.**4 (DNA and heredity),
5.5 (life at the extremes), → Read pp. 241-243 in sec. 7.1 on "Does life need liquid water?"
Skip sec. 5.6.
Emphasized in lectures (with outside notes provided): Elementary background on molecular bonds, chemical reactions and cell biology. Why carbon? Why water? Why polymers? Molecular basis of life—prebiotic organic molecules; amino acids, nucleotides, proteins, nucleic acids.

Ch. 6. Origin [and Evolution] of Life on Earth—We will only cover the "Origin" part of this chapter here, which means subsections
6.1 (searching for life's origins) and
6.2 (origin of life—will spend most of our time here, especially on "RNA world;" requires you understand lecture material mentioned above in connection with Ch. 5)
6.6 (artificial life; possibly omitted, depending on time).

……*Second exam here (Wed, Feb 27*)……

III. Life in the Solar System? (Only five lectures, but you are responsible for all of it.)
Ch.7 Searching for life in our solar system
Ch.8 Mars
Ch.9 Moons of giant planets (emphasis on Titan and Europa)
.....*Third exam here (Wed, March 20,* [Wednesday after Spring Break])**.....**

IV. Development of Complex Life; Relation to History of Earth's Environment (9 lectures)
Ch. 4. Habitability of the Earth
4.1 (geology and life**),**
4.2 (radiometric ages),
4.3 (Hadean Earth and the dawn of life),
4.4. Geology and habitability, *not on exam*],
4.5 (Climate regulation and change).
Skip sec. 4.6 (origin of our moon).

Chapter 4 is about the earliest development of life on Earth and its relation to geological/climatic conditions.
Then: Back to **Ch. 6 (**sections on evolution of life on Earth):
6.3 Development of life on Earth. Empirical timeline, interpretations, implications for extraterrestrial complex life.
Contingency vs. convergence is a major issue here, as it is in most of the course.
Class lectures: Major developments in history of life, from molecular level to oxygenation of atmosphere.
6.4 Impacts and mass extinctions—biological development driven by catastrophic events, severe environmental changes (e.g. snowball Earth episodes, oxygen holocaust, major impacts, episodes of intense volcanism…)
6.5 Appearance of human-like cognition-- discussion of problematic status of human uniqueness; development of cognitive function in organisms including humans; nature of "intelligence(s)" will be probably be postponed to exam V.
……*Fourth exam here (Friday, April 12)*…….

V. Modes of contact (9 lectures)
Ch. 12 The search for extraterrestrial intelligence (SETI)—listening strategies
12.1 Drake equation (review). Emphasis on importance of lifetime of a technological civilization—how could L be large enough to allow contact?
12.2 Intelligence—This may be supplemented with outside readings from cognitive science, cross-cultural and animal studies, artificial intelligence research. We will discuss in detail in class lectures. This is crucially important in designing strategies for signal detection (see below).
12.3 Searching for intelligence. SETI experiments (proposed encoding and signaling techniques, "magic frequencies," ongoing SETI programs)
If time: The nature of language and its possible alternatives.
[12.4 UFOs, artifacts, abduction phenomena,,... (Read ch.**12.4** for traditional scientist perspective; 12.4 will not be on the exam.)]

Ch. 13 Interstellar Travel and the Fermi Paradox
13.1, 13.2. Limiting factors and proposed designs for starflight.
13.3. The Fermi paradox: Galactic colonization and the "Where are they?" conundrum.
[Skip 13.4 (theory of relativity) except for your own interest.]
..... *Fifth (last) exam here, on last class day (Friday, May 3)……*

There is no comprehensive final. You should be able to compute your final average score (we will give you a formula to help) and so you will know your letter grade in the course after receiving the results of the 5th exam.
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