Concepts of Science Syllabus 1017

1) Credit hours

Lecture 3 credits (3 contact hours)
Recitation or Lab. 1 credit (1 contact hour)

2) Text and Resources


Recitations- The recitation material is dynamic. Mostly, Web based material is used as a basis for recitation discussions, the recitation assignments for Fall 07 are attached.

3) Course Description:

Description for Bulletin- Science Core. Interdisciplinary course which presents major scientific concepts and stresses the interactions between the sciences and the humanities.

Concepts of Science is a comprehensive interdisciplinary course that presents major scientific concepts. The course includes classroom instruction (75% of the grade) and recitations or labs (25% of the grade). The honors section SCMH 1017 will have a dedicated recitation section that will allow for discussions at a more advanced level.

5) Course Objectives:

The course exposes students to both the wonders of, and the benefits derived from science. Specialization is not appropriate for non-science majors; hence, this course presents a picture of all science disciplines and aims towards a scientific understanding among the students. The value to the students will come from an appreciation of the scientific method, from a certain degree of science literacy, from learning new concepts and from appreciating some of the seminal as well as important current findings of science.
6) Course Outline (classroom instruction) – Number of periods is approximate

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Periods</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>Chapter 1</td>
<td>3</td>
<td>Science: A Way of Knowing</td>
</tr>
<tr>
<td>Chapter 2</td>
<td>3</td>
<td>The Ordered Universe</td>
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<tr>
<td>Chapter 3 &amp; 4</td>
<td>3</td>
<td>Energy and Heat</td>
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<tr>
<td>Chapter 5</td>
<td>2</td>
<td>Electricity and Magnetism</td>
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<tr>
<td>Chapter 6</td>
<td>3</td>
<td>Waves and Electromagnetic Radiation</td>
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<tr>
<td>Chapter 7</td>
<td>2</td>
<td>Einstein and the Theory of Relativity</td>
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<td>Chapter 8</td>
<td>2</td>
<td>The Atom</td>
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<tr>
<td>Chapter 10</td>
<td>3</td>
<td>The Chemical Bond</td>
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<tr>
<td>Chapter 12</td>
<td>2</td>
<td>The Nucleus of the Atom</td>
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<tr>
<td>Chapter 14 &amp; 15</td>
<td>2</td>
<td>The Stars and Cosmology</td>
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<tr>
<td>Chapter 16 &amp; 17</td>
<td>3</td>
<td>The Earth and other Planets, Plate Tectonics</td>
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<tr>
<td>Chapter 21 &amp; 22</td>
<td>4</td>
<td>Molecules of life, The living Cell</td>
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<tr>
<td>Chapter 23</td>
<td>4</td>
<td>Classical and Modern Genetics</td>
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<tr>
<td>Chapter 24</td>
<td>3</td>
<td>The new Science of life</td>
</tr>
<tr>
<td>Chapter 25</td>
<td>2</td>
<td>Evolution</td>
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</tbody>
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Two exams and a Final will be given with approximate equal time intervals between the dates. Finals will be given during the scheduled times.

**Grading:**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Points</th>
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<tbody>
<tr>
<td>A</td>
<td>90-100</td>
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<tr>
<td>B</td>
<td>80-89</td>
</tr>
<tr>
<td>C</td>
<td>70-79</td>
</tr>
<tr>
<td>D</td>
<td>60-69</td>
</tr>
<tr>
<td>F</td>
<td>below 60</td>
</tr>
</tbody>
</table>

**Points:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 hour Exams (including the final)</td>
<td>22% EACH</td>
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<tr>
<td>Final</td>
<td>31%</td>
</tr>
<tr>
<td>Recitations</td>
<td>25%</td>
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</tbody>
</table>

**Recitation materials:** The recitations are interactive, discussion is required. Recitation assignments must be type written. Plagiarism and cheating will not be tolerated- evidence of cheating will be handled through University channels.

7) Sample course policy

**Course:** Concepts of Science: SCMH-1017, Spring 200X

M, W, F 1:00 – 1:50

**Room:** Chemistry 151

WE WILL START PROMPTLY AT 1:00, Please turn off cell phones!
**Instructor:** Prof. XXXXX  
Office-- Chemistry XXX

**Text:**  
“The Sciences. An Integrated Approach” Trefil and Hazen

**Material:**  
See syllabus

**Grading:**  
A = 90-100  
B = 80-89  
C = 70-79  
D = 60-69  
F = below 60

**Points:**  
3 hour Exams (including the final) 22% EACH  
Recitations 25%  
Class participation 9%

**Recitations:** The recitations are mandatory and you must pass the recitation to pass the course. If you have an excused absence you must see the graduate teaching assistant as soon as possible after the missed event.

**Exams:** Exams are mandatory. There will be three one-hour exams. It is essential that you be present for all exams, missing an exam is extremely serious and only university-sanctioned excused absences will be considered. It's the students responsibility to notify the instructor immediately of a missed exam. Un-excused absences will result in a grade of 0. There will be no exceptions to this policy.

**Exam Grading:** Students will have TWO CLASS DAYS from the date that an exam is returned to check the exam and look for errors in grading. If errors in the grading are found, highlight the error in yellow and hand the entire exam back in to be checked.

**Attendance:** According to Auburn University policy, students are expected to attend all scheduled classes. You will be responsible for all class announcements and functions such as exam date changes and pop quizzes.

<table>
<thead>
<tr>
<th>Tentative exam</th>
<th>Exam I</th>
<th>Friday XXXX Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>dates</td>
<td>Exam II</td>
<td>Friday XXXX YY</td>
</tr>
<tr>
<td></td>
<td>Exam III (FINAL)</td>
<td>As scheduled</td>
</tr>
</tbody>
</table>
The honors section of Concepts of Science will have a dedicated recitation section where discussions at a higher level will be expected.

Concepts of Science – Fall 07
Science: 1) a branch of knowledge or study dealing with a body of facts or truths systematically arranged and showing the operation of general laws. 2) systematic knowledge of the physical or material world. 4) knowledge, as of facts or principles; knowledge gained by systematic study.
[from Webster’s Dictionary]

Web Address
The following website has this document with active links (HTML), pdf files of articles for some of the assignments and some lecture PowerPoint materials. Changes to the recitations and additional information will be posted to this website. Some of the links will only work with a computer on campus. The site is password protected, the password is -- fallconcepts
http://www.auburn.edu/academic/classes/scmh/1010/

Recitation Assignments
For many of the recitations you will read and study printed or Web articles. In some cases you will be required to find your own material or supplementary material, we highly recommend that you try to find these resources on the Web. During the recitation period you will discuss the materials, you may be asked to hand in summaries or opinions of the articles, do a project or to take a quiz. You will also need to hand in detailed references. ALL WORK HANDED IN MUST BE TYPED.

In-class work must be legible.

Cheating and plagiarism will not be tolerated. Cases involving cheating and or plagiarism will be forwarded to Professor Illies, Director of Concepts of Science and Professor of Chemistry and/or the Associate Dean of Academic Affairs for the Collage of Science and Mathematics.

Changes to the following assignments will be announced in recitations and by e-mail.

Each recitation is meant to be a “snapshot” into a science topic, the recitations do not follow the course material, they are self-contained individual topics.
1) Recitation assignment August 28, 29 or 30. Introduction

Introduction: This is a serious science course. We will discuss: recitation policies, plagiarism and cheating, use of the internet, what is expected and how to…. This will be followed by a discussion on science- you are expected to participate in the discussion.

Find a current event article on a science topic from the popular media (Time, Newsweek, NY Times, Discover magazine, etc.) or the Web. Write a 150 word opinion of the science described in the article. Pick two science words or terms from the article and define them. Be prepared to discuss the article and define the words or terms during the recitation. Think about questions such as:

- How does the issue impact society?
- Is this really important?
- What is the point of the research, work or idea.

You will need to hand in a copy of the article, your opinion and the definitions.

2) Recitation assignment for September 4, 5 or 6. On the Scale of Things

A recitation on the relative sizes of things. Study the first (Defining Dimensions) and third (New Sets of Eyes) units at the following website on Size and Scale.

http://invsee.asu.edu/nmodules/sizescalemod/unit1.htm

You will need to learn how to relate the sizes of things, an example is: if the Earth were the size of a baseball then the average person will be the size of a ________. These ways of relating the sizes of things involve the ratios being constant. There will be an in-class quiz.

3) Recitation assignment for September 11, 12 or 13. Einstein, a Giant in Science.

“Albert Einstein” pdf article at the Website

In recitation video- “Exploring Einstein: Life of a Genius”

You will take a quiz during the recitation on BOTH the “Time” article and the video.

4) Recitation assignment for September 18, 19 or 20. Nanotechnology

Two assigned readings are given below. Each student will be assigned a group number by your GTA. Prepare a 250 response to the question corresponding to your group number to be used during the recitation and handed in for grading. During the recitation each group will be allowed about 10 minutes to discuss their question. The groups will then present the answer to the entire class. All members of the group are expected to participate in answering the question assigned to the group.

   http://www.thenewatlantis.com/archive/2/keiperprint.htm
Questions
1. Keiper makes a distinction between “mainstream nanotechnology” and “molecular manufacturing.” Define these two terms.
2. What commercial products has mainstream nanotechnology changed or enhanced? How do those products immediately impact your life?
3. What is an assembler and how does it work within molecular manufacturing? Why does Drexler say that nanotechnology has the potential to create a “genie machine”? What are some ways nanotechnology’s “genie machine” could potentially change our lives?
4. What is the “gray goo” problem—and why is it a problem?
5. According to Smalley, what is the “fat fingers” problem and the “sticky fingers” problem? Why are these concepts significant to the future of nanotechnology?

5) Recitation assignment for September 25, 26 or 27. The Chernobyl Accident
“Ten years of the Chernobyl Era” pdf article at the Website
“Chernobyl Revisited” pdf article at the Website
“Radiation is Everywhere” pdf article at the Website

6) Recitation assignment for October 2, 3 or 4. Pests in Alabama
The discussion will be on pests in Alabama, the damage they do, and ways to control and/or eradicate them.
“Weevil Wars” from “Chemistry-Spring 2003” at http://www.chemistry.org/Chemistry (the second C must be Capitalized) For full access to this site you must access the site from a computer on campus.
“Fire Ants” at http://www.aces.edu/pubs/docs/A/ANR-1149/
“Pine Bark Beetles” at http://www.aces.edu/pubs/docs/A/ANR-0422/
There will be an in-class quiz.
7) Recitation assignment for October 9, 10 or 11. Human Impact on Global Warming

Global Warming – Research the topic of “Global warming” at the links below.
http://epa.gov/climatechange/index.html
http://www.ucsusa.org/global_warming/
There are endless other articles on global warming you could research, hundreds can be found at: http://topics.cnn.com/topics/global_climate_change

Prepare yourself for an in-class debate on the following two topics: Are the changes in global temperatures we see now different from the previous climatic cycles of Earth? If the cycles have changed, do you think humans are responsible for these changes? In other words, do you think we are capable of tipping the global climate equilibrium?

8) Recitation assignment for October 16, 17 or 18. Studying Climate - Tree Growth, Coral Growth and Ice Cores.

Scientists use numerous types of experiments to study climate, this recitation will focus on three ways that climate is studied. These include studies of Tree Rings, Coral Rings and Ice Cores. The previous recitation focused on the human impact of climate change and the social implications, this recitation focuses on how scientists can “look back in time” and learn about pre-historic climates. Study the Web sites and be prepared to discuss and explain the methods, including the pros and cons.
http://earthobservatory.nasa.gov/Study/Paleoclimatology_CloseUp/
http://earthobservatory.nasa.gov/Study/Paleoclimatology_CloseUp/paleoclimatology_closeup_2.html
http://ww.emporia.edu/earthsci/student/sedlacek3/icecore.htm

9) Recitation assignment for October 23, 24 or 25. On the Earth’s Magnetic Field

In-recitation video, “Magnetic Storm”. In-recitation quiz.

10) Recitation assignment for October 30, 31 or November 1. On Science and Health

Find a very recent article (printed or Web) on a health related issue. Summarize the article in no less than 250 words and be prepared to discuss it during the recitation. Pick and define two new science words or terms (cannot be at the “Mickey Mouse” level). Topics may include: diseases in the news (Bird flu, West Nile Virus, SARS, diabetes, Mad Cow disease, etc.) new drugs or drug development.

11) Recitation assignment for November 6, 7 or 8. Life at the Extremes

Research the topic of life at the extremes on planet Earth using Google and the references below.
Microbes at the Extremes May Tell Us How Life Began. pdf article at the Website
http://pubs.acs.org/cen/news/84/i31/8431notw3.html
http://www.nsf.gov/news/frontiers_archive/7-97/7extreme.jsp
http://www.nsf.gov/about/history/nsf0050/arctic/arctic.htm
For access to some of these websites you must use a computer on campus.

Create a campaign for your favorite extremophile!! Include a picture of your favorite
organism, their natural habitat, and what special features of the organism help it to
survive its extreme lifestyle. Best campaigns from each section will receive an extra
homework grade.

12) Recitation assignment for November 13, 14 or 15. NanoBiology

A PowerPoint presentation entitled Biotechnology and NANObiology developed by
James Bradley will be presented during the recitation. The discussion questions will be
interspersed with the PowerPoint presentation and discussed as the PowerPoint is
presented.

Three assigned readings are given below, the two Web site readings are very short. Each
student will be assigned a group number by your GTA. Prepare a 250-word response to
the question corresponding to your group number to be used during the recitation and
handed in for grading. During the recitation each group will be allowed about 10 minutes
to discuss their question. The groups will then present the answer to the entire class. All
members of the group are expected to participate in answering the question assigned to
the group.

1. James T. Bradley, “Biotechnology and Nanobiology” pdf article at the Website

Questions

1. Bradley identifies many stages at which “personhood” may begin (at least five
   stages). What are those stages? At which stage do you believe that “personhood”
   begins?

2. When making stem cell lines, scientists generally use excess frozen embryos from
   IVF clinics. Many of these embryos will eventually be destroyed when their owners
   (parents) decide not to implant them and do not wish to pay for their upkeep. Why
does IVF often produce excess embryos? What do you think of this process? What
should we do with these excess embryos?

3. Embryonic stem cells may cure or repair many types of human maladies. Identify two
   or three of them. Should we destroy embryos to create new stem cells lines in order to
   research ESC treatments? Should the government pay to have more stem cell lines
   created? Why or why not?

4. What is a quantum dot and how might it be used to detect cancer? After our
discussion in an earlier class about the potential dangers of nanoparticles, does this
type of procedure worry you? If you had cancer, would you volunteer as a test subject?

5. What is a “nanobomb” and how might it be used to treat breast cancer? After our discussion in the last class about the potential dangers of nanoparticles, does this type of procedure worry you? If you had cancer, would you volunteer as a test subject?

Additional Questions

Bradley identifies four major ethical concerns related to medical applications of nanobiology. What are they? In your opinion, which ethical concern is the most urgent or important and what should we do about it?

How might nanobiology and biotechnology provide the potential to greatly lengthen human life spans? Would virtual immortality be good for humankind? Are we ready for the ethics of such a future?

How might nanobiology and biotechnology provide the potential to greatly enhance physical and cognitive abilities in humans? Do you think it is ok to alter “human nature”?

13) Recitation assignment for November 27, 28 or 29. Genetic Engineering.

Genetic Engineering. Research the topic of genetic engineering at reputable websites as it relates to foods and health on the web. There will be millions of “hits.” Below are a few websites you could start with. Think about your opinions on the pros and cons of genetic engineering.

http://www.ucsusa.org/food_and_environment/genetic_engineering/
http://www4.od.nih.gov/oba/rac/cover.htm
http://www.nsf.gov/

14) Recitation assignment for December 4, 5 or 15. Science and politics.

Research and find 3 issues where science and politics overlap in the state you were born in. There will be a discussion on science and politics. Course wrap-up.