Phsc 3500 Solar and Alternate Energy

Introduction and course description

> Course Description: Introduces the various techniques for utilizing solar energy and brings the students up to date on work to the present time on the broad spectrum of solar energy systems. Other alternative energy sources such as fission and fusion powers, geothermal energy, energy from the wind and from solid waste will also be included. Satisfies G.E. area F1.

This course is an Upper Division General Education course in Mathematics and the Natural Sciences. ***Important Note***: if you are taking this class for GE credit, be aware that you must achieve upper division status, that is have already completed successfully 60 units of course work, by the end of this semester.

Learning Goals

- To understand the fundamental issues in the different options that we have for energy generation, usage, etc.
- To be able to understand and explain the advantages and disadvantages of each.

Course Requirements

- Math skills/level - This class requires the use of basic geometry and algebra only. Trigonometry and calculus are not required. In geometry you will need to know the basic properties of simple shapes (cubes, spheres, etc). From algebra you will need to be able to rearrange algebraic expressions to solve for an unknown variable. It will help if you can interpret equations in terms of functional dependence.
- Graphical skills - You should be able to interpret data presented in x-y graphs, and be able to draw such graphs. (We will rarely if ever use any other type of graph or chart, such as bar charts, pie charts, etc.) For x-y graphs you should know what is meant by the slope of a plot which is a straight line.
- Reasoning skills - I will expect that, once a physical concept has been introduced, you will be able to apply the concept to situations that might not have been directly discussed in class.

Class Information

Meeting time and room:	MWF at 9:05 am in room S 137 (Note: this room is in the old Science I building, not in Naraghi Hall
Instructor:	Dr Ian M. Littlewood
Office:	N 165 or N 172
Phone:	667-3466 or 667-3467. Fax number 667-3099
Email	ian@physics.csustan.edu
Office Hours	MWF 10:10-11:15; TF 1:25-2:30
Web Site:	http://physics.csustan.edu
Text:	"*Energy, Environment, and Climate*", by Wolfson (Norton)

Grading Scheme

Category	Percentage
Assignments	25 %
Reading Quizzes	20 %
Practical Projects	20 %
Debates	10 %
Midterm	15 %
Final Paper	10 %
Total	100 %

Letter grades will be determined from a curve using the final scores. I will not be using a +/- grading scheme.

Debates

A significant portion of the class grade is assigned to a culminating debate activity which is meant to bring together the concepts that have been discussed in class. This portion will have two components, the debate activity itself and a final paper based on the debates. The details of the debates will be distributed later, once the class roster has settled down, and will take place on the last two or three class periods. Expect any one individual debate to take approximately 25 minutes, so we should be able to cover two such debates during any one class period. There will be significant time in class to help prepare for the debates.

Class attendance

Attendance is highly recommended. Quizzes and group work assignments can occur at any time. There will be no opportunities for missed work.

GE Goals

Since this class is part of the General Education program it is required that it addresses the goal of that program. First of all let me acquaint you with what those goals are:

1. Subject knowledge. To provide an educational experience that will enhance students understanding of the disciplines' basic principles, methodologies, and perspectives.
2. Communication. To provide an educational experience that will enhance the ability to communicate.
3. Inquiry and Critical Thinking. To provide an educational experience that will enhance critical thinking skills and will contribute to continuous inquiry and life-long learning.
4. Information Retrieval and Evaluation. To provide an educational experience that will enhance the ability to find, understand, examine critically, and use information from

various sources.

5. Interdisciplinary Relationships. To provide an educational experience that will enhance students' understanding of a discipline's interrelationships with other .
6. Global or Multicultural Perspectives. To provide an educational experience that will enhance the ability to look at issues from multiple perspectives and/or will describe the disciplines impact on or connection to global issues, AND/OR
7. Social Responsibility. To provide an educational experience that will help students understand the complexity of ethical judgment and social responsibility and/or that will describe the discipline's impact on or connection to social and ethical issues.

Note on units

In this class we will be using the rationalized SI units (or MKSA units). In this convention the correct units are

- Base units
  - for distance - meter (m). A meter is a little over 3 feet, and there are roughly 1600 m to the mile
  - for time - second (s)
  - for mass - kilogram (kg). A 1 kg loaf of bread would be about 2.2 lbs. The mass of an average adult is around 75 kg, and the mass of a car in the range 1000 to 3000 kg.
  - for electrical current - ampere (A)
- Derived or composite units, which are combination of the above four base units
  - for example the unit of energy is the Joule (J) where 1 J = 1 kg m^2/s^2

However you will encounter a variety of other units in the literature, and the ability to convert from one set of units to another is a critical skill. We will cover unit conversion in class.

Unit prefixes

Some numbers are particularly large or small. It is common to use prefixes to units to avoid writing out long numbers with lots of zeroes[1,2]. The prefixes we shall be using are

- T = 1,000,000,000,000 = 10^{12} (pronounced Terra)
- G = 1,000,000,000 = 10^{9} (pronounced Giga)
- M = 1,000,000 = 10^{6} (pronounced mega)
- k = 1,000 = 10^{3} (pronounced kilo)
- m = 0.001 = 10^{-3} (pronounced milli)
- μ = 0.000001 = 10^{-6} (pronounced micro)
- n = 0.000000001 = 10^{-9} (pronounced nano)
- p = 0.000000000001 = 10^{-12} (pronounced pico)
- f = 0.000000000000001 = 10^{-15} (pronounced atto)

although this list is not exhaustive, and we may encounter more.

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1 An alternative to prefixes is the use of scientific notation. I am going to assume that you already are aware of scientific notation. If not, then please let me know and I will happily go over it with you.

2 When using scientific notation and calculators there is a common trap that many students fall into. I will discuss this further in class.

Note on Answering Numerical Questions

Remember goal 2 above, Communication. I interpret that to mean that you can communicate not only the correct answer but that you know what you are doing. You might for example imagine that you are writing a short report to your supervisor in a company. He is knowledgeable about the subject, but does not know the detailed information of the project that you are working on. Your report to him needs to tell him your conclusion, and enough to know that he can rely on your judgment when making business decisions.

So, imagine that I ask the question "If I drive at 30 km/h for 20 minutes, how far do I go?" Here are some possible responses

Response	Comment
600 km	
10 km	
10,000 m	
time = 20 minutes = ⅓ hour distance = speed * time = 30 km/h * ⅓ hour = 10 km	

On tests it is to your advantage to write out your calculation. If you make a mistake part way through then I will assign partial credit to the amount that you have correct.

Your final step in answering a numerical question is to ask if the answer looks right. You will often have a rough idea of the correct answer, and if your answer is outside the range of expected answers that is a good indication that you have made a mistake.

Two notes on calculators

You will need to buy a scientific calculator for this class. For some problems scientific notation is unavoidable, and non scientific calculators often cannot display numbers which are either very large or very small. Remember to bring them to the tests and final. I do not have calculators for the whole class. On the other hand don't spend large amounts of money on fancy graphing calculators with programming capabilities. You won't need them.

- Walmart sells two different brands of scientific calculator, each for only $7 or $8. Their online store has a Texas Instruments TI-30X IIS Scientific Calculator for $14.58 which is also suitable for our needs.
- Target has a Casio Scientific Calculator (FX300ES) for $12.99.
- Office Depot has a Casio® fx-260 Solar Scientific Calculator for $8.99, as well as other good options. Amazon has the same model for $8.35.
- There is even an online calculator you can use for FREE!!![3].

Please see me if you are unsure about entering scientific notation numbers into your calculator. There is a small variation between different brands, but I have found in the past many students are not entering the number correctly.

3 http://www.ecalc.com/calculator/scientific/