Syllabus for Chem. 3700

Alternative Energy

Professor Thomas Orlando, School of Chemistry and Biochemistry
Molecular Science and Engineering Building (MoSE), Office G209C
Phone: 404 894-4012
Thomas.Orlando@chemistry.gatech.edu

Class Meetings:
Tuesdays and Thursdays, 9:35 – 10:55, Howey Physics S104

Holidays:
Sept. 7, 2015
Oct. 10-13, 2015
Nov. 25-27, 2015

TA: Giovani DeLuca
E:mail: Giovanni.DeLuca@gatech.edu
Office: MoSE G221
Office Hours: Mon 1-2

Credit Hrs: 3

Course Description:
This course will give a general overview of the most popular alternative energy sources which are currently being used or developed to help relieve the world dependence on fossil fuels. The basic scientific principles governing the current and future approaches in solar photo-voltaics, fuel cells, biomass conversion, nuclear energy, smart-grids, wind power etc. will be presented. Though the course will focus on the basic principles and fundamental science underpinning the current advancements in energy technologies, there will also be an emphasis on understanding the economic, political, and general sustainability issues associated with the most popular alternate energy options. Due to the interdisciplinary nature of the topic, the course will involve multiple guest instructors from across the campus.

Many class periods will involve a discussion of a reading assignment or an in-class presentation. For each of these classes you will be required to submit a discussion point that is based on the assigned reading or presentation. You will be required to submit this by 6 PM the day BEFORE the reading/discussion assignment is to be discussed in class. Write a few sentences about your discussion point and include any supplementary material that would help others in the class appreciate the topic (e.g. images, websites or other scientific papers). These discussions will usually be limited to 30 minutes and will be lead by a student. Each person will be expected to contribute to the discussion sessions. Each student will be graded on the quality of your discussion and general participation in the discussion sessions.

You will be required to read and provide a critical written and oral report for one additional book or topic on alternative energy. You will have a final research project that will be a small group (3-5 students) demonstrating and testing a basic alternative energy technology. Each group will be required to carry out the project and present a formal presentation to the class.

Primary Instructor: Prof. Thom Orlando (Chem./Biochem. – Primary Course Instructor), **"Guest"-instructors**: Joe Dufek (EAS), Kim Cobb (EAS), Peter Loutzenhiser (Mechanical Engineering), and Chaitanya Deo (Mechanical Engineering).

Required Text: Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, **THIRD EDITION**, ISBN: 13 978-0-19-954332
Note: Information will be presented and distributed from other sources. There will also be other required reading assignments given through-out the course.

Resource Text: Fundamentals of Renewable Energy Processes, Aldo V. da Rosa, Third Edition, ISBN 970-012-397219-4.

Notes on grading:

15% will be based on the written homework questions and discussion points that you submit through T-Square for each assigned reading/discussion. Late submissions will not be accepted.

10% will be based on class participation. This grade includes active participation in discussions and presenting your discussion points to the class.

20% will be based on your written report/critique of an article/topic that you choose for individualized reading. Articles/topics must be approved in advance.

25% will be based on your end-of-term project – this shall be a small group (3-4 students) demonstration and testing of a basic alternative energy technology.

30% will be based on a final written exam.

Schedule

Aug. 18, 20

Introduction to the course

- What is the world energy inventory and projected use?
- General discussion of needs for alternative energy options. (What are the global atmospheric/climate change drivers?

Aug. 25

- Discussion of world's fossil fuel reserves and social climate/policy.
- Where are we and where do we go from here?

Aug. 27, Sept. 1

- Introduction to basic thermodynamics, energetics and overview.

Sept. 3, 8, 10

- General discussion of solar energy basics
- The need for solar photovoltaics
- Current approaches in solar cells
- The "new age" of solar cells and solar technology

Sept . 15, 17, 22

- The need for solar production of fuels
- Catalysis for fuels conversion
- Overview of the political climate of solar
- Overview of the commercial viability of solar fuels

Sept. 27, 29

- Energetics of hydrogen production
- Water splitting and hydrogen production
- General discussion of a potential “Hydrogen economy”

Oct. 1, 6

- General discussion of modern fuel-cells
- Solid-oxide fuel cell operations
- Proton membrane based fuel cells.
- What are the barriers to a hydrogen economy?

Oct. 8

- The energetics of biomass conversion
- How do you choose a “fuel –stock”

Oct. 10 – 13, Student Recess

Oct. 15 Written Report Due

Oct. 15, 20

- Goals, options and limitations of biomass conversion
- Catalysis and fuel production from biomass

Oct. 22

- An overview of fuel cells and limitations

Oct. 27

- An overview of geothermal energy

Oct. 29, Nov. 3

- An overview of batteries and the grid

Nov. 5, 10

- General discussion regarding the viability of wind power
- Predictability of wind patterns
- Geographical selections
-

Nov. 12, 17

- An overview of wave/tidal energy
- Examples of tidal and wave technologies

Nov. 19, 24

- The basics of nuclear energy and nuclear fusion
- Nuclear waste issues
- General discussion regarding the viability or nuclear power
- The need vs. the political climate

Nov. 25 - 27 – Thanksgiving Recess

Dec. 1, 3

- Oral presentations of projects

Dec. 7 - 11, Final Exam Week

Note: This schedule may change slightly based upon class consensus and in-class focus discussions. All changes will be announced several days in advance.