MSE 5390
Fundamentals of Sustainable Energy

Spring 2011
MoWe 4:00PM-5:20PM, 308 Woolf Hall

Goals: To explain how each energy process works and to prepare students to meet the challenges of a complex energy future. This course will cover a broad spectrum of sustainable energy conversion technologies, including thermal, tide, solar, biomass, wind and electrochemical devices, with emphasis on fundamentals in materials & engineering.

Instructor:

Dr. Fuqiang Liu

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Office hours: Monday and Wednesday 2:00 to 4:00 pm

Text Book: "Fundamentals of Renewable Energy Processes", by Da Rosa, Aldo Vieira, 2nd ed., June 2009, Academic Pr, ISBN: 9780123746399

Exams Two midterms and a final term project

Project: One project will be given to students at the end of the semester. The topic should be related to energy generation - an energy problem or a new design. Discussion with the instructor on selecting the subject is encouraged. A review with an extensive literature analysis and a comprehensive mastery over the subject are expected. The project will be presented in class. A report with minimum 5 pages is required.

Website: http://www.uta.edu/faculty/fuqiang/index_files/courses_files/MSE5390.htm

Grading:

Homework	20%
2 midterms	40%
Project and presentation	40%

Note: typical grading policy is >85 A, 75-84 B, 65-74 C, 55-64 D, and <55 F

Attendance will be taken and bonus points may be offered to students who miss only 2 or fewer classes.

MSE 5390 section 002

Fundamentals of Sustainable Energy

Course Outline

1. Introduction: renewable and non-renewable energy sources, fossil fuel reserves, and energy utilization rate

2. Thermal energy
    a. Heat Engine: thermodynamics, efficiency theory, heat of combustion, Carnot cycles, different types of mechanical heat engines
    b. Ocean thermal energy conversion: Configuration, efficiency and design
    c. Geothermal: mechanism and application
    d. Thermoelectricity: experimental observation, thermoelectric generator, Widedmann-Franz-Lorenz law, thermal conductivity in solid, physics of thermoelectricity, and design
    e. Thermionics: thermionic emission, electron transport, and different types of diodes due to thermionics

3. Fuel cells: electrochemical fundamentals, fuel cell thermodynamics, proton exchange membrane fuel cell (PEMFC) materials, PEMFC operation, durability, direct methanol fuel cells, solid oxide fuel cells

4. Hydrogen: hydrogen production (chemical production, electrolytic hydrogen, thermolytic production, as well as photolytic and photobiologic hydrogen production) and hydrogen storage (by compression, hydride and chemical compounds).

5. Batteries: operating principles, materials, primary batteries, and rechargeable batteries

6. Energy from the Sun
    a. Solar radiation and collection
    b. Biomass: biomass as fuel and photosynthesis
    c. Photovoltaic converters: theoretical efficiency, carrier multiplication, beam splitting, and different types of solar cells
    d. Wind: wind machine configurations, wind turbine configuration, and principle of aerodynamics
    e. Ocean engines: wave energy, energy from ocean current, salination energy and osmosis

Classroom Behavior

Students should NOT hold conversations.
Wireless communications devices MUST be silenced or turned off.

American with Disabilities Act

The University of Texas at Arlington is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 93112 - The Rehabilitation Act of 1973 as amended. With the passage of new federal legislation entitled Americans with Disabilities Act (ADA), pursuant to section 504 of the Rehabilitation Act, there is renewed focus on providing this population with the same opportunities enjoyed by all citizens.

As a faculty member, I am required by law to provide "reasonable accommodation " to students with disabilities, so as not to discriminate on the basis of that disability. Student responsibility primarily rests with informing faculty at the beginning of the semester and in providing authorized documentation through designated administrative channels. If you require an accommodation based on disability, I would like to meet with you in the privacy of my office during the first week of the semester to make sure that you are properly accommodated.

Academic Dishonesty

It is the philosophy of the University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspension or expulsion from the University.

"Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts." (Regents' Rules and Regulations, Part One, Chapter VI, Section 3, Subsection 3.2, Subdivision 3.22)

In particular, it is expected that in the course of taking an examination, students will NOT (1) accept information of any kind from others; (2) use any material that is unauthorized by the examiner;(3) use aids to memory other than those expressly permitted by the examiner.

Following an examination, students will not try to deceive the instructor by misrepresenting or altering their previous work.

For homework, students can discuss questions with each other, but each student must write the answers in his/her own words.