ME 417
Design of Alternative Energy Systems
MWF 9:10-10:00 106 Bessey Hall

Instructor

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Course Goals

1. Development and practice of design skills as they apply to alternative energy systems.
2. Development of modeling skills.
3. Development of an understanding of the non-technical issues associated with alternative energy systems.

Course Outline

Week of	Topics
1/10	Sociological, Political and Economic Aspects
1/17	Review of Basic Thermal Sciences
1/24	Wind Energy
1/31	Wind Energy
2/7	Geothermal Energy
2/14	Geothermal Energy
2/21	Ocean Energy
2/28	Ocean Energy
3/7	***Spring Break***
3/14	Solar Energy
3/21	Solar Energy
3/28	Fuel Cells and Electric Storage
4/4	Fuel Cells and Electric Storage
4/11	Appropriate Energy Technology
4/18	Nuclear Energy
4/25	Biomass Energy

Wednesday, May 4 7:45-9:45 a.m. Policy Recommendation Presentation

Projects

1. Essay on the Pros and Cons of Alternative/Renewable Energy Systems
2. Design of a Wind Energy System
3. Design of a Geothermal Heat Pump System
4. Design of a Solar Energy System

Project #1 will be done on an individual basis. The remaining projects will be done in groups of two as assigned by the instructor.

Quizzes

There will be three fifteen minute quizzes during the semester. The purpose of these quizzes is to test the student's ability to use the simple predictive models for alternative energy systems that have been provided in class. To assist the students in preparing for these quizzes, several practice problems will be posted on the web. The quizzes will be closed book and closed notes, but all needed equations will be provided with the quiz.

Policy Recommendation

Each student shall identify an appropriate energy technology and draft a one page recommendation on the technology that he/she would submit as an advisor to the Director-General of the United Nations Educational, Scientific and Cultural Organization (UNESCO) to implement their recommendation. During the final exam period (Wednesday, May 4 7:45-9:45 a.m), the student shall make a 1 minute presentation on the recommendation and will be prepared to defend the recommendation during a 1 minute question period with the class.

Assignment Due Dates (Tentative)

Assignment	Due Date
Project #1	2/7/11
Project #2	2/28/11
Quiz #1	3/2/11
Project #3	3/28/11
Quiz #2	4/1/11
Project #4	4/25/11
Quiz #3	4/27/11
Policy Recommendation	5/4/11 7:45a.m.

Grading

The course total will be based upon the following weightings:

Each quiz: 5%
The policy recommendation: 5%
(Failure to submit and present the policy recommendation will result in a 0.5 decrease in the student's course grade)
Each project: 20%

The course grade will be determined on the basis of a distribution. That is, the class's numerical scores are graphed and grade divisions are drawn based on how students group themselves. A straight scale is used to **guide** the setting of these grade divisions. A student will never receive a grade less than that predicted by the following straight scale.

Course Total (%)	Course Grade
89.5 and above	4.0
84.5 – 89.49	3.5
79.5 – 84.49	3.0
74.5 – 79.49	2.5
69.5 – 74.49	2.0
64.5 – 69.49	1.5
59.5 – 64.49	1.0
Less than 59.5	0.0

Course Learning Objectives

1. Concepts of Analytical Design
   a. Students recognize the value of using predictive models in the design process
   b. Students are able to conduct parametric studies
   c. Students are able to determine an appropriate objective or cost function
   d. Students are able to perform a simple optimization

2. Wind Power Systems
   a. Students are able to understand the nature of wind as an energy source
   b. Students are able to understand and evaluate different types of wind turbines
   c. Students are able to calculate the performance of wind turbines
   d. Students are able to design a wind power system

3. Ocean Power Systems
   a. Students are able to understand the nature of the ocean as an energy source
   b. Students are able to understand and evaluate different types of ocean energy sources, such as ocean thermal energy conversion, wave energy, and tidal energy
   c. Students are able to calculate the performance of ocean power systems
   d. Students are able to design an ocean power system

4. Solar Energy Systems
   a. Students are able to understand the nature of the sun as an energy source
   b. Students are able to understand and evaluate different uses of solar energy, such as direct conversion to electricity (photovoltaic), active space heating, and passive heating and cooling
   c. Students are able to calculate the performance of solar energy systems
   d. Students are able to design a solar energy system

5. Nuclear Power Systems
   a. Students are able to understand the nature of nuclear fission and fusion as energy sources
   b. Students are able to understand and evaluate different types of nuclear power systems

c. Students are able to calculate the performance of fission based nuclear power systems
d. Students are able to design a fission based nuclear power system

6. Fuel Cells
a. Students are able to understand the nature of the fuel cells as an energy source
b. Students are able to understand and evaluate different type of fuel cells
c. Students are able to calculate the performance of fuel cells
d. Students are able to design a fuel cell energy system

7. Geothermal Energy Systems
a. Students are able to understand the nature of the earth as an energy source or sink
b. Students are able to understand and evaluate different types of geothermal energy systems
c. Students are able to calculate the performance of geothermal energy systems
d. Students are able to design a geothermal energy system

8. Biomass Energy
a. Students are able to understand the nature of the biomass as an energy source
b. Students are able to understand and evaluate different biomass fuels
c. Students are able to calculate the performance biomass fuels
d. Students are able to design a biomass energy system

8. Batteries, Electrical Storage and Control
a. Students are able to understand the nature of electrical storage and control
b. Students are able to understand and evaluate different types of batteries
c. Students are able to calculate the performance of batteries
d. Students are able to design an electrical storage and control system

10. Engineering Project Skills
a. Students are able to communicate ideas, methods, results, and decisions effectively in a written technical memo
b. Students are able to work effectively with a partner to equitably distribute and carry out the tasks associated with a design project.
c. Students are able to evaluate their performance on a project team