

Physics 130/Environmental Studies 130

Science of Renewable Energy

Spring 2019

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MWF 1:10 – 2:10 OLRI 100

Introduction

This course provides a detailed treatment of the state-of-the-art science and engineering of electrical power generation by solar and wind and their integration on the grid using energy storage. In the first part of the course general aspects of grid electricity production will be surveyed. The focus of the course will be an in-depth treatment of the physics and engineering of renewable energy implementation such as solar cells and wind turbines, as well as the most promising energy storage options. We will conclude with a discussion of current technical and economic issues associated with the large scale implementation and integration of these technologies.

The purpose of the course is to provide a broad and rigorous foundation in the basic economics and technology of energy to inform policy decisions. It can also serve as an introduction to renewable technology for those are interested in pursuing scientific and engineering research in this area. While energy policy will not be a focus of the course, we will touch upon some aspects of policy when appropriate.

Prerequisite and Materials

There is no textbook for the class, but there will be numerous handouts (on Moodle) throughout the semester.

Assignments

Problems will be assigned most class periods due the next class period. You are encouraged to consult with each other on the problems after you have made your best effort to solve the problems on your own. However, if you work together, each student must still submit their own copy of the problems. There will be three one hour examinations. There will also be typically 1-page weekly reading reflections on assigned readings.

Evaluation:

Homework: Your problem assignments will count 20% of your grade.

Exam: The exams will each count 20% of your grade.

Readings: The reading reflections will count 20% of your grade

Attendance and Consultation

Since there is no textbook for the course, the material presented in class is your only reference for the homework and the exams (readings are *supplementary* to class material). Therefore, *class attendance is mandatory*. We cover a lot of ground every class, so if you miss a class you need to get the notes from another student.

You are *encouraged to see me if you have difficulties with assigned problems or any other aspect of the course*. My office hours are posted on my office door, and you may also make an appointment. You may also “drop in” if I am in my office and not busy with another person or on the telephone.

Tentative Schedule (especially exam dates!)

<u>Week</u>	<u>Topic</u>
1/28	Energy Fundamentals
2/4	Energy Fundamentals, Thermal Energy
2/11	Chemical Energy and Internal Combustion Engines
2/18	Biofuels
2/25	Electrical Energy
3/1	Exam 1
3/4	Conventional Electrical Power Generation (Fossil Fuel, Nuclear)
3/11	Electrochemistry: Batteries, Hydrogen Economy
3/18	Spring Break
3/25	Electric Vehicles/ Photovoltaics
4/1	Photovoltaics
4/5	Exam 2
4/8	Wind Energy
4/15	Geothermal, Fusion
4/22	Energy Storage and Grid Integration
4/29	Energy Storage and Grid Integration
5/6	Last Day of Class: Exam 3