EK 225: Introduction to Energy Conversion and Environmental Engineering

Fall 2021

Instructor
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Class Time: Monday/Wednesday 10:10-11:55AM

Classroom: WED 208

Office Hours: Mondays 2:00-3:00 PM, or by appointment

Course Description:
This class examines the existing state of the world's energy use and its impact on society and the planet. A quantitative framework is provided in order to evaluate current and potential technologies. Individual energy generation, conversion, and end use options are evaluated within this framework. Both renewable energy generation technologies: wind, solar, biomass, and hydro, and conventional sources such as nuclear and fossil fuels will be compared. Energy conversion is discussed with regards to batteries and fuel cells, liquid bio- fuels, and grid level storage systems. These technologies are then put into a social context and their use around the world is discussed. Evaluations are based on homework and class discussions, a project, and two exams. Cannot be used for credit towards an engineering degree.

Grading:

Homework	10%
Exam 1	20%
Exam 2	25%
Project	25%
Participation	10%
Discussion Lead	10%

Homework
Homework will count for 10% of the final grade. 8 homework sets are assigned throughout the semester. Due dates for homework are given on the Course Schedule. Homework should be turned in via Blackboard. Late homework will not be accepted. Your lowest homework grade will be dropped and your overall homework grade will be out of 7 assignments.

Homework assignments should be presented in a professional manner. This includes clean, legible writing; clear, logical work; labeled plots and tables.

Exams

Two exams will be given during the semester. The first will be an in-class exam and will cover chapters indicated on the Course Schedule. The second exam will be given during the scheduled finals block.

All exams are to be done individually. The use of online websites or sources are not allowed during any exam. Collaboration of any kind or use of prohibited sources will be grounds for a zero on the exam and possible disciplinary action.

Project

A team project will be assigned mid-semester that will count for 25% of your final grade. Details on the project will be given in a separate document.

Participation

Participation includes in-class discussions, asking questions in class, attending office hours, answering questions, and generally being present and making an effort.

Discussion Lead

Once during the semester you will chose a short reading (~5-8 pages) relevant to the topic of the day and lead a discussion on the reading. The reading should come from a peer reviewed scientific journal and have been published within the last 5 years. The reading should discuss a state of the art technology, societal, environmental or economic aspect of the topic. Readings should not present a review or overview of the topic.

Readings should be selected a week before the class and 2 questions should also be assigned. The questions and a PDF of the selected reading should be emailed to Prof. Ryan (ryanem@bu.edu) one week ahead of class. Readings and questions will be posted on Blackboard.

Sign up for your discussion lead here:

https://docs.google.com/spreadsheets/d/1eqa_zXNHktgEVdG7tQZroRPNRWweNVKojTreaeDkkYM/edit?usp=sharing

Sign up is first come, first serve. If someone has signed up for a slot, please do not add your name or delete theirs, chose another slot.

Class Policies:

1. Academic dishonesty will not be tolerated. Students are expected to follow the BU Code of Student Responsibilities: http://www.bu.edu/dos/policies/student-responsibilities/
2. Attendance: You are expected to be present and engaged during class, however attendance will not be taken. Your attendance and engagement is reflected in the participation portion of the grade.
    a. Per BU COVID-19 policies, you will not be allowed to attend class if you are ill, are out of compliance with BU testing and attestation policies or if you are not wearing a mask that covers both your nose and mouth.

3. Inclusion: I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.
4. Accommodations for Students with Documented Disabilities: If you are a student with a disability or believe you might have a disability that requires accommodations, requests for accommodations must be made in a timely fashion to Disability & Access Services, 25 Buick St, Suite 300, Boston, MA 02215; 617-353-3658 (Voice/TTY). Students seeking academic accommodations must submit appropriate medical documentation and comply with the established policies and procedures: http://www.bu.edu/disability/accommodations/
    a. Requests for accommodations must be submitted to Prof. Ryan at least 1 week before an exam.

Course Materials:
Blackboard will be used for all class communications and documents.

An up to date Course Schedule will be on Blackboard and will include all readings, homework assignments, and due dates. Please check it regularly as it will be a living document.

Required Textbook:
R.L Jaffe, W. Taylor, *The Physics of Energy*, Cambridge Press, 2018.

Reference Textbooks:
1. J.W. Tester, E.M. Drake, M.J. Driscoll, M.W. Golay, W.A. Peters, *Sustainable Energy: Choosing Among Option*, MIT Press, Second Edition, 2012.
2. K. Weston, *Energy Conversion,* EBook, http://www.personal.utulsa.edu/~kenneth-weston/.
3. A.W. Culp, *Principles of Energy Conversion*, McGraw-Hill, 1991.
4. Y.A. Cengel, M.A. Boles, *Thermodynamics*, McGraw-Hill, 2002.
5. J.R. Mihelcic, J.B. Zimmerman, *Environmental Engineering: Fundamentals, Sustainability, Design*, Wiley, 2014.

Topics:
1. Overview of Energy Conversion
2. Heat Transfer Fundamentals
3. Thermodynamics Fundamentals
4. Vapor Power Cycles
5. Gas Power Cycles
6. Cleaning up fossil fuels
7. The Electric Grid
8. Nuclear Power
9. Wind
10. Solar
11. Ocean/Wave Energy
12. Geothermal
13. Other Renewable Energy Systems
14. Chemical-Electrical Conversion

15. Environmental Impacts

Course Schedule

A separate course schedule document can be found on Blackboard. You should refer to this for all readings, assignments and due dates. Note that the Course Schedule is a living document and will be updated throughout the semester.