EK 225: Introduction to Energy Conversion and Environmental Engineering

Fall 2024

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

Classroom: EPC 208

Office Hours: In Person, Mondays 2:30-3:30 PM

Virtual, Tuesdays 12:30-1:00PM (https://bostonu.zoom.us/my/ryanem)

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. 6 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 5 assignments.

Homework assignments should be presented in a professional manner. This includes clean, legible writing; clear, logical work; labeled plots and tables. Problems should be presented in order and uploaded to Blackboard as a single PDF.

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. The project will focus on learning about state of the art energy conversion technologies. Groups of 3 students will work together to research a topic related to a new or advanced energy conversion technology selected from the provided list of topics. Teams will present their technology in class during a mock poster session for the Energy Conversion Conference held mid-semester. Grading will be based on your abstract, poster, presentation and reviews by your fellow classmates. Details on the project will be given in class.

Project Sign Up

Note: Project topic selection is first come, first serve

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

Teams of 2-3 will lead a class discussion based on a short (~5-8 pages) reading relevant to the topic of the day. The reading should discuss a state of the art technology, societal, environmental or economic aspect of the topic. The reading should come from a reputable source (i.e. a peer reviewed scientific journal, or respected news organization) and have been published within the last 5 years. Readings should not present a review or overview of the topic.

The discussion should start with a short (~2 minute) overview of the paper and then an interactive class discussion for ~15 minutes. The discussion can take many forms and should be INTERACTIVE, for example you can discuss data in a plot or figure of the paper; you can ask questions of how the paper relates to class or to wider aspects of sustainability, you can discuss the paper in the context of current events, etc. Slides are allowed but not required for the discussion.

Readings should be selected a week before the class and emailed to Prof. Ryan. Late submission will result in a lower grade on the assignment or may be rejected if too late. Decisions on penalties or rejection is at the discretion of Prof. Ryan. Readings will be posted on Blackboard.

Discussion Sign Up

Class Policies:

1. Academic dishonesty will not be tolerated. Students are expected to follow the BU Code of Student Responsibilities: https://www.bu.edu/academics/policies/academic-conduct-code/
    a. Any violation of the code will be punishable by possible zero for the assignment or course grade and will be sent to the conduct committee.
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.
3. Use of AI: The use of A.I. tools such as ChatGPT is allowed in this course under some circumstances. For homework and projects, you must clearly indicate any use of A.I. tools and provide appropriate citations or references for any A.I.-generated content or results produced. This should include full documentation of exactly how the tool was used. A.I. should not replace your individual effort or original work but rather, should be used as supplemental resources to support your own analysis, critical thinking, and problem-solving. However, you should note that all large language models still have a tendency to make up incorrect facts and fake citations, code generation models have a tendency to produce inaccurate outputs, and image generation models can occasionally come up with highly offensive products. You will be responsible for any inaccurate, biased, offensive, or otherwise unethical content you submit regardless of whether it originally comes from you or an A.I. model.

    For quizzes and exams, use of any external resource (A.I., Google, your textbook, other students, etc.) is strictly prohibited. Any misuse or violation of the policy, including unauthorized or excessive use of A.I., will be considered a breach of academic integrity and subject to disciplinary actions as per BU's policies and procedures on academic misconduct.

    Text taken from: https://teaching.unl.edu/resources/strategies-techniques/teaching-technology/ai-policy-creation/
4. 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.
5. 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:
O.S. Miljanic, J.A. Pratt, *Introduction to Energy and Sustainability*, Wiley-VCH, 2022.

Reference Textbooks:

1. R.L Jaffe, W. Taylor, *The Physics of Energy*, Cambridge Press, 2018.
2. 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.
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 can be found on Blackboard. Refer to this for all readings, assignments and due dates. Note it is a living document that will be updated throughout the semester.