ME 533: Energy Conversion

Fall 2024

Instructor
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Class Time: Monday/Wednesday 12:20-2:05PM

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:
Thermodynamic and mechanical aspects of modern energy conversion systems, including traditional systems such as steam power plants, gas turbines and internal combustion engines and refrigeration systems, and renewable systems, such as solar, wind, geothermal, and energy storage. Combined heat and power and cogeneration are also considered, as well as economic and environmental aspects of energy conversion.

Grading:

Homework	15%
Exam 1	20%
Exam 2	20%
Project	25%
Participation	10%
Discussion Lead	10%

Homework
Homework includes in-class assignments and assigned problem sets and will count for 15% of the final grade. Homework should be turned in via Blackboard. Late homework will not be accepted.

Homework assignments should be presented in a professional manner. This includes clean, 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 material from the first half of the semester. The final exam will be a take home exam.

The final exam will be a report discussing your vision for a sustainable energy future. The report must include citations, quantitative information to support your vision, a discussion of how your project topic fits (or does not fit) into your vision, and the economic implications of your vision. Details on the report requirements will be given out in class.

All exams are to be done individually. Collaboration of any kind will be grounds for a zero on the exam and possible disciplinary action.

Project

The project will focus on learning about state of the art energy conversion technologies. Groups of 4 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 engaged.

Discussion Lead

Teams of 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. Each group will chose their reading. 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 Lead 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.

Readings:

Selected articles, reports, and book chapters will be assigned throughout class and are posted to Blackboard.

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. A.W. Culp, *Principles of Energy Conversion*, McGraw-Hill, 1991.
3. Y.A. Cengel, M.A. Boles, *Thermodynamics*, McGraw-Hill, 2002.

Topics:

1. Overview of Energy Conversion
2. Environmental Impacts
3. Thermodynamics Review
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. Direct Energy Conversion

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.