ME 533: Energy Conversion

Spring 2022

Instructor
Emily M Ryan
Office: 110 Cummington Mall, Room 416
Email: ryanem@bu.edu
Phone: 617-353-7767

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

Classroom: MCS B31

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

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. 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, assigned problem sets, and attendance of webinars 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.

Attendance of webinars: The Department of Mechanical Engineering, College of Engineering and the Institute for Sustainable Energy have a number of webinars on energy related topics scheduled throughout the spring semester. As part of your homework grade you should attend 5 webinars and write a short summary (1/2 page) of what you learned. These should be turned in throughout the semester via Blackboard.

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, calculations 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 2 or 3 students will work together to research a topic related to a new or advanced energy conversion technology. 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 Team Sign-up

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 will chose a short reading (~5-8 pages) relevant to the topic of 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 one week ahead of class. Readings and questions will be posted on Blackboard.

Note: You must have different partners and topics for the project and the discussion lead.

Discussion Lead Sign-up

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. Cell phone use during class or exams is not allowed. This includes phone calls, texting, browsing, calculator functions, etc.
3. Class begins promptly at 10:10AM. Late arrival is not permitted without prior approval.
4. If you will be absent for an extended time due to COVID, reach out to Prof. Ryan as soon as possible.

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. 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.

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 Chemical-Electrical Conversion

Webinars:

Institute for Sustainable Energy

Where is Energy Storage Headed?

1. January 28, 2022 - Interfacial Phenomena in Electrochemical Systems
2. February 11, 2022 - Challenges of Degradation in Long-term Operation
3. February 25, 2022 - The Future of Electrochemical Systems – New Architectures and Functional Materials

Energy of the Future Series

1. March 18, 2022 - AI and the Electric Grid
2. April 29, 2022 – AI and Transportation

College of Engineering Seminars

Energy, Sustainability, and Climate

Every Tuesday and Thursday in February and March at 12:00PM

Mechanical Engineering

Select Fridays at 12:00PM

January 28th, 2022

February 18th, 2022

Materials Science, and Engineering

Monday/Wednesday/Fridays in February @ 3PM