MEC 517: Energy Technologies Laboratory II

Spring / 2019
Light Engineering LE-132
Tues 7-10 PM (Sec 01), Thurs 7-10 PM (Sec 02)

Instructors/ Office Hours:

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Catalog Description:

Experiments in the areas of thermoelectric power, fuel cells, photovoltaics, wind turbines, hydrogen storage, hydrogen generation, and power electronics in addition to related project work. The focus is on system efficiencies, system integration, and design for residential markets. Student groups are assigned laboratory projects to build experience applying various energy technologies to solve problems.

This course and MEC 516 (offered in the Fall) are laboratory courses designed to give students hands-on experience with power generating and energy related technologies in a laboratory environment. Students will learn basic concepts of power generation and how they apply to specific technologies such as thermos electrics, fuel cells, electrolysis cells, wind turbines, photovoltaics, and generators. We will understand how these technologies deliver power and study the factors that effect the efficiency of the power generation and transmission. These courses will serve to illustrate and reinforce the theories and principles learned in other MEC lecture courses.

Textbook:

- There is no required text for the course
- Reading materials for the various experiments will be posted to Blackboard

Reference books:

- *Fuel Cell Systems Explained, Larminie and Dicks*
- *Fundamentals of Eng. Thermodynamics, Morran and Shapiro*
- *Heat Transfer, Holman*
- *Heat Transfer: a practical approach, Yunus A. Cengel*
- *Principles of Solar Engineering, Goswani, Kreith, and Kreider*

Activities:

1. Thermoelectric Experiments (1-4) – Students will learn about thermoelectric devices – how they work and what are the principle modes of operation. Understand the Seebeck and Peltier effects and how they relate to TE's. Factors that affect the efficiency such as heat loss, resistive heating, and thermal conductivity and how to arrange a TE assembly to optimize efficiency and heat transfer.

2. Fuel Cell Labs 1 & 2 - Students will learn about the concepts of operation of fuel cells and how to optimize the output efficiency of a fuel cell system.

3. Electrolysis Lab – Students will learn about the process by which electrolysis produces electrical power – how an electrolysis cell works and what are some of the cell design parameters that can be optimized to improve the efficiency.

4. Power Inverter Lab – Students will learn about the differences between DC and AC power, how power inverters convert DC current to AC, and how to measure AC power output.

5. Generator Lab – Students will work with small generators to understand the conversion of gravitational potential energy into electrical energy and the storage of energy in a flywheel.

6. Wind Turbine Lab – Students will learn how wind turbines convert wind energy into electrical energy and how the efficiency is affected by wind speed.

7. Photovoltaics Labs – Students will learn how to measure Voltage-Current characteristics and performance of a photovoltaic panel.

8. Charge Controller Lab - Students will learn how charge controllers are used to manage the output of power generating systems such as photovoltaics, and how to measure their efficiency.

The laboratory is an environment for learning.

Students are strongly encouraged to collaborate in the laboratory within your lab group and other groups. You should compare your observations and data with other groups to check for consistent results. Ask questions if you need help, and offer help if you see others struggling or doing something that you think is incorrect.

While it is OK to compare results, and collaborate in the lab, your group's reports should be your own work.

Learning Outcomes and Goals:

Students will:

- become familiar with power generating and energy storage technologies, how systems operate and what are the factors that affect their efficiency.
- Learn how to measure the practical efficiency of an energy system
- Understand basis electrical power measurements and computations
- Design experiments and plan measurements to answer questions and obtain desired results
- Graphically analyze data and present results in concise, coherent reports.
- Collaborate and work with a group to plan, solve problems, and produce analysis.

Grades:

- Each of the labs will be graded out of 10 points. As a graduate level class, 1 of the 10 points is reserved for producing a graduate level report. This point will be given for superior work at the graders discretion. Combined, the labs are worth **60%** of the semester grade.

- A group project report will be assigned and due mid-semester and will be worth **20%** of the semester grade. Further details will be given in class and on Blackboard.

- An end of semester exam will be given worth **20%** of the semester grade. This will include questions from each experiment performed during the semester.

Americans with Disabilities Act

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact Disability Support Services at (631) 632-6748 or http://studentaffairs.stonybrook.edu/dss/. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website: http://www.sunysb.edu/ehs/fire/disabilities.shtml

Statement on Academic Dishonesty

Academic dishonesty is an extremely serious offense and will not be tolerated in any form. Academic dishonesty in general is the presentation of intellectual work that is not originally yours. Examples include, *but are not limited to*, copying or plagiarizing class assignments including homework, reports, designs, and other submitted materials; copying or otherwise communicating answers on exams with

other students; bringing unapproved aids, either in physical (written) or electronic form to an exam; obtaining copies of an exam prior to its administration, etc. Academic dishonesty violates both the ethical and moral standards of the Engineering profession and all infractions related to academic dishonesty will be prosecuted to the fullest via the CEAS CASA committee. For you, the honest student, academic dishonesty results in lower class curves, hence a depression in your GPA and class standing, while cheapening the degree you earn.

Inclusivity Statement

We understand that our members represent a rich variety of backgrounds and perspectives. The Mechanical Engineering program/department is committed to providing an atmosphere for learning that respects diversity. While working together to build this community we ask all members to:

- share their unique experiences, values and beliefs
- be open to the views of others
- honor the uniqueness of their colleagues
- appreciate the opportunity that we have to learn from each other in this community
- value each other's opinions and communicate in a respectful manner
- keep confidential discussions that the community has of a personal (or professional) nature