MEC 517: Energy Technologies Laboratory II

(Spring 2025, 3 Credits) - Tentative, Subject to Change

Catalog Course 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.

Instructor

David J. Hwang (david.hwang@stonybrook.edu), 222 Heavy Engineering Building

Office Hours: Tue 12:30-3:30 PM (222 Heavy Engineering) + Lab hours (132 Light Engineering).
Contact instructor by email for further questions or setting up extra office hours (allow 24-48 hours for reply).

Teaching Assistant

Yiting Zheng (yiting.zheng@stonybrook.edu), will mainly assist lab tasks in 132 Light Engineering Building.

Office Hours: TBD.

Schedule

- **Labs/Lectures:**
  - **MEC517-L01** 3:30 – 6:20 PM Tuesdays, 132 Light Engineering Building
  - **MEC517-L02** 6:30 – 9:20 PM Tuesdays, 132 Light Engineering Building
- **Final Exam:** Take-home exam, Final Week

*. All the students are required to attend Labs/Lectures and take the exam as scheduled (check page 3) or should contact the instructor in advance for possible accommodation or makeup.

Textbook: No required textbook. Lab manuals and supplementary materials to be uploaded on Brightspace

Reference books (NOT required):

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

Labs (12 labs) + Group Project, subject to change

- **Thermoelectric Experiments 1-4 (TE1, TE2, TE3, TE4)** – Students will learn about thermoelectric devices – how they work and what are the principles and modes of operation. Understand the Seebeck and Peltier effects and how they relate to TE's. Factors that affect efficiency such as heat loss, resistive heating, and thermal conductivity and how to arrange a TE assembly to optimize efficiency and heat transfer.
- **Fuel Cell Experiments 1 & 2 (FC1, FC2)** – Students will learn about the concepts of operation of fuel cells and how to optimize the output efficiency of a fuel cell system.
- **Electrolysis Experiment (ELEC)** – 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.
- **Power Inverter Experiment (INV)** – 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.

- **Generator Experiment (GEN)** – 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.
- **Wind Turbine Experiment (WT)** – Students will learn how wind turbines convert wind energy into electrical energy and how the efficiency is affected by wind speed.
- **Photovoltaics Experiment (PV)** – Students will learn how to measure Voltage-Current characteristics and performance of a photovoltaic panel.
- **Charge Controller Experiment (CC)** - 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.
- **Group Project -** Students will work on a research or technical project and presentation. Details to be shared separately on Brightspace.

Course Structure

- This is an in-person lab course.
- Students form groups to perform all the labs.
- Manuals for scheduled labs will be posted on Brightspace in advance. Students are required to read before lab hour.
- Each group submits a single report for each lab via Brightspace by the beginning of next scheduled lab session.
- In Brightspace, you will access course materials including lab manuals, lecture/reference materials.
- There will be a group project assigned.
- Each student must write at least three reports as a primary author. Peer-evaluations are being considered, and upon insufficient contribution by specific group member(s), separate grading scale and/or additional tasks will be applied.
- Take-home final exam will be given and each student should take the exam.

Grading

- **Lab Reports (70%):** Students form groups of four to five. Each group collectively submits a single report for each lab. 70% of the semester grade will be based on the total grade of all lab reports.
- **Group Project (20%):** Each group collectively presents the project outcomes, and collectively submits a single project report, accounting for 20% of the semester grade. The project will focus on energy applications to broaden knowledge gained through the course lab sessions. Further details on the group project will be provided.
- **Final Exam (10%):** Each student will take a final exam during the final exam period, accounting for 10% of the semester grade. The exam will include questions from the labs performed during the semester, and any lecture and supplemental materials covered during the semester.

Technical Requirements

- This course uses Brightspace for the facilitation of communications between faculty and students, submission of assignments including lab reports, group project and final exam, and posting of grades and feedback. The Brightspace course site can be accessed at https://brightspace.stonybrook.edu. If you are unsure of your NetID, visit https://it.stonybrook.edu/help/kb/finding-your-netid-andpassword for more information.

Course Learning Outcomes/Objectives

- To become familiar with power generating and energy storage technologies, how systems operate and what are the factors that affect their efficiency.
- To learn how to measure the practical efficiency of energy and power generating systems.
- To understand basis electrical power measurements and computations
- To design experiments and plan measurements to answer questions and obtain desired results
- To graphically analyze data and present results in concise, coherent reports.
- To collaborate and work with a group to plan, solve problems, and produce analyses.

Detailed Schedule for Labs (tentative, subject to change)

All the sessions to be held in 132 Light Engineering Building
EXCPET WT-G Lab

		MEC 517-01 3:30-6:20PM	MEC 517-02 6:30-9:20PM	Notes	Lab Set Schedule A	 B	 C	 D
Week 1		1/28/2025 Intro	1/28/2025 Intro	First Class	Introduction and Group Formation			
Week 2	*	2/4/2025 Lab 1	2/4/2025 Lab 1	First Lab	TE1	TE1	TE3	TE3
Week 3	*	2/11/2025 Lab 2	2/11/2025 Lab 2	(Lab 1 Report Due)	TE3	TE3	TE1	TE1
Week 4	*	2/18/2025 Lab 3	2/18/2025 Lab 3	(Lab 2 Report Due)	TE2	TE2	TE4	TE4
Week 5	*	2/25/2025 Lab 4	2/25/2025 Lab 4	(Lab 3 Report Due)	TE4	TE4	TE2	TE2
Week 6	*	3/4/2025 Lab 5	3/4/2025 Lab 5	(Lab 4 Report Due) (Project Proposal)	FC1	FC1	GEN	GEN
Week 7	*	3/11/2025 Lab 6	3/11/2025 Lab 6	(Lab 5 Report Due)	GEN	GEN	FC1	FC1
Week 8		3/18/2025 Spring Recess (no lab)	3/18/2025	Spring Recess	no lab	no lab	no lab	no lab
Week 9	*	3/25/2025 Lab 7	3/25/2025 Lab 7	(Lab 6 Report Due)	FC2	FC2	ELEC	ELEC
Week 10	*	4/1/2025 Lab 8	4/1/2025 Lab 8	(Lab 7 Report Due)	ELEC	ELEC	FC2	FC2
Week 11	*	4/8/2025 Lab 9	4/8/2025 Lab 9	(Lab 8 Report Due)	WT	WT	PV	PV
Week 12	*	4/15/2025 Lab 10	4/15/2025 Lab 10	(Lab 9 Report Due)	PV	PV	WT	WT
Week 13	*	4/22/2025 Lab 11	4/22/2025 Lab 11	(Lab 10 Report Due) (Project Draft Due)	INV	INV	CC	CC
Week 14	*	4/29/2025 Lab 12	4/29/2025 Lab 12	(Lab 11 Report Due)	CC	CC	INV	INV
Week 15		5/6/2025 Review and Project Pres.	5/6/2025	Last class (Lab 12 Report Due)	Project Presentations & Final Exam Review (during lab hours) Take-Home Final Exam Assigned on 5/7/2025			
Final Period		5/7/2025-5/21/2025 (no lab)		(Project Report & Final Exam Due)	Take-Home Final Exam Due (given on 5/7, due by 5/14 midnight) Group Project Final Report Due (5/21, midnight)			

Groups 1A/1B/1C/1D 3:30-6:20
Groups 3A/3B/3C/3D 6:30-9:20

STUDENT ACCESSIBILITY SUPPORT CENTER STATEMENT

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, Stony Brook Union Suite 107, (631) 632-6748, or at sasc@stonybrook.edu. 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 the Student Accessibility Support Center. For procedures and information go to the following website: https://ehs.stonybrook.edu/programs/fire-safety/emergency-evacuation/evacuation-guide-people-physical-disabilities and search Fire Safety and Evacuation and Disabilities.

ACADEMIC INTEGRITY STATEMENT

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html.

CRITICAL INCIDENT MANAGEMENT

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Student Conduct and Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

STATEMENT ADDRESSING ABSENCES

Students are expected to attend every class, report for examinations and submit major graded coursework as scheduled. If a student is unable to attend lecture(s), report for any exams or complete major graded coursework as scheduled due to extenuating circumstances, the student must contact the instructor as soon as possible. Students may be requested to provide documentation to support their absence and/or may be referred to the Student Support Team for assistance. Students will be provided reasonable accommodations for missed exams, assignments or projects due to significant illness, tragedy or other personal emergencies. In the instance of missed lectures or labs, the student is responsible for reviewing posted lecture materials, recorded lectures and recorded lab videos, and communicate/collaborate with group members to write lab report based on sample data. Please note, all students must follow Stony Brook, local, state and Centers for Disease Control and Prevention (CDC) guidelines to reduce the risk of transmission of COVID. For questions or more information click here.