MEC 516: Energy Technologies Laboratory I

Catalog Description

Laboratory experiments are conducted in the areas of infrared imaging, spectral properties of visible light and IR radiation, geothermal and Split heat pumps, batteries, power electronics, passive solar thermal, thermal conductivity and insulation, and wireless power transfer. The focus is on measuring system efficiencies and the factors that affect it, system integration, and design for residential markets. The fundamentals of the relevant technologies will be presented and utilized in the laboratory sessions. Students will analyze experimental data, compare their data with physical and theoretical models, and present their results in reports. Student groups are assigned laboratory projects or a research topic focused on applying various energy technologies to solve engineering problems.

Course Instructors:

Arzu Kurt arzu.kurt@stonybrook.edu

office: LE132 office hours: tues, wed 6:30-7pm, and by appnt.

Sean Stoll sean.stoll@stonybrook.edu

office: LE132 office hours: tues, wed 6:30-7pm, and by appnt.

Rafael Tejada (Laboratory Technical Staff) Rafael.tejada@stonybrook.edu

office: HE152 office hours: Tu, Th 10-1PM, by appnt.

Reference books (not required)

- *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*
- *Additional background papers and reading materials specific to the experiments will be provided*

Activities/Experiments

1. Solar Thermal Heating Lab – Measure the operating data to understand a passive solar-thermal heating system trainer to understand the components of a solar thermal heating system and how they work.

2. Infrared Radiation Lab 1 – Examination of thermal radiation, measuring surface emissivity, temperature, and thermal imaging using IR cameras.

3. Infrared Imaging Lab 2 – Measuring thermal radiation emitted from a body, considering surface emissivity, temperature, and thermal measurement using IR sensors and thermocouples.

4. Spectrophotometer Lab 1 – Understanding how a spectrometer works, what it measures and how to use it to measure the spectral transmission, absorbance, and reflectivity of materials.

5. Spectrophotometer Lab 2 – Using the spectrophotometer to characterize the optical and thermal properties of commercial window samples. Using the spectrophotometer to measure the absolute power output of light sources.

6. House - $1/r^2$ Lab – Using thermal imaging to audit energy efficiency of structures. Measuring attenuation of thermal radiation.

7. Thermal Conductivity / Insulation Lab – Measuring and comparing the thermal insulating properties of some common building materials.

8. Motor / Generator Lab – working with electric motors and generators and measuring the efficiency of delivering power to a load.

9. Battery Lab – Measure the efficiency of the charge/discharge cycles of LiPO batteries, assessing the charge status and health of Lead/Acid batteries.

10. Geothermal Heat Pump Lab – Using a Geothermal system "trainer" to record system data and study the performance of a geothermal heat pump.

11. Fujitsu "Split" Heat Pump Lab - Using a Fujitsu "split" heat pump system to record system data and study the performance of a heat pump.

12. Wireless Power Transfer – Explore the process of inductive charging used in the charging of electronic devices such as cell phones. Measure the efficiency of the process and study factors that affect the efficiency such as proximity and coil alignment.

These are the planned experiments for the semester. Other experiments may be substituted if equipment or scheduling issues arise.

In addition to the time spent working in the lab on scheduled weekly experiments, students are expected to work with their groups on their project.

Assignments and Required Reading

- Assignments will be posted on Blackboard and through email announcements. Students are expected to check Blackboard regularly for updates.
- A schedule of the laboratory experiments will be posted on Blackboard. Laboratory manuals and supplementary materials for each experiment will also be posted on Blackboard. Students are required to read the materials and come to class prepared to conduct the experiments.

Grades

- Students will form groups to conduct the lab experiments and submit a report. Each of the lab reports will be graded out of 10 points. All students in a group receive the same report grade. The lab reports account for 70% of the semester grade.

- A group project or report will be assigned and due mid-November and will be worth 20% of the semester grade. The project will focus on the application of knowledge of heat and energy transfer gained through the course experiments. Further details will be given in class and on Blackboard.

- An exam will be given at the end of the semester, during Final Exam week, worth 10% of the semester grade. The exam will include questions from the experiments performed during the semester and any supplemental material covered during the semester. The time and place for the exam will be announced later in the semester. Check Blackboard for the date/time/place of the exam. No make-up exams will be given.

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

Academic Integrity

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 University 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.