

Mechanical Engineering (ME) 677: Solar and Renewable Energy Utilization

Catalog Description: (2016 – 2017 Catalog) Introduction to renewable energy applications. Includes environmental motivations, historical perspectives, solar photovoltaic and thermal applications, implications in building designs, wind energy, biomass, alternative fuels, geothermal power utilization, utility considerations, and political and economic factors. Required course for the Solar and Renewable Energy graduate certificate

Prerequisites: Admission to the Solar and Renewable Energy graduate certificate

Co-requisites: None

Note: This course is crosslisted with ME 477. Credit at the 600-level requires additional work.

Credits: 3 **Contact Hours:** 3 (Lecture)

Course Coordinator: Robert Boehm

Course Learning Outcomes: At the conclusion of this class, students will be able to

- Correctly describe the various types of solar and renewable energy systems,
- Conduct basic measurements of solar drinking hot water and photovoltaic system performance
- Explain the basic principles and features of building energy systems
- Identify the main features of straw bale house construction
- Conduct a basic life cycle analysis of renewable energy systems
- Determine the needed size of a wind electric turbine based on energy demand and available wind energy
- Identify the basic types of biofuels
- Describe the basic types of energy storage systems\.

Course Objective: To present information on an overview of renewable energy technologies and their use, indicating wherever possible the availability and costs of using these technologies as future energy supplies for the world. Special emphasis will focus on the US. .

Brief List of Topics Covered:

1. Energy and the Sun
2. Facility Tour
3. Experiments (Solar Domestic Hot Water and Photovoltaics)
4. Heat Transfer and Thermal Storage
5. Solar Domestic Water Heating
6. Building Energy
7. Passive Building Energy
8. Straw Bale Houses
9. Concentrating Solar Power
10. Geothermal Energy
11. Photovoltaic (PV) Technology

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12. PV Reliability, Life Cycle Analysis
13. Cost Analysis, subsidies
14. Wind Energy
15. Bioenergy
16. Water Power
17. Energy Storage
18. Battery Storage
19. Institutional Issues
20. Economics
21. Vehicles
22. Current Event presentations

Supplemental Information:

Class Notes: It is recommended that notes be taken during the lectures. Some lectures will be illustrated by slides. And some of these sets will be posted. If so, this will be done after the lecture.

Current Events: On the last day of class each student will present a brief (no more than 5 minutes) presentation of a current (no more than 6 months old) article about some aspect of renewable energy. The topics should not be highly technical, but deal with new developments in a manner that can be understood by people from both technical and non-technical backgrounds. Use of slides is recommended, but they should not number more than 3.

Textbook: V. Nelson and K. Starcher, **Introduction to Renewable Energy**, Second Edition, CRC Press, 2016. This is to be considered a learning resource, but much additional information not found in the book will be presented in the class.

Library Resources: Students may consult with a librarian on research needs. For this class, the subject librarian is Sue Waincott. (https://www.library.unlv.edu/contact/librarians_by_subject). UNLV Libraries provides resources to support students' access to information. Discovery, access, and use of information are vital skills for academic work and for successful post-college life. Access library resources and ask questions at <https://www.library.unlv.edu>.

UNLV Policies:

Academic Misconduct—Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility and professionalism. By choosing to join the UNLV community, students accept the expectations of the Student Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling in UNLV assume the

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obligation to conduct themselves in a manner compatible with UNLV's function as an educational institution.

An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another, from the Internet or any source, without proper citation of the sources. See the *Student Academic Misconduct Policy* (approved December 9, 2005) located at: <https://www.unlv.edu/studentconduct/student-conduct>.

Copyright—The University requires all members of the University Community to familiarize themselves **with** and to follow copyright and fair use requirements. **You are individually and solely responsible for violations of copyright and fair use laws. The university will neither protect nor defend you nor assume any responsibility for employee or student violations of fair use laws.** Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. Additional information can be found at: <http://www.unlv.edu/provost/copyright>.

Disability Resource Center (DRC)—The UNLV Disability Resource Center (SSC-A 143, <http://drc.unlv.edu/>, 702-895-0866) provides resources for students with disabilities. If you feel that you have a disability, please make an appointment with a Disabilities Specialist at the DRC to discuss what options may be available to you. If you are registered with the UNLV Disability Resource Center, bring your Academic Accommodation Plan from the DRC to the instructor during office hours so that you may work together to develop strategies for implementing the accommodations to meet both your needs and the requirements of the course. Any information you provide is private and will be treated as such. To maintain the confidentiality of your request, please do not approach the instructor in front of others to discuss your accommodation needs.

Religious Holidays Policy—Any student missing class quizzes, examinations, or any other class or lab work because of observance of religious holidays shall be given an opportunity during that semester to make up missed work. The make-up will apply to the religious holiday absence only. It shall be the responsibility of the student to notify the instructor within the first 14 calendar days of the course for fall and spring courses (excepting modular courses), or within the first 7 calendar days of the course for summer and modular courses, of his or her intention to participate in religious holidays which do not fall on state holidays or periods of class recess. For additional information, please visit: <http://catalog.unlv.edu/content.php?catoid=6&navoid=531>.

Transparency in Learning and Teaching—The University encourages application of the transparency method of constructing assignments for student success. Please see these two links for further information:

<https://www.unlv.edu/provost/teachingandlearning>

<https://www.unlv.edu/provost/transparency>

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Incomplete Grades—The grade of I—Incomplete—can be granted when a student has satisfactorily completed three-fourths of course work for that semester/session but for reason(s) beyond the student’s control, and acceptable to the instructor, cannot complete the last part of the course, and the instructor believes that the student can finish the course without repeating it. The incomplete work must be made up before the end of the following regular semester for undergraduate courses. Graduate students receiving “I” grades in 500-, 600-, or 700-level courses have up to one calendar year to complete the work, at the discretion of the instructor. If course requirements are not completed within the time indicated, a grade of F will be recorded and the GPA will be adjusted accordingly. Students who are fulfilling an Incomplete do not register for the course but make individual arrangements with the instructor who assigned the I grade.

Tutoring and Coaching—The Academic Success Center (ASC) provides tutoring, academic success coaching and other academic assistance for all UNLV undergraduate students. For information regarding tutoring subjects, tutoring times, and other ASC programs and services, visit <http://www.unlv.edu/asc> or call [702-895-3177](tel:702-895-3177). The ASC building is located across from the Student Services Complex (SSC). Academic success coaching is located on the second floor of the SSC (ASC Coaching Spot). Drop-in tutoring is located on the second floor of the Lied Library and College of Engineering TEB second floor.

UNLV Writing Center—One-on-one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-3-301. Although walk-in consultations are sometimes available, students with appointments will receive priority assistance. Appointments may be made in person or by calling 702-895-3908. The student’s Rebel ID Card, a copy of the assignment (if possible), and two copies of any writing to be reviewed are requested for the consultation. More information can be found at: <http://writingcenter.unlv.edu/>.

Rebelmail—By policy, faculty and staff should e-mail students’ Rebelmail accounts only. Rebelmail is UNLV’s official e-mail system for students. It is one of the primary ways students receive official university communication such as information about deadlines, major campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the university. Students’ e-mail prefixes are listed on class rosters. The suffix is always @unlv.nevada.edu. **Emailing within WebCampus is acceptable.**

Final Examinations—The University requires that final exams given at the end of a course occur at the time and on the day specified in the final exam schedule. See the schedule at: <http://www.unlv.edu/registrar/calendars>.