

Applied Building Sciences (ABS) 632 Solar Energy Applications in Architecture

Catalog Description: Solar energy as a renewable energy resource for heating and cooling of buildings. Presents technical and design issues of passive and active solar energy systems, as well as solar electric power (photovoltaics). Emphasis on architectural design integration and occupant comfort. Explores design-related projects and case studies of existing solar buildings. Satisfies a course requirement for the Solar and Renewable Energy Graduate Certificate

Prerequisites: Graduate Standing in the Solar and Renewable Energy Graduate Certificate

Co-requisites: None

Credits: 3

Instructor: Alfredo Fernandez-Gonzalez

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

- Recognize the strategic importance that passive and active solar systems have in reducing the consumption of fossil fuels and greenhouse gas emissions.
- Appreciate the impact passive and active solar systems may have as architectural form determinants.
- Understand and use quantitative methods to analyze the design and performance of passive and active solar systems, and
- Design projects that
 - optimize, conserve, or reuse natural and built resources,
 - provide healthful environments for occupants/users,
 - reduce the environmental impacts of building construction and operations, through means such as carbon neutral design, bioclimatic design and energy efficiency

Topics covered:

1. Course introduction, 2030 Challenge/2030 Palette
2. Climate adaptive design; developing a climate summary
3. Designing a solar home; identifying a solar design issue; understanding your solar design issue
4. Housing Design Charette, Energy and Performance Evaluation of Designs using HEED
5. Daylighting principles; design for adequate daylighting
6. Passive solar heating; design for passive solar heating
7. Natural Ventilation, designing naturally ventilated buildings

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8. Passive cooling strategies; designing for passive cooling
9. Solar Thermal applications, designing and building integrated solar thermal applications
10. Building integrated photovoltaic systems; designing BIPV systems
11. Integrating and Evaluating Solar Design Strategies
12. Final project preparation and presentation

Supplemental Information: ABS 632 – Solar Energy Applications in Architecture is a multi-disciplinary seminar that explores the various ways in which solar energy can be successfully harnessed and utilized in buildings to reduce their energy consumption and greenhouse gas emissions. This seminar discusses the important roles played by “passive” solar strategies in reducing buildings’ energy loads and the necessary integration of “active” solar systems to produce thermal and electric energy to fully (or at least partially) satisfy buildings’ power demands.

ABS 632 – Solar Energy Applications in Architecture emphasizes the architectural integration of passive (i.e., daylighting, heating, cooling, clothes-drying, and cooking) and active (i.e. solar thermal and electric) systems and their anticipated effects on building form and energy performance. This seminar also discusses the design of Net Zero Site Energy Buildings (i.e., buildings that produce at least as much energy as they use in a year, when accounted for at the site) and their feasibility in the State of Nevada.

It is recognized that students bring their own wealth of experiences to this seminar. These experiences will be tapped in this class. This year ABS 632 – Solar Energy Applications in Architecture focuses on the design of a home for a tribal community in Nevada that may be used to enter the U.S. Department of Energy Challenge Home Student Design Competition.

Due to the multi-disciplinary nature of this seminar, the course format is extremely open-ended and requires self-motivation and discipline.

Required Textbooks:

Sun, Wind, and Light, 2nd Edition by Brown and DeKay (NA2542.3 .B76 2001)

Course Materials on Reserve at the Architecture Studies Library

The following books are fundamental references for this course. For your convenience, they have been placed on two-hour reserve at the Architecture Studies Library:

- **Sun, Wind & Light: Architectural Design Strategies** G.Z. Brown and Mark DeKay (NA2542.3 .B76 2001)
- **Mechanical and Electrical Equipment for Buildings**, 11th Edition Grondzik, Kwok, Stein, and Reynolds (TH6010 .S74 2010)

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- **The Green Studio Handbook: Environmental Strategies for Schematic Design**
Alison G. Kwok and Walter T. Grondzik (NA2542.35 .K96 2007)
- **Heating, cooling, lighting: design methods for architects.**
Norbert Lechner (TH7222 .L33 2001)
- Additional selected readings will be used during this seminar. These readings are available on the UNLV Library's Electronic Reserve section under the instructor's name.

Library Resources

- Students may consult with a librarian on research needs. For this class, the subject librarian is Sue Wainscott.
(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 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>.

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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>

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

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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>.