



ECE 4610 & ECE 6610: FUNDAMENTALS OF SOLAR ENERGY

ECE 4610 Sections 001, 400 & 843

ECE 6610 Sections 001, 400 & 843

FALL 2021

August 17, 2021

**MEETING TIME:** T, TH: 2.00 PM to 3.15 PM

**MEETING LOCATION:** Riggs Hall # 226

**INSTRUCTOR:** Dr. Rajendra Singh, [srajend@clemson.edu](mailto:srajend@clemson.edu), Mobile: 864-710-1311

**TACHING ASSISTANT:** Mr. Vishwas Powar, [vpoar@clemson.edu](mailto:vpoar@clemson.edu), Mobile: 864-260-7282

**OFFICE HOURS AND PROCEDURES:** Send e mail or text me to set up zoom time to meet on line. Exclusively, I have set up M, W, and F (1 PM-3 PM) as office Hours. However, if these hours do not suit you, contact me by text or e mail to set up some other time.

**COURSE MODALITY:** Traditional

**COURSE DESCRIPTION:** Introduces solar energy conversion systems: Topics include environmental benefits of solar energy, solar thermal systems, concentration solar power, photovoltaic (PV) Cell design and manufacturing, sizing of PV systems, hybrid photovoltaic/thermal systems, energy storage, and urban/rural applications

**COURSE PREREQUISITES:** ECE 3200 with a C or better or instructor approval for ECE 4610, Graduate students are expected to have completed a course comparable to ECE 3200 or instructor's approval for ECE 6610

**STUDENT LEARNING OUTCOMES:** At the completion of the course, students should be able to:

1. Analyze fundamentals behind solar energy as sustainable energy
2. Design of high efficiency and low-cost photovoltaic modules
3. Manufacturing of high efficiency and low-cost photovoltaic modules
4. Design of Photovoltaic systems with energy storage
5. Novel applications of photovoltaics for desalination and sustainable electric transportation

**REQUIRED MATERIALS:** No text book. Class notes will be provided

The student is required to have a laptop computer, internet connectivity capable of transmitting and receiving video, a video camera, a microphone, and a cell phone.

**TOPICAL OUTLINE**

Topic hours (in parenthesis)

Course Overview (1)

Solar Energy: Introduction (2)

Importance of Solar Energy as Clean & Sustainable Energy (3)

Fundamentals & Technology of Solar Thermal Systems (1)

Fundamentals & Technology of concentration solar power (1)

Operating principles and design of photovoltaic (PV) cell (8)

Processing and manufacturing of photovoltaic Modules (8)

Design, sizing and sub-systems of PV system (5)

Operating principles design of hybrid photovoltaic/thermal systems (0.5)

Manufacturing of Hybrid photovoltaic /thermal systems (0.5)

Electrical energy storage systems (4)

Digitized grid and PV systems (2)

DC Microgrid and DC Nanogrid (3)

Urban and rural applications of solar energy (2)

Importance of PV in Transport Sector (1)

Topics of Instructors Choice (4)

Tests (2)

**Total 48**

**MATLAB:** In some optimization problems, we will use MATLAB. Make sure you can use MATLAB to solve some problems.

**CLASS CANCELLATION POLICY:** Class is cancelled if the instructor is more than 15 minutes late to start lecture.

**GRADING POLICY:**

**ECE 4610 Grading Policy:** Final grade for this course will be determined by following procedure:

Tests (2) 50%

Homework 20%

Final Exam 30 %

A=90-100, B=80-89, C=70-79, D=60-69 and F= 0- 59

**ECE 6610 Grading Policy:** Final grade for this course will be determined by following procedure:

Tests (2) : 40%

Homework: 15%

Research Paper (individual research) : 25%

Final Exam : 20 %

A= 90-100; B= 80-89; C= 70-79; F= 0-69

**ATTENDANCE POLICY:** 1. Class attendance is mandatory. If for some genuine reason (e.g. sickness, job/internship interview etc.) you cannot attend the class, please send me e mail before the class that you will not be able to attend the class due to a particular reason.

2. If on any test day class is canceled, alternate date will be used during class time.

3. A copy of class notes, power point files etc. will be distributed to the class.

4. Canvas will be used for posting course related material.

5. Every attempt will be made to record the lectures and post on Canvas.

6. For Charleston campus the zoom link for this course is given below:

Zoom link:

<https://clemson.zoom.us/j/91071911201?pwd=bUErY0pDVDVXSzF5YlpZSUUpGYzh3UT09>

Meeting ID: **91071911201**

Passcode: **484202**

**RESEARCH PAPER (ECE 6710):** Each student will select their own individual topic and get approval from the instructor. All communications through e mail. Do not send PDF files. Submit only word files.

Following are the deadlines:

August 24 , 2021 to September 7: Get approval of Topic

September 21, 2021, 5 PM: Submit, Abstract (200 Words) and minimum two main recent journal articles

October 12, 5 PM: Complete list of references

November 9, 2021: Complete Paper, 5 PM: Single space, Times Roman, 12 Fonts, 6 pages (without Figures, Tables, references, Footnotes etc.)

November 9, 2021: Feedback given for making corrections

December 1, 2021, 5 PM: Submit both flees (a) paper with my input and (b) Final paper

**ACCESSIBILITY STATEMENT:** Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to a class should let the instructor know and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848 or by emailing [studentaccess@lists.clemson.edu](mailto:studentaccess@lists.clemson.edu). Students who receive Academic Access Letters are strongly encouraged to request, obtain, and present these to their instructors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester. You can access further information here: <http://www.clemson.edu/campus-life/campus-services/sds/>.

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**SAFE CAMPUS:** Clemson University is committed to providing a safe campus environment for students, faculty, staff, and visitors. As members of the community, we encourage you to take the following actions to be better prepared in case of an emergency:

- a. Ensure you are signed up for emergency alerts (<https://www.getrave.com/login/clemson>)
- b. Download the Rave Guardian app to your phone  
(<https://www.clemson.edu/cusafety/cupd/rave-guardian/>)
- c. Learn what you can do to prepare yourself in the event of an active threat  
(<http://www.clemson.edu/cusafety/EmergencyManagement/>)

**ACADEMIC INTEGRITY:** As members of the Clemson University community, we have inherited Thomas Green Clemson’s vision of this institution as a ‘high seminary of learning.’ Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. In instances where academic standards may have been compromised, Clemson University has a responsibility to respond appropriately to charges of violations of academic integrity. Further information on Academic Integrity can be found in the [Undergraduate Announcements](#) and in the [Graduate School Policy Handbook](#).

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**TEST DATES:** First Test: October 5, 2021, Second Test: November 16, 2021

**MODIFICATION STATEMENT:** The instructor reserves the right to modify any aspect of the syllabus at any time during the semester for reasons including but not limited to COVID-related situations. This syllabus was posted on August 17, 2021.

**ADDITIONAL INFORMATION:**

1. Procedures for turning in homework – Look for Canvas announcements.
2. Tests will be in class time and final exam as per University exam schedule.