



ECE 8260: SOLAR CELLS

ECE 8260 Section 001, Section 100 & Section 843

SPRING 2021

JANUARY 5, 2021

**MEETING TIME:** T, TH: 3.30 PM to 4.45 PM

**MEETING LOCATION:** on line course for the entire semester

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

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

**ZOOM LINK FOR CLASS**

<https://clemson.zoom.us/j/98978736414?pwd=TkdIUktzR1FKSW5wa2Y5ZzVNaHRzQT09>

**OFFICE HOURS AND PROCEDURES:** Send e mail or text me to set up 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 to set up some other time. To connect with me (other than class hours) use following zoom link:

<https://clemson.zoom.us/j/98978736414?pwd=TkdIUktzR1FKSW5wa2Y5ZzVNaHRzQT09>

Keep this zoom link handy and always use to connect with me

**COURSE MODALITY:** On Line Course

**COURSE DESCRIPTION:** To provide fundamental knowledge about generating solar electricity by the use of solar cells. Special attention will be paid to demonstrate the potential role of photovoltaic systems as clean and sustainable electricity generation source for current and future generations of mankind. The importance of DC Electricity generated by solar cells as the source of paradigm shift in global electricity infrastructure will be covered.

**Topics to be covered:**

Importance of Solar Electricity as Clean & Sustainable Energy  
Fundamentals of Solar Energy (concept of trackers and concentration included)  
Operating principles and design of photovoltaic (PV) Devices  
Processing and manufacturing of photovoltaic Modules  
Micro Inverters, Smart Inverters and Balance of System  
Design, sizing and sub-systems of PV system  
Operating principles design of hybrid photovoltaic/thermal systems  
Batteries and capacitor based electrical energy storage systems  
Smart grid, Micro Grid, Nano Grid and PV systems  
Urban and rural applications of PV Electricity  
Financing and Cost Estimation of Solar Electricity

Energy Policy and PV Electricity  
Importance of DC Electricity in Global Electricity Infrastructure  
PV for Electrification of Transportation  
Solving Water Problem by Photovoltaics Generated Electric Power  
Eradication of Global Poverty by PV electricity

**COURSE PREREQUISITES:** Permission of Instructor

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

Upon completion of this course, students should be able to:

1. Analyze fundamental requirements to build clean electric power infrastructure based on solar energy as free fuel
2. Operating principle of solar cells
3. Manufacturing of solar cells and Photovoltaic modules
4. Describe the technologies for storage of PV generated electric power
5. Design of Photovoltaic System based on PV Modules and Batteries for storing electric power
6. PV and batteries based nanogrids, microgrids and central grids
6. Transformative role of PV electric power in solving climate challenges and providing mobility solution and Power for Desalination
7. Access of Electric power to all

**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.

**TOPICS TO BE COVERED:**

Importance of Free Fuel Based Solar Electricity as Clean & Sustainable Electrical Power  
Fundamentals of Solar Energy (concept of trackers and concentration included)  
Operating principles and design of photovoltaic (PV) Devices  
Processing and manufacturing of photovoltaic Modules  
Micro Inverters, Smart Inverters and Balance of System  
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Energy Policy and PV Electricity  
Importance of DC Electricity in Global Electricity Infrastructure  
PV for Electrification of Transportation  
Solving Water Problem by Photovoltaics Generated Electric Power  
Eradication of Global Poverty by PV electricity

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

### **GRADING POLICY:**

**ECE 8260 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

### **TEST AND FINAL EXAM DATES:**

**Test 1:** February 18, 2021 (In class time)

**Test 2:** April 15, 2021 (in class time)

**Final Exam** (As per University Schedule): April 30, 2021: 11.30 AM- 2.00 PM

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

January 8-January 22, 2021: Get approval of Topic for research

February 16, 2021, 5 PM: Submit, Abstract (200 Words) and minimum two main recent journal articles

February 26, 2021, 5 PM: Complete list of references

March 9, 2021: 5 minutes class presentation

March 22, 2021: Complete Paper, 5 PM: Single space, Times Roman, 12 Fonts, 6 pages (without Figures, Tables, references, Footnotes etc.)

March 27, 2021: Feedback given for making corrections

April 3, 2021: Power point (PP) file submitted for 15 minutes presentation in class

April 5, 2021 Feedback given for making PP file corrections

April 13, 15, and 20, 2021: In class presentations

April 22, 2021, 5 PM: Submit both flees (a) paper with my input and (b) Final paper

**ATTENDANCE POLICY:** 1. On line 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. All tests will be given only during class time. 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.

**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/>.

**TITLE IX STATEMENT:** Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972.

**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 [Graduate School Policy Handbook](#).

**COPYRIGHT STATEMENT:** Materials in this course are copyrighted. They are intended for use only by students registered and enrolled in this course and only for instructional activities associated with and for the duration of the course. They may not be retained in another medium or disseminated further. They are provided in compliance with the provisions of the Teach Act. Students should be reminded to refer to the Use of Copyrighted Materials and "Fair Use Guidelines" policy in on the Clemson University website for additional information: <https://clemson.libguides.com/copyright>.

**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 January 5, 2021.

**ADDITIONAL INFORMATION:**

1. All tests and final exam will be on line
2. Procedures for turning in homework online will be provided in Canvas announcements.
3. Contact information of Teaching Assistant is included in this document.