Course Code: EE4377/EE5381
Course Title: Applied Photovoltaics
Classification: 
Credits: 3

Prerequisites: EE 3329 or MME 3309
Co-requisites: 
Schedule: Two - 80 minutes lectures per week

Instructor: Deidra R. Hodges, drhodges@utep.edu
Office and Hours: A-304
M & W: 10:30 - 11:30 AM
1:30 – 2:30 PM

Course Description:
Semiconductors have emerged as the most promising material class of materials that can convert sunlight directly into electrical energy. This course presents the fundamental principles of the solar energy conversion process and the most common cell technologies are discussed. A range of semiconductor materials are discussed for their potential use in photovoltaic applications, considering the material properties that affect the device performance, including efficiency, cost and environmental conditions (e.g., terrestrial or space applications and duration of sunshine), and the availability and toxicity of the raw materials. This course will also cover a range of fundamental problems and the relationship between the physics, material science, and technology aspects of solar cell development. Students will learn the fundamental and quantitative principles of the solar energy, as well as its potential economic and societal impact.

Textbook:

References:
2. Semiconductors for Solar Cells, Hans Joachim Möller, Artech House, 1993

Online References:
1. Nanohub.org (PV simulation)
2. PVCDROM (pveducation.org)
3. NREL.gov (photovoltaics); Dept. of Energy (doc.gov); Energy Information Administration (EIA Annual Energy Outlook)
4. DSIREUSA.org (incentives & rebates database); El Paso Electric Renewable Energy (epelectric.com)

Course Objectives:
This course provides students with the basic information needed to understand the principles of photovoltaic system operation, to identify appropriate applications and to undertake simple photovoltaic system design. Upon successful completion of this course, students should be able to:
1. List and explain the main sources of solar energy and their primary applications in the United States and worldwide.
2. Describe challenges and problems associated with the use of solar energy, with regard to future supply and the environment.
3. Discuss remedies/potential solutions to the supply and environmental issues associated with photovoltaics, compared to other energy sources.
4. List and describe the balance of system components of a solar energy photovoltaic system.
5. Simulate, describe and illustrate basic electrical concepts and system components of a photovoltaic system.
6. Convert units of energy – to quantify energy demands and make comparisons among energy uses, resources, and technologies.
7. Collect and organize information on photovoltaic energy technologies as a basis for further analysis and evaluation.
8. Design, build and demonstrate a photovoltaic power generation system that delivers power to and drives a load.
## Topics Covered:

<table>
<thead>
<tr>
<th>Wk. 1</th>
<th>Wk. 9</th>
<th>Wk. 10</th>
<th>Wk. 11</th>
<th>Wk. 12</th>
<th>Wk. 13</th>
<th>Wk. 14</th>
<th>Wk. 15</th>
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<tbody>
<tr>
<td>PV Introduction and Background</td>
<td>Thin-Film Compound Semiconductors</td>
<td>PV Cell Interconnection and Module Fabrication</td>
<td>PV System Components (Balance of System)</td>
<td>Design of Stand-alone PV Systems</td>
<td>Design of Grid-Connected PV Systems</td>
<td>Specific Purpose PV Applications</td>
<td>Project Demonstrations and Presentations</td>
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<td>The Characteristic of Sunlight</td>
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<td>Semiconductors and p-n junctions</td>
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<td>The Behavior of Solar Cells</td>
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<td>Cell Properties and Design</td>
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<td>Properties of Lattice Defects</td>
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<td>Spring Break: March 18-22, 2019</td>
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## Evaluation Criteria:

Instruments for course evaluation will be used to measure established course objectives.

<table>
<thead>
<tr>
<th>Grade Composition</th>
<th>Grade Scale</th>
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<tr>
<td>20% Homework</td>
<td>A = 90 - 100</td>
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<tr>
<td>20% Quizzes</td>
<td>B = 80 – 89</td>
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<tr>
<td>20% Midterm Exam</td>
<td>C = 70 - 79</td>
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<tr>
<td>20% Final Exam</td>
<td>D = 60 - 69</td>
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<tr>
<td>20% Final Project</td>
<td>F = 0 – 59</td>
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**Homework – Late penalty:** one letter grade per day late decrease from the actual homework grade.

**Quizzes** – Several **unannounced** and **announced** quizzes will be given **5 minutes** after the start of class.

**Exams** – A midterm exam will be given **March 13, 2019**.

**Course Drop Deadline – April 5th.**

**Final Exam** – The final exam is comprehensive and is given in accordance with the University’s Final Exam schedule, **Friday, May 17, 2019, 1:00pm-3:45 pm.**

**Final Project** – Design, build and demonstrate a photovoltaic panel system, which generates power and drives a load. Make the PV panel using silicon solar cells to drive the load. No addition of a battery allowed in the project design. No cell phone charger projects. Work in teams of two or three(max.).

Project grade will be calculated based on the following:
1) demonstration of final projects, 2) PowerPoint presentation, 3) solar cell simulation using wxAMPS, 4) a project final report that includes electrical schematic, photographs, and a project description, 5) a discussion and inclusion of a related **peer-reviewed** journal article, 6) and the quality of the project and the level of effort.

**NO USE OF CELL PHONES, LAPTOPS, TABLETS OR OTHER DEVICES ON EXAMS. NO RESTROOM BREAKS DURING EXAMS.**
Academic Dishonesty:
As an entity of The University of Texas at El Paso, the Department of Electrical and Computer Engineering is committed to the development of its students and to the promotion of personal integrity and self-responsibility. Acts of scholastic dishonesty such as cheating, plagiarism, collusion, the submission for credit of any work or material that are attributable in the whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student, or the attempt to commit such acts will not be tolerated. Any case involving academic dishonesty will be referred to the Engineering Dean’s Office and the Office of the Dean of Students. The Dean of Students will assign a Student Judicial Affairs Coordinator who will investigate the charge and alert the student as to its disposition. Consequences of academic dishonesty may be as severe as dismissal from the University. See the Office of the Dean of Students' home page at www.utep.edu/dos/acadintg.htm for more information.