ECE 5832: Photovoltaics and Energy Conversion

Course Description

Photovoltaic materials and devices; solar cell device physics; solar cell simulation, design and operation; silicon cell technologies; thin film technologies; III-V technologies; nanostructures; terrestrial and space applications.

Prior Course Number: 835.01
Transcript Abbreviation: Photovoltaics
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad, Graduate
Student Ranks: Junior, Senior, Masters, Doctoral
Course Offerings: Autumn
Flex Scheduled Course: Never
Course Frequency: Even Years
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Prereq: 3030, or Grad standing in Engr or Physics.
Exclusions: Not open to students with credit for 835.01.
Cross-Listings:

Course Rationale: Existing course.

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.1001
Subsidy Level: Doctoral Course

Course Goals

Gain a fundamental understanding of solar cell physics
Understand basic solar cell operation, design and limitations
Understand the physical concepts and operation of advanced photovoltaics
Gain appreciation of competing solar cell technologies and their applications

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Photovoltaics, global energy issues and the solar spectrum	2.0							
Optical properties of photovoltaic materials	3.0							

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Electronic and transport properties of photovoltaic materials	5.0							
PN junction transport under solar illumination	4.0							
Solar cell spectral response and output parameters	2.0							
Solar cell simulations	2.0							
Non-idealities, material parameters and practical cell design	3.0							
Solar radiation and theoretical conversion efficiency limits	2.0							
Crystalline silicon solar cell technology	2.0							
Thin film technologies	3.0							
III-V multijunction and concentrator technologies	3.0							
Nanostructure approaches	2.0							
Space photovoltaics	3.0							
Characterization of solar cells	2.0							
In-class presentations	3.0							

Representative Assignments

Several homework assignments
Midterm examination
In-class presentations
Term Paper

Grades

Aspect	Percent
Homework	10%
Midterm examination	20%
Class presentations	35%
Term Paper	35%

Representative Textbooks and Other Course Materials

Title	Author
The Physics of Solar Cells	Jenny Nelson

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
*	c	An ability to design a system, component, or process to meet desired needs.
	d	An ability to function on multi-disciplinary teams.
	e	An ability to identify, formulate, and solve engineering problems.
*	f	An understanding of professional and ethical responsibility.
***	g	An ability to communicate effectively.
***	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.

Course Contribution		College Outcome
**	i	A recognition of the need for, and an ability to engage in life-long learning.
***	j	A knowledge of contemporary issues.
**	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Additional Notes or Comments

Updated prereqs, exclusions, goals and topics to conform to university format 3/29/12

Chnge title of course to "Photovoltaics and Solar Energy Conversion" 2/18/14
Change course number from 7832

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