هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Solar Cells Physics
Course Code:	2034219- 3
Program:	Bachelor in Physics
Department:	Physics Department
College:	College of Science
Institution:	Taif University
Version:	1
Last Revision Date:	2020

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: (7th Level / 4th Year)					
4. Course general Description:					
This elective course presents an important addition to the required courses of the program. The topic of solar cells aims to teach the student the important application of semiconductors in converting the solar radiation to electric power. The student learns the working principle of solar cells from fundamental semiconductor physics, and understands the role of a photovoltaic system in the production of electric power from sun radiation. Part of the course introduces the student to modern last generation solar cells.					
5. Pre-requirements for this course (if any):					
None					
6. Co-requisites for this course (if any):					
None					
7. Course Main Objective(s):					
-Recognize the correlation between the semiconductor physics and the working principle of the solar cell, and hence the important application of semiconductors to convert the sun radiation to electric power via the solar cell device. -Acquire knowledge on the function of photovoltaic systems (solar cell arrays and solar cell panels) to produce large scale electric power.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45 (3h per week)	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	
5.	Others (specify)	
Total		45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Outline the working principle of the conventional solar cells.	K1	Lecture Discussion	Written exam
1.2	Recognize the role of optoelectronic materials and associated technology in the field of new generation solar cells.	K3	Lecture Discussion	Written exam
2.0	Skills			
2.1	Apply the fundamentals of solar cells to draw the equivalent circuit of real solar cells and determine their power conversion efficiency.	S1	Lectures and Essays	Written exam Activities
2.2	Develop skill versatility in solving theoretical and practical problems related to solar cells and solar systems.	S4	Problem solving	Written exam Activities
3.0	Values, autonomy, and responsibility			
3.1	Show responsibility in working independently with continuous improvement of personal capacities.	V1	Group discussion	Essays

C. Course Content

No	List of Topics	Contact Hours
1.	The Sun as a radiation resource.	3
2.	Generations of solar cells: First, second and third.	3
3.	Photovoltaic effect	3
4.	Basic Semiconductor Physics	3
5.	p-n semiconductor junction.	3
6.	Generation and recombination of electron-hole pairs under light excitation.	3
7.	Solar cell equivalent circuit and parameters extraction.	3
8.	Crystalline Silicon Solar Cells	3
9.	Thin-film solar cells	3
10.	Organic Solar cells	3
11.	Combination of photovoltaic generator and load resistor.	3
12.	Energy storage units (Solar Batteries).	3
13.	DC-DC convertor.	3
14.	DC-AC convertor (invertor).	3
15.	Revision.	3
Total		45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm exam I	7^{th}	15%
2.	Midterm exam II	11^{th}	15%
3.	Activities	Periodically	20%
4.	Final exam	16^{th}	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	**Martin A. Green,** "Solar Cells: Operating Principles, Technology and System Application" - University of New South Wales - Kensington, Australia - 1998
Supportive References	Physics of Solar cells, J. Nelson, Imperial college, London, first published 2003.
Electronic Materials	
Other Learning Materials	Lecture notes and PowerPoint presentations

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (projector, smart board, software)	Data show
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect
Effectiveness of Students assessment	Instructor Program coordinator Departmental council	Indirect
Quality of learning resources	Students Faculty	Indirect
The extent to which CLOs have been achieved	Program leaders Faculty	Direct
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**PHYSICS DEPARTMENT COUNCIL**
REFERENCE NO.	**NO. 4-45**
DATE	**27/09/2023 (12/03/1445)**

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Physics Department
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