COURSE Syllabus

Course Name: Photovoltaic System

Course Number: 4083161, 408421

General Course Information:

Course title	Photovoltaic System	
Course number	4083161,408421	
Credit hours (theory, practical)	2 hours (theory)	
Contact hours (theory, practical)	2 hours (theory)	
Prerequisites/corequisites	4082251	
Academic Program	Renewable energy engineering	
Program code	RE	
Awarding institution	Isra University	
Faculty	Engineering	
Department	Renewable energy engineering	
Level of course	3rd	
Academic year /semester	2022/2023 (1st)	
Awarded qualification	B.Sc	
Other department(s) involved in teaching the course	-	
Language of instruction	English	
Date of production/revision	-	

Course Coordinator:

Coordinator's Name: faten alsarayrah
Office No.: 3rd floor
Office Phone: 2502
Office Hours: Sun: [9:00-10:00], Mon: [11:00-12:00], Tue: [9:00-10:00], Wed: [11:00-12:00], Thu: [12:00-1:00]
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Other Instructors:

Instructor's Name: **Office No.:** **Office Phone:** **Office Hours:** **Email:**

Course Description:

This course of photovoltaic energy systems will focus on fundamentals of solar energy conversion, photovoltaic, basic manufacturing processes for the production of solar panels, environmental impacts, and the related system engineering aspects will be included to provide a comprehensive state of the art approach to solar utilization. Stand- alone PV system components. Designing stand- alone PV system and sizing. Analysis of efficiency of solar cells. PV power system. Grid connected PV.

Text Book: *Author(s), Title, Publisher, Edition, Year, Book website.*

1- Photovoltaic solar energy generation. A Goetzberger V.U Hoffmann. Springer- Verlag Berlin Heidelberg 2005. 2- Solar Energy: Fundamentals, technology and Systems, Klause Jager, Olindo Isabella, Arno

References: *Author(s), Title, Publisher, Edition, Year, Book website.*

Required book (s), assigned reading and audio-visuals: **1.**

Course Educational Objectives (CEOs):

1.	Understanding basic characteristics of solar energy and technologies for their utilization, semiconductors as basic solar cell material, materials and properties, P-N junction and solar cell. Sources of losses and prevention.	
2.	Understand the principles of solar energy conversion.	
3.	Understand the methods of measurement and analysis of solar radiation for energy use.	
4.	Understand the constructional features of various systems and sub- systems of a solar energy.	
5.	Understand performance grid- connected solar system	

Intended Learning Outcomes (ILO's):

	Intended Learning Outcomes (ILO's)	**Relationship to CEOs**	**Contribution to PLOs**

A	**Knowledge and Understanding:**		
A1	Gain an understanding of the available solar energy and the current solar energy conversion and utilization processes.		
B	**Intellectual skills:**		
B1	Understand the manufacturing processes involved environmental challenges that need to be solved, economic aspects, and potential of solar energy utilization.		
C	**Subject specific skills:**		
C1	To know the most important characteristics of the elements within a PV system and how they work: battery and charge controller, DC/AC converter (inverter), DC/DC converter and loads.		
D	**Transferable skills:**		
D1	Understand basic concepts from grid integration of solar systems.		

Topic Outline and Schedule:

Topic	Weeks	Achieved ILOs
Introduction to photovoltaic (PV) systems. Historical development of PV systems, overview of PV usage in the world.	1	
Solar energy potential for PV, irradiance, solar radiation and spectrum of sun, geometric and atmospheric effects on sunlight.	2	
Photovoltaic effect, conversion of solar energy into electrical energy, behavior of solar cells.	3	
Basic manufacturing processes for the production of solar panels.	4	
Solar cells, basic structure and characteristics: single-crystalline, multicrystalline, thin film silicon solar cells, emerging new technologies. .	5	
Electrical characteristics of the solar cell, equivalent circuit,	6	
Modeling of solar cells including the effect of temperature irradiation and series/ shunt resistances on the open- circuit voltage and short- circuit current.	7	

Mid exam	8	
Solar cell arrays, PV modules, PV generators, shadow effect and bypass diodes	9	
hot spot problem in a PV module and safe operating area, terrestrial P module modeling.	10	
Grid- connected (utility interactive) PV systems.	11	
Active power filtering with real power injection.	12	
Cleaning systems	13	
Storage systems	14	
calculations	15	
Final exam	16	

Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:

- Lectures

Course Policies:

A- Attendance policies:

The maximum allowed absences is 15% of the lectures.

B- Absences from exams and handing in assignments on time:

First Exam and second exam can be retaken based on approval of excuse by the instructor's discretion.

Not handing assignment on time will incur penalties.

C- Academic Health and safety procedures

D- Honesty policy regarding cheating, plagiarism, and misbehaviour:

Cheating, plagiarism, misbehaviour will result in zero grade and further disciplinary actions may be taken.

E- Grading policy:

- All homework is to be posted online through the e-learning system.
- Exams will be marked within 72 hours and the marked exam papers will be handed to the students.

F- Available university services that support achievement in the course: **Labs, Library.**

Required equipment:

Assessment Tools implemented in the course:

- ☐ First Written Exam.
- ☐ mid

- ☒ Final Written Exam.
- ☒ Quizzes.
- ☒ Homework.
- ☐ Integrative Projects.
- ☐ Case Study.
- ☐ Written Reports.
- ☒ Participation in Lecture.
- ☐ Practice in the Lab.
- ☒ Illustrative Presentations.
- ☐ Oral Exams.
- ☐ Others (identify):

Program Learning Outcome (PLOs):

Program Learning Outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviours that students acquire as they progress through the program. A graduate of the () program will demonstrate	
a.	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
b.	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
c.	An ability to communicate effectively with a range of audiences
d.	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
e.	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
f.	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
g.	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Responsible Persons and their Signatures:

Course Coordinator	**Eng Faten Alsarayrah**	**Completed Date**	
		Signature	

Received by (Department H-+98+ead)	**Dr. Zakaria al omari**	**Received Date**	/ /
		Signature	