



Course Specification

DIPLOMA

Course Title: **Thermal Solar Energy Systems**

Course Code: **APRT3212**

Program: **Renewable energy technologies**

Department: **Diploma Department**

College: **The Applied College**

Institution: **Umm Al-Qura University**

Version: **1**

Last Revision Date: **10 February 2025**



Table of Contents

A. General information about the course:	3
B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods	5
C. Course Content.....	7
D. Students Assessment Activities	8
E. Learning Resources and Facilities.....	8
F. Assessment of Course Quality	9
G. Specification Approval	9



A. General information about the course:

1. Course Identification

1. Credit hours: (.....)

2. Course type

A. ☐ University ☐ College ☒ Department ☐ Track ☐ Others
B. ☒ Required ☐ Elective

3. Level/year at which this course is offered: (4th Level / 2nd Year)

4. Course General Description:

1. Course Description

- This course will provide general information regarding methods and technologies of solar energy usage in different processes. For this purpose, Fundamental of solar energy processes and review on heat transfer with emphasize on radiation solar energy for heating processes should be detailed. In this course will be presented plate and concentrating collectors (fixed and tracking systems); introduce concepts of the photovoltaic (PV) systems -Solar energy potential for PV -irradiance, solar radiation and spectrum of sun -Photovoltaic effect, conversion of solar energy into electrical energy -behavior of solar cells -Solar cells, basic structure and characteristics: Single crystalline, multi-crystalline -thin film silicon solar cells – Electrical characteristics of the solar cell-equivalent circuit, modeling of solar cells including the effects of temperature.

5. Pre-requirements for this course (if any):

6. Co-requisites for this course (if any):

7. Course Main Objective(s):



Course Main Objective

The objective of this course is to provide general information regarding methods and technologies of solar energy usage in different processes.

At the end of the course the student should know the following:

- 1- Fundamental of solar energy processes
- 2- Review on heat transfer with emphasize on radiation
- 3- Solar energy for heating processes
- 4- Plate and concentrating collectors
- 5- To gain an understanding of the state of the art and current primary research focuses on all common and emerging photovoltaic technologies.
- 6- To learn how solar cell operation is modeled to diagnose and optimize devices.

To know the different algorithms to extract maximum power from the PV system

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	5	100%
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> • Traditional classroom • E-learning 		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	30
2.	Laboratory/Studio	45
3.	Field	
4.	Tutorial	
5.	Others (specify)	
Total		75

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

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Figure out a comprehensive knowledge and critical understanding of the main subjects of the Solar thermal energy or specialization, including the main concepts, principles, theories and their current applications in the field of academic research specializing in Energy management and energy efficiency.	K1	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam
1.2	Understand deeply one or more areas of specific specialization in relation to the latest theories, research and professional practice in Solar thermal energy	K2	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam
2.0	Skills			
2.1	Apply continuously theoretical and practical knowledge in dealing with a variety of contexts, new and unexpected scientific, and provide authentic and innovative responses to problems and issues. Make convincing and informed judgments in situations where complete or consistent information is not available.	S1	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.2	Extracts from published research or professional reports in Solar thermal energy and can apply them, develops important new ideas and integrates them into their knowledge or experiences. Applies specialized and general research methods in the creative analysis of complex issues and in the development of results and proposals related to its academic field.	S2	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam
2.3	Plan and execute large projects or part of scientific research independently, applying his theoretical and practical knowledge and using research methods to arrive at valuable conclusions that lead to important additions to current knowledge or professional practices in certain field of Solar thermal energy	S3	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam
3.0	Values, autonomy, and responsibility			





Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
3.1	Practice knowledge and skills to identify, independently and responsibly, the real problem by realizing a given problem statement in real selection of different Solar thermal energy systems , perform Literature Review to establish the need to solve the problem, define the real problem and develop technical objectives and a mission statement based on assumptions and realistic constraints to guide him to solve the problem.	V1	Study presentation and report preparation	Oral presentation and minor projects.
3.2	Communicate individual work well in written / oral form for diversified audience.	V2	Study presentation and report preparation	Oral presentation and minor projects.
3.3	Conduct professionally and perform research in his engineering discipline to write / publish a scholarly article.	V3	Study presentation and report preparation	Oral presentation and minor projects.

C. Course Content

No	List of Topics	Contact Hours
1. 1	<i>Fundamental of solar energy processes</i>	3
2. 2	<i>Review on heat transfer with emphasize on radiation</i>	3
3	<i>solar energy for heating processes;</i>	3
4	<i>plate and concentrating collectors (fixed and tracking systems); heat exchangers and thermal storage; cooling systems; water desalination systems; solar thermo- chemical processes to produce hydrogen and solar power generation</i>	6
5	<i>Introduction to low temperature applications such as solar hot water, space heating and water distillation</i>	3
6	<i>System design and performance; predicted energy savings and related economics</i>	3



7	Perspective Study: Design Development	3
8	Perspective Study: Evaluation	3
9	Interpretation, Writing, and Publishing results	3
7	Lab Work	45
Total		75

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1. 1	Quizzes and Exercise	3-8	%10
2. 2	Report & Presentation	3-8	%20
3. 3	Mid-term	9	%20
4	Final exam	17/18	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	<ul style="list-style-type: none"> Garg & Prakash, H. P. Garg, <i>Solar Energy: Fundamentals and Applications</i>, McGraw-Hill Education, 2000 Yüncü, Hafit, Paykoc, E., Yener, Y <i>Solar Energy Utilization Fundamentals and Applications</i>, Springer iwari, G. N., Tiwari, Arvind, Shyam <i>Handbook of Solar Energy Theory, Analysis and Applic</i> Springer
Supportive References	
Electronic Materials	<i>Solar Energy</i> , ISSN: 0038-092X Elsevier <ul style="list-style-type: none"> <i>Applied Solar Energy</i> ISSN: 0003-701X (print version) ISSN: 1934-9424 (electronic version springer)
Other Learning Materials	

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	Faculty	Direct (project, HW, Quiz, midterm and final exam)
Effectiveness of Students assessment	Students	Indirect (Student Survey)
Quality of learning resources	Program Coordinator	Direct analysis
The extent to which CLOs have been achieved	Program Coordinator	Direct analysis
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify))

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Umm Al-Qura University Council
REFERENCE NO.	851141114462/190394
DATE	22/11/1446

