GAU, Faculty of Engineering

Course Unit Title	Solar Energy and Photovoltaic Systems
Course Unit Code	ENE 440
Type of Course Unit	Technical Elective
Level of Course Unit	3rd year B.Sc.
National Credits	3
Number of ECTS Credits Allocated	6 ECTS
Theoretical (hour/week)	3
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	3rd or 4th year
Semester when the course unit is delivered	
Name of Lecturer (s)	
Mode of Delivery	Face to Face, E-learning activities
Language of Instruction	English
Prerequisities and co-requisities	ENE 202, ENG 202
Recommended Optional Programme Components	Basic foundation of Electronics

Objectives of the Course: Teaching fundamentals of photoelectric conversion and how solar cells convert light into electricity. Laboratory sessions explore how a solar cell works in practice. Teaching modelling, design and analysis of various PV systems. Provision a solid foundation for successful careers in this rapidly growing market.

Learning Outcomes

When this course has been completed the student should be able to		Assessment.
1	Analyze solar energy potential and solar radiation	1
2	Understand PV effect, conversion of solar energy into electrical energy	1
3	Analyze electrical characteristics of the solar cell, solar cell arrays, PV modules	1
4	Understand and apply maximum power point tracking (MPPT) algorithms	1
5	Conduct experiments and interpret obtained data	3,5

Assessment Methods: 1. Written Exam, 2. Assignment 3. Project/Report, 4.Presentation, 5 Lab. Work

Course's Contribution to Program

		CL
1	Ability to understand and apply knowledge of mathematics, science, and engineering	4
2	Ability to design and conduct experiments as well as to analyze and interpret data	5
3	Ability to work in multidisciplinary teams while exhibiting professional responsibility and ethical conduct	2
4	Ability to apply systems thinking in problem solving and system design	4
5	Knowledge of contemporary issues while continuing to engage in lifelong learning	2
6	Ability to use the techniques, skills and modern engineering tools necessary for engineering practice	3
7	Ability to express their ideas and findings, in written and oral form	4
8	Ability to design and integrate systems, components or processes to meet desired needs within realistic constraints	1
9	Ability to approach engineering problems and effects of their possible solutions within a well structured, ethically responsible and professional manner	3
10	Ability to apply chemical, physical and thermodynamic principles and concepts in the design, manufacture and technological development of conventional and renewable energy systems	5
11	Ability to produce economically feasible sustainable engineering projects on production, distribution, consumption and storage of energy, by using single or hybrid energy systems	5

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate 4: High, 5:Very High)

Course Contents

Week			Exams
1		Introduction to photovoltaic (PV) systems	
2	Chapter 8	Solar energy potential, solar radiation	
3	Chapter 8	Photovoltaic effect, conversion of solar energy into electrical energy	
4	Chapter 8	Solar cells, basic structure and characteristics	
5	Chapter 8	The equivalent circuits of solar cells.	Quiz 1
6	Chapter 8	Solar cell arrays, PV modules, PV generators	
7	Chapter 9	Energy storage alternatives for PV systems	
8			Midterm
9	Chapter 9	Power conditioning and maximum power point tracking (MPPT)	
10	Chapter 9	Inverter control for stand-alone and grid-connected operation.	
11	Chapter 9	Stand-alone PV systems	Quiz 2
12	Chapter 9	Grid-connected (utility interactive) PV systems.	
13	Chapter 9	Modelling and simulation of complete stand-alone and grid-connected PV systems	
14			Lab. Exam
15			Final

Recommended Sources

Textbook: *Renewable and Efficient Electric Power Systems*. By Gilbert M. Masters. John Wiley & Sons, Inc. 2004.
Supplementary Material (s): Renewable Energy. Martin Kaltschmitt, Wolfgang Streicher, Andreas Wiese. Springer-Verlag Berlin Heidelberg 2007.

Assessment

Attendance& E-learning	5%	
Laboratory	10%	
Quiz 1	10%	Lab Grade= (Lab exam gradeLab Attendance)
Midterm Exam	25%	
Quiz 2	10%	
Final Exam	40%	
Total	100%	

ECTS Allocated Based on the Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class (including the Exam week)	15	2	30
Labs and Tutorials	8	2	16
Assignments	-	-	-
Project/Presentation/Report Writing	8	2	16
E-learning Activities	7	6	42
Quizzes	2	6	12
Midterm Examination	1	12	12
Final Examination	1	12	12
Self Study	14	2	28
Total Workload			168
Total Workload/30 (h)			5.60
ECTS Credit of the Course			6