GAU, Faculty of Engineering

Course Unit Title	**Solar Energy and Photovoltaic Systems**
Course Unit Code	EEN477
Type of Course Unit	Technical Elective
Level of Course Unit	3rd Year BSc
National Credits	3
Number of ECTS Credits Allocated	6 ECTS
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	2
Year of Study	3
Semester when the course unit is delivered	7
Mode of Delivery	Face to Face, E-learning activities
Language of Instruction	English
Prerequisities and co-requisities	EEN303
Recommended Optional Programme Components	Basic background 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	Strong foundation on the fundamentals of Electrical and Electronics Engineering such as Circuit Theory, Signals, Systems, Control and Communications, which are necessary for successful practice in the field	5
11	Awareness on the contemporary requirements, methods and applications of the Electrical and Electronics Engineering	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%	
Midterm Exam	25%	Lab Grade= (Lab exam grade×Lab Attendance)
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