EE6623: SUSTAINABLE ENERGY SYSTEMS

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Sustainable Energy Systems

Subject Code
EE - Electrical Engineering
Course Number
6623

Academic Unit
Electrical Engineering (EE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract
This course offers an in-depth exploration of sustainable energy systems, focusing on the development, integration, and management of renewable energy sources. As the world moves towards a low-carbon future, understanding the

principles and technologies behind sustainable energy is crucial. The course covers a broad range of topics, including the fundamentals of sustainability, various renewable energy technologies (such as solar, wind), and energy storage solutions. Additionally, it addresses the integration of renewable energy into existing power grids, the role of smart grids, and the policies and economics that drive the adoption of sustainable energy systems.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Demonstrate an in-depth understanding of the core principles of sustainability, including energy efficiency, carbon footprint reduction, and the integration of renewable energy technologies into the broader energy landscape.	20	x		
2	Analyse and evaluate the design, operation, and performance characteristics of various renewable energy technologies, such as photovoltaic systems, wind turbines, hydroelectric power, biomass conversion processes, and geothermal energy extraction methods.	30	x	x	x
3	Assess the technical and operational challenges of integrating renewable energy sources into existing power grids, including the implementation of smart grid technologies, energy storage systems, and advanced grid management techniques to optimize energy distribution and reliability.	30	x	x	x
4	Critically analyse the economic viability, environmental impact, and social implications of sustainable energy systems, and evaluate the effectiveness of policies, regulations, and incentives designed to promote the adoption and integration of renewable energy technologies into national and global energy frameworks.	20	x	x	

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	The students will learn key concepts of sustainable energy systems	1, 2, 3, 4	2 hrs/wk
2	Tutorials	The students will work out key calculations in renewable energy problems based on questions and problem solving	2, 3	0.5 hrs/wk
3	Laboratory	The students will gain hands-on experience through lab sessions for the PV and Wind systems	2, 3	0.5 hrs/wk

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Project	2, 3	10	
2	Quiz	1, 2, 4	20	
3	Assignments (laboratory etc.)	2, 3	10	

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Additional Information for ATs

Remark:
To pass the course, students are required to achieve at least 30% in course work and 30% in the examination.

Assessment Rubrics (AR)

Assessment Task

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Achievements in CILOs

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Coursework (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Achievements in CILOs

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Achievements in CILOs

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Coursework (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Achievements in CILOs

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal levels

Additional Information for AR

Constructive Alignment with Programme Outcomes

PILO	How the course contribute to the specific PILO(s)
1,2,3,4	The course requires the analysis and the design of engineering systems and therefore provides many opportunities for students to solve engineering problems by applying knowledge of mathematics, science, and engineering.
3	Students are required to complete project and laboratory experiments to gain practical hands-on experience.

Part III Other Information

Keyword Syllabus

1. Photovoltaic (PV) Systems
Detailed study of photovoltaic technology, including solar cell materials and fabrication, efficiency factors, PV system design and sizing, and integration into the electrical grid.
2. Wind Turbine Technologies
Examination of wind turbine components and design, performance characteristics, site assessment and selection, and the impact of environmental factors on wind energy production.
3. Energy Storage Solutions for Renewable Systems
Overview of energy storage technologies, including batteries, pumped hydro, and compressed air energy storage; their role in supporting intermittent renewable energy sources; and strategies for effective storage system integration.
4. Grid Integration and Smart Grid Technologies
Challenges and solutions for integrating PV and wind energy systems into existing power grids, the role of smart grid technologies in enhancing grid stability and reliability, and advanced grid management techniques for optimal renewable energy utilization.
5. Carbon Policy and Carbon Markets
Examination of carbon policies and regulations, the functioning of carbon markets, mechanisms for trading carbon credits, and methods for tracking and reducing the carbon footprint of energy systems.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Kutscher, C. F., & Milford, J. B. (2018). Principles of sustainable energy systems. CRC Press.