MNE4123: RENEWABLE AND SUSTAINABLE ENERGY SYSTEMS

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Renewable and Sustainable Energy Systems

Subject Code
MNE - Mechanical Engineering
Course Number
4123

Academic Unit
Mechanical Engineering (MNE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

To achieve the goal of carbon neutrality by the middle of the century, renewable and sustainable energy will play a key role. In this course, the main renewable and sustainable energy systems such as solar, wind, hydropower, biomass, nuclear energy, fuel cell will be introduced. As the energy storage systems are needed to smooth the intermittent manner of renewable energy systems, the different battery energy storage systems will be covered in the course. The system designs, operations and principal theories will be introduced in this course. For students who will work or further study in the energy related areas after graduation, this course will especially be helpful. For those students not working in energy areas, it is still helpful as the usage of clean energy will inevitably be part of our future life.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the system designs for various renewable and sustainable energy systems together with battery energy storage systems.		x	x	x
2	Explain the principles for various energy systems.		x	x	x
3	Analyse the system operational efficiency, safety and cost.		x	x	x
4	Demonstrate reflective practice in an engineering context.		x	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	Take place in classroom setting which consists of lectures on different topics related to system design and operations of the various energy systems, and related basic theories and engineering practices.	1, 2, 3, 4	3hrs/week for 13 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Quizzes/Mid-term Test	1, 2, 3, 4	20	One mid-term test
2	Mini-project	1, 2, 3, 4	20	1 report to be submitted

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Assessment Rubrics (AR)

Assessment Task

1. Quizzes/ Mid-term Test

Criterion

Describe the major subsystem and components of the solar energy, wind energy, and different battery energy storage systems. Understand the basic theories and engineering practices for above energy systems.

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

2. Mini-project

Criterion

Ability to apply the learned theories to conduct the research for a renewable and sustainable energy system.

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
3. Examination

Criterion
Describe the design and operation of the various energy systems, and the functions of the major components. Understand the basic theories and engineering practices for the design and operation of the various energy systems.

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

Additional Information for AR
Note: For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Part III Other Information

Keyword Syllabus
- Concentrating Solar Power (CSP) Technologies
- Photovoltaic (PV) systems
- Wind energy systems
- Battery energy storage systems
- Nuclear energy systems
- Hydropower systems
- Biomass energy systems
- Fuel cells

Reading List

Compulsory Readings

	Title
1	Gilbert M. Masters, Renewable and Efficient Electric Power Systems, Wiley-Interscience Press, 2004.
2	Lamarsh, J. R., and Baratta, A. J., Introduction to Nuclear Engineering, 3rd Edition, Prentice Hall, 2001.

Additional Readings

	Title
1	Volker Quaschning, Understanding Renewable Energy Systems, Earthscan Publication, 2005.
2	Tiwari G.N., Renewable Energy Resources: Basic Principles and Applications, Alpha Science Intl Ltd, 2005.
3	Murray, R. L., Nuclear Energy, 6th Edition. Butterworth-Heinemann, 2009.