MNE2114: EXPERIMENTAL SUSTAINABLE ENGINEERING TECHNIQUES

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Experimental Sustainable Engineering Techniques

Subject Code
MNE - Mechanical Engineering
Course Number
2114

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

The course aims to equip students with the experimental skills and further practical appreciation on the various sustainable engineering technologies. Being an experimental-based course, the course will also impart essential skills in data collection, critical analysis of experimental data to good practice in report writing. Through this course, students will grow appreciation in bridging theoretical knowledge with experimental practice.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Apply the theory of thermodynamics and heat transfer, to systems of energy efficiencies, for instance refrigeration cycle and heat exchanger design; collect and analyze relevant experimental data; apply good practice in report writing.			x	
2	Apply the theory of renewable energy conversion systems, such as photovoltaic solar cells, fuel cells and biofuel conversion; collect and analyze relevant experimental data; apply good practice in report writing.			x	
3	Apply the theory of environmental abatement techniques in air and wastewater purification; collect and analyze relevant experimental data; apply good practice in report writing.			x	
4	Apply good practice in verbal presentation of experimental findings.			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	Explain key concepts and principles behind each experimental module.	1, 2, 3	1
2	Lab-based experiment and oral presentation	Hands-on lab session to acquire and analyze data; present experimental findings.	1, 2, 3, 4	2

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Lab report	1, 2, 3	85	
2	Oral presentation	4	15	

Continuous Assessment (%)

100

Examination (%)

0

Additional Information for ATs

To pass a course, a student must do the following: Obtain at least 30% of the total marks allocated to each coursework component of lab reports and oral presentation.

Assessment Rubrics (AR)

Assessment Task

1. Lab report

Criterion

Ability to explain the methodology and procedure and analyze the experimental data and discuss the experimental findings.

Excellent (A+, A, A-)

Strong evidence of critical thinking; good organization, capacity to analyze and synthesize; superior grasp of subject matter; evidence of extensive knowledge of the experimental matters concerned.

Good (B+, B, B-)

Evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of issues; evidence of familiarity with experiment.

Fair (C+, C, C-)

Student who is profiting from the laboratory class; understanding of the subject; ability to develop solutions to concerning the experiment.

Marginal (D)

Sufficient familiarity with the laboratory content to enable the student to move onto other laboratory materials.

Failure (F)

Little evidence of familiarity with the laboratory class materials; weakness in critical and analytic skills; limited, or irrelevant use of data.

Assessment Task

2. Oral presentation

Criterion

Ability to orally present the key information related to the experiments.

Excellent (A+, A, A-)

Strong ability to orally present the key information related to the experiments.

Good (B+, B, B-)

Good ability to orally present the key information related to the experiments.

Fair (C+, C, C-)
Some ability to orally present the key information related to the experiments.

Marginal (D)
Marginal ability to orally present the key information related to the experiments.

Failure (F)
Not even reaching marginal levels.

Additional Information for AR
Note: To pass a course, a student must do the following:
Obtain at least 30% of the total marks allocated to each coursework component of lab reports and oral presentation.

Part III Other Information

Keyword Syllabus

- **Energy efficiency:**
  - Refrigeration cycle
  - Heat exchanger design
- **Renewable energy conversion:**
  - Solar cells assembly and assessment
  - Fuel cells assembly and assessment
  - Waste to biofuel conversion
- **Environmental abatement:**
  - Advanced oxidation techniques in wastewater treatment
  - Treatment of wastewater

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Cengel, Y.A., Boles, M.A., Thermodynamics: An Engineering Approach, McGraw-Hill, 2006.
2	Incropera, F.P., DeWitt, D.P., Bergman, T.L., Lavine, A.S., Fundamentals of heat and mass trasnfer, John Wiley & Sons, New York, 2011.
3	Hagfeldt, A., Boschloo, G., Sun, L., Kloo, L., Pettersson, H., Dye-sensitized solar cells, Chem. Rev. 2010, 110, 6595.
4	O’ Hayre, R., Cha, S.-W., Colella, W., Prinz, F.B., Fuel Cell Fundamentals, John Wiley and Sons, New York, 2006.
5	Tchobanoglous, G., Burton, F., David Stensel, H., Wastewater Engineering: Treatment and Reuse, Metcalf and Eddy, McGraw-Hill, 2002.
6	Burch, R., Knowledge and know-how in emission control for mobile applications, Catal. Rev.-Sci. Eng., 2004, 46, 271.