SEE2001: ELECTROMAGNETIC PRINCIPLES FOR ENERGY ENGINEERS

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Electromagnetic Principles for Energy Engineers

Subject Code
SEE - School of Energy and Environment
Course Number
2001

Academic Unit
School of Energy and Environment (E2)

College/School
School of Energy and Environment (E2)

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
PHY1201 General Physics I;
MA1200 Calculus and Basic Linear Algebra I or
MA1300 Enhanced Calculus and Linear Algebra I; AND
MA1201 Calculus and Basic Linear Algebra II or
MA1301 Enhanced Calculus and Linear Algebra II

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to lay down the basic knowledge of electricity, magnetism, waves, optics and modern physics related to energy science. Upon successful completion of the course, students are expected to have enhanced ability in comprehending technical information, reasoning through scientific questions and analysis, and applying physics principles to solve problems related to energy issues.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Recognize basic laws and principles of electricity and apply such concepts in problem solving.	20		x	
2	Identify underlying physical principles of magnetism.	20		x	
3	Apply the basic concepts and theories on electricity, magnetism and wave to explain and predict phenomena related to energy science.	20		x	
4	Analyse and solve problems involving electromagnetic radiation and physical optics.	20		x	
5	Describe fundamentals of quantum physics and applications of the Schrodinger Equation.	20		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.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Explain theories and concepts	1, 2, 3, 4, 5	2
2	Tutorials	Apply theories and concepts on practical examples	1, 2, 3, 4, 5	1

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments	1, 2, 3, 4, 5	25	
2	Midterm test/Quizzes	1, 2, 3, 4	25	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

Examination duration: 2 hrs
Percentage of coursework, examination, etc.: 50% by coursework; 50% by exam

To pass a course, a student must do ALL of the following:
1) obtain at least 30% of the total marks allocated towards coursework (combination of assignments, pop quizzes, term paper, lab reports and/ or quiz, if applicable);
2) obtain at least 30% of the total marks allocated towards final examination (if applicable); and
3) meet the criteria listed in the section on Assessment Rubrics.

Assessment Rubrics (AR)

Assessment Task

1. Assignments

Criterion

Ability to analyse and solve problems related to application of electromagnetic principles in energy engineering

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. Midterm test /Quizzes

Criterion

Ability to analyse and solve problems related to application of electromagnetic principles in energy engineering

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
Ability to analyse and solve problems related to application of electromagnetic principles in energy engineering

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

Part III Other Information

Keyword Syllabus

OSCILLATIONS AND WAVES
- Oscillations
- Traveling Waves
- Superposition and Standing Waves

ELECTRICITY AND MAGNETISM
- The Electric Field
- Discrete Charge Distributions
- Continuous Charge Distributions
- Electric Potential
- Capacitance
- Electric Current and Direct-Current Circuits
- The Magnetic Field

- Sources of the Magnetic Field
- Magnetic Induction
- Alternating-Current Circuits
- Maxwell's Equations and Electromagnetic Waves

LIGHT
- Properties of Light
- Optical Images
- Interference and Diffraction

MODERN PHYSICS
- Wave-Particle Duality and Quantum Physics
- Applications of the Schrodinger Equation
- Atoms
- Molecules
- Solids

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Physics for Scientists and Engineers by Paul A. Tipler and Gene Mosca, 5th edition (Extended version), W. H. Freeman, 2004.
2	Physics for Scientists and Engineers with Modern Physics by Raymond A. Serway, 4th Edition, Saunders College Pub, 1996.