EE3121: DIFFERENTIAL EQUATIONS FOR ELECTRICAL ENGINEERING

Effective Term
Semester A 2023/24

Part I Course Overview

Course Title
Differential Equations for Electrical Engineering

Subject Code
EE - Electrical Engineering
Course Number
3121

Academic Unit
Electrical Engineering (EE)

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
MA2001 Multi-variable Calculus and Linear Algebra

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course introduces differential equations for solving practical problems of electrical and electronic engineering, including power conversion, wireless communication and circuit analysis. It is to help students develop the ability to carry out engineering analyses for engineering problems involving differential questions.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Use vector arithmetic and vector calculus to solve geometric problems in different coordinate systems, such as rectangular, cylindrical, and spherical.		x	x	
2	Understand and communicate the main ideas of differential equations, transforms, line and surface integrals.		x	x	
3	Identify and solve engineering problems involving ordinary differential equations, systems of differential equations, and Laplace transforms.		x	x	
4	Apply numerical methods to find approximate solutions for practical engineering problems involving differential equations.			x	x
5	Synthesize and extend the mathematical concepts learned in the course to tackle new and challenging problems involving differential equations.			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 self-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	Lecture	Key concepts are described and illustrated.	1, 2, 3, 4, 5	3 hrs/wk
2	Tutorial	Key concepts are worked out based on examples or problems.	1, 2, 3, 4, 5	1 hr/wk
3	Project	Key concepts are worked out by simulations and/or experiments.	4, 5	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks
1	Tests (min.: 2)	1, 2, 3	30	
2	Assignments (min.: 3)	1, 2, 3, 4, 5	15	
3	Project	4, 5	5	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

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

Assessment Rubrics (AR)

Assessment Task

Tests

Criterion

Two mid-term tests will assess students' level of achievement of the CILOs, with emphasis placed on correctly understanding the core concepts of differential equation systems.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reachingmarginal levels

Assessment Task

Assignments

Criterion

The assignments will assess students' understanding of core concepts and computational method.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reachingmarginal levels

Assessment Task
Project

Criterion
The project will evaluate the students' ability to synthesize the core concepts of the course and solve practical engineering problems using numerical methods.

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

Criterion
Examination questions are designed to assess students' level of achievement of the CILOs, with emphasis placed on correctly understanding and solving differential equation problems.

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

Vector Calculus for Engineering
Vector calculus in rectangular coordinate, cylindrical coordinate, and spherical coordinate systems; Curl and divergence; Line and surface integrals; Theorems of Gauss, Stokes, and Green.

Ordinary Differential Equations in Electrical and Electronic Engineering
First order differential equations, Second and higher order linear differential equations; Laplace transform; System of linear differential equations for the circuit design, electromagnetics, and wireless communication.

Partial differential equations in Electronic and Electronic Engineering
Diffusion, wave and Laplace equations; Initial value problems; Fourier series; Boundary value problem. Simulation projects for solving engineering problems in the circuit design and wireless communication.

Reading List

Compulsory Readings

	Title
1	Vector Calculus by Peter Baxadall & Hans Liebeck, Dover Publications, 2008
2	Mathematics for Engineering and Science, Department of Mathematics, City University of Hong Kong, Prentice Hall, Pearson Education South Asia, 2008
3	Differential Equations (4th ed.) by Richard Bronson, Mc-Graw Hill, 2016

Additional Readings

	Title
1	Nil