EE2108: COMPUTATIONAL ENGINEERING ANALYSIS

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Computational Engineering Analysis

Subject Code
EE - Electrical Engineering
Course Number
2108

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
For Normative 4-year Degree Students Only:
MA1200 Calculus and Basic Linear Algebra I or MA1300 Enhanced Calculus and Linear Algebra I

Precursors
For Normative 4-year Degree Students Only:
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

The course aims to provide the concept of what numeric methods are and how they relate to engineering problem solving. Students will learn how to formulate numerical models, select appropriate numerical methods, and implement the methods using computer programming language, such as Python, MATLAB, etc.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Identify the needs in applying numerical methods for solving engineering and mathematical modelling problems		x	x	
2	Analyze different types of errors in numerical computation		x	x	
3	Develop computer programs to solve numerical problems		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.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Explain key concepts in numerical methods and practice with various examples	1, 2, 3	3-hour/week
2	Programming Laboratory	Hands-on exercise on solving numerical problem with computer programming language	3	Six 2-hour sessions

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Tests (min.: 2)	1, 2, 3	30	
2	#Assignments (min.: 3)	1, 2, 3	10	
3	Lab Exercises/Reports	1, 2, 3	10	

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 course work and 30% in the examination. Also, 75% laboratory attendance rate must be obtained.

may include homework, tutorial exercise, project/mini-project, presentation

Assessment Rubrics (AR)

Assessment Task
Examination

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

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

Part III Other Information

Keyword Syllabus

Introduction
Overview of numerical analysis, programming fundamentals, data visualization, error analysis

Root Searching Techniques
Bracketing methods, open methods

Linear Systems
Matrix algebra, Gauss elimination, LU factorization, Gauss-Seidel method

Curve Fitting
Least-squares data fitting, polynomial interpolation, splines

Differentiation and Integration
Numerical differentiation, Trapezoidal rule, Simpson’ s rules, Romberg integration

Reading List

Compulsory Readings

	Title
1	Jaan Kiusalaas, Numerical Methods in Engineering with Python 3, Cambridge University Press

Additional Readings

	Title
1	Amos Gilat, Numerical Methods for Engineers and Scientists, Wiley
2	Titus A. Beu, Introduction to Numerical Programming: A Practical Guide for Scientists and Engineers Using Python and C/C++, CRC Press
3	Mark Summerfield, Programming in Python 3: A Complete Introduction to the Python Language, Addison-Wesley
4	Gerald W. Recktenwald, Numerical Methods with MATLAB: Implementations and Applications, Prentice Hall