MNE2036: ENGINEERING COMPUTING

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Engineering Computing

Subject Code
MNE - Mechanical Engineering
Course Number
2036

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 fundamental principles of engineering modelling and computation.

The objectives of the course are to develop skills for formulating engineering problems into mathematical models and to study numerical methods for solving the former. In addition, to cultivate mathematical skills to estimate the error between numerical and analytical solutions, and how to improve the model.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain the basic principles for engineering problem analysing and modelling.		x		
2	Apply analytical methods to analyse some engineering problems and translate them into appropriate mathematical models or equations.			x	x
3	Apply appropriate numerical algorithms to solve the derived mathematical models or equations.				x
4	Implement a given analytical or numerical algorithm in a software program for finding solutions for a given engineering problem.			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 the fundamental principle of engineering modelling and computation, such as optimization, root finding, curve fitting, etc.Explain how to solve the engineering problem by mathematical and numerical methods. Students need to apply the learned knowledge to solve engineering problems.	1, 2, 3	2 hrs/week

2	Laboratory Work	Require students to formulate the engineering problems into mathematical models and execute as projects.Require students to solve the former mathematical models by numerical methods.	2, 3, 4	3 hrs/week for 6 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Quiz	1, 2, 3	10	
2	Project Reports	2, 3, 4	35	2 reports to be submitted
3	Skill Test**	2, 3, 4	10	

Continuous Assessment (%)

55

Examination (%)

45

Examination Duration (Hours)

2

Additional Information for ATs

**Skill Test - Programming tasks will be given to students to test their basic programming skill.

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. Quiz

Criterion

1.1 Ability to explain the fundamental principle of engineering modelling and computation with the necessary Details.

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.Project Reports

Criterion

2.1 Ability to solve the “Root Finding” problem by numerical method.2.2 Ability to develop numerical algorithms to solve the derived mathematical models or equations.

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. Skill Test

Criterion

3.1 Ability to solve an engineering problem by software programming.

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

4. Examination

Criterion

4.1 Ability to solve the engineering problems by mathematics equations.4.2 Ability to formulate the engineering problems into mathematical models and solve the former by 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

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
Engineering Modelling and Analysis, Engineering Computation, Numerical Methods, Round-off Error, Truncation Error, Taylor Series, Differential Equations, Finite Difference Equations, Roots of Equations, One-Dimensional Unconstrained Optimisation, Fourier transformation.

Reading List

Compulsory Readings

	Title
1	Steven C. Chapra and Raymond P. Canale, Numerical Methods For Engineers, 7th edition, 2016, McGraw Hill Higher Education, ISBN-10: 9352602137

Additional Readings

	Title
1	Bohdan T. Kulakowski, John F. Gardner and J. Lowen Shearer, Dynamic Modeling and Control of Engineering Systems, 3rd Edition, Cambridge University Press, ISBN-10: 1107650445.
2	R. W. Hamming, Numerical Methods for Scientists and Engineers (Dover Books on Mathematics) 2nd Revised ed. Edition, Dover Publications, ISBN-10: 0486652416.