MA3525: ELEMENTARY NUMERICAL METHODS

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Elementary Numerical Methods

Subject Code
MA - Mathematics
Course Number
3525

Academic Unit
Mathematics (MA)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
MA2503 Linear Algebra; or MA1503 Linear Algebra with Applications

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract
This course aims to give an introduction of elementary numerical methods. It trains students to apply numerical methods in solving problems in calculus, linear algebra and differential equations, as well as to use software packages in writing computer

programs and analyzing solutions of problems. The course also serves to give students practice in clear and concise written and spoken communication of the results of an investigation.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	manipulate computing software packages, such as MATLAB, as tools in solving and analyzing solutions of problems.	0			
2	design programs of numerical computation with MATLAB.	0			
3	explain clearly mathematical concepts of basic numerical methods.	10	x		
4	apply computational techniques in linear algebra, such as solving a linear system, matrix eigenvalue problem and the least squares problem.	40	x	x	x
5	evaluate integrals and interpolating polynomials numerically.	20	x	x	
6	solve nonlinear equations by using an algorithmic approach technique.	20	x	x	x
7	the combination of CILOs 1-6	10	x	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.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Learning through teaching is primarily based on lectures.	1, 2, 3, 4, 5, 6, 7	39 hours in total
2	Take-home assignments	Learning through tutorials is primarily based on interactive problem solving and hand-on computer exercises allowing instant feedback.	1, 2	2 hours

3	Take-home assignments	Learning through tutorials is primarily based on interactive problem solving and hand-on computer exercises allowing instant feedback.	3	1 hour
4	Take-home assignments	Learning through tutorials is primarily based on interactive problem solving and hand-on computer exercises allowing instant feedback.	4	4 hours
5	Take-home assignments	Learning through tutorials is primarily based on interactive problem solving and hand-on computer exercises allowing instant feedback.	5	3 hours
6	Take-home assignments	Learning through tutorials is primarily based on interactive problem solving and hand-on computer exercises allowing instant feedback.	6	3 hours
7	Online applications		6	after-class
8	Math Help Centre		1, 2, 3, 4, 6	after-class

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Quizzes/Test/Midterm	3, 4, 5	20	Questions are designed for the first part of the course to see how well the students have learned the basic concepts of numerical methods and their applications in solving problems of linear algebra and polynomial interpolation.
2	Hand-in assignments	1, 2, 3, 4, 5, 6	10	These are skills based assessment to enable students to approach mathematical problems via numerical means and to analyze solutions with the aid of computing software packages.

3	Project(s)	1, 4, 5, 6	0	Students are assessed on their ability in applying numerical and computational methods to solve mathematical problems, as well as on the presentation of numerical results with analysis.
4	Formative take-home assignments	1, 2, 3, 4, 5, 6	0	The assignments provide students chances to demonstrate their achievements on numerical methods learned in this course.

Continuous Assessment (%)

30

Examination (%)

70

Examination Duration (Hours)

3

Additional Information for ATs

30% Coursework
70% Examination (Duration: 3 hours, at the end of the semester)

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

Assessment Rubrics (AR)

Assessment Task

1. Quizzes/Test/Midterm

Criterion

ABILITY to APPLY and EXPLAIN the basic concepts and methodology of 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
2. Hand-in assignments

Criterion
CAPACITY for LEARNING to understand the principles of 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
3. Projects

Criterion
N.A.

Assessment Task
4. Formative take-home assignments

Criterion
CAPACITY for LEARNING to understand the principles of 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
5. Examination

Criterion
ABILITY to ANALYZE and DEVELOP 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

Part III Other Information

Keyword Syllabus
MATLAB for numerical computation, Computer Arithmetics. Linear System of Equations. Polynomial Interpolation and Splines. Numerical Integration. Least Squares Problems. Matrix Eigenvalue Problem. Root-finding Methods.

Reading List

Compulsory Readings

	Title
1	Richard L. Burden and J. Douglas Faires, Numerical Analysis, 9th edition, Brooks/Cole
2	Mark H. Holmes, Introduction to Scientific Computing and Data Analysis, Springer

Additional Readings

	Title
1	Nil