MA1301: ENHANCED CALCULUS AND LINEAR ALGEBRA II

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Enhanced Calculus and Linear Algebra II

Subject Code
MA - Mathematics
Course Number
1301

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
(i) MA1300 Enhanced Calculus and Linear Algebra I; or
(ii) Grade B or above in MA1200 Calculus and Basic Linear Algebra I (approval from MA must be obtained)

Precursors
Nil

Equivalent Courses
MA1201 Calculus and Basic Linear Algebra II

Exclusive Courses
MA1006 Calculus and Linear Algebra for Business
MA1508 Calculus

Part II Course Details

Abstract

This is the second of two required courses designed for students pursuing studies in **mathematics**, or **engineering/science** students requiring solid background in mathematics. It aims to

- develop fluency in concepts and techniques from integral calculus, linear algebra and complex numbers,
- introduce elementary theory of differential and integral calculus, and
- foster skills in implementing methods of calculus and linear algebra to mathematical and physical applications.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	explain elementary theory of differential and integral calculus.	15	x		
2	perform techniques of integration to evaluate integrals of functions.	30		x	
3	explain at high level concepts from vector and matrix algebra.	10	x		
4	manipulate expressions and solve geometric problems with vector arithmetic.	10		x	
5	implement techniques of matrix arithmetic and of solving linear systems.	15		x	
6	perform operations and solve equations involving complex numbers.	10		x	
7	develop mathematical models through calculus and linear algebra, and appropriately apply to problems in science and engineering.	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	Lectures	Learning through teaching is primarily based on lectures.	1, 2, 3, 4, 5, 6, 7	39 hours in total

2	Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	1, 2, 3, 4, 5, 6, 7	13 hours in total
3	Take-home assignments and Online exercises	Learning through take-home assignments and online exercises helps students implement concepts of functions and limits, evaluate limits of sequences, series and functions, test for convergence/divergence of series as well as apply techniques of differential calculus.	1, 2, 3, 4, 5, 6, 7	after class
4	Math Help Centre	Learning activities in Math Help Centre provides students extra assistance in study.	1, 2, 3, 4, 5, 6, 7	after-class, depending on need

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Quizzes/Test/Midterm	1, 2, 3, 4, 5, 6, 7	21	Questions are designed to see how well students have learned theory of calculus, techniques of integral calculus, as well as concepts and methods of linear algebra and complex numbers. These assessment tasks monitor students' progress and reveal gaps in knowledge.
2	Hand-in assignment(s)	1, 2, 3, 4, 5, 6, 7	9	These are skills based assessment to see whether students are familiar with elementary theory of calculus as well as essential methods and applications of integral calculus, linear algebra and complex numbers.

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 methodology of integral calculus and linear algebra

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 assignment(s)

Criterion

2.1 CAPACITY of SELF-DIRECTED LEARNING to understand the main concepts of integral calculus and linear algebra, and master the mathematical techniques involved.

Excellent (A+, A, A-)

Demonstrates a thorough understanding of the concepts, theories and techniques in integral calculus and linear algebra, and can always apply this understanding to solve a range of mathematical problems.

Good (B+, B, B-)

Demonstrate a substantial understanding of the concepts, theories and techniques in integral calculus and linear algebra, and can usually apply this understanding to solve some mathematical problems.

Fair (C+, C, C-)

Demonstrate a general understanding of the concepts, theories and techniques in integral calculus and linear algebra, and can sometimes apply this understanding to solve some mathematical problems.

Marginal (D)

Demonstrate a partial understanding of the concepts, theories and techniques in integral calculus and linear algebra, and can rarely apply this understanding.

Failure (F)

Demonstrate a little understanding or some misunderstanding of the concepts, theories and techniques in integral calculus and linear algebra, and can rarely or almost never apply this understanding.

Assessment Task

3. Examination

Criterion

3.1 ABILITY to APPLY mathematical techniques and theories to solve problems involving the intended learning outcomes.

Excellent (A+, A, A-)

Demonstrates a thorough understanding of the concepts, theories and techniques in integral calculus and linear algebra, and can always apply this understanding to solve a range of mathematical problems.

Good (B+, B, B-)

Demonstrate a substantial understanding of the concepts, theories and techniques in integral calculus and linear algebra, and can usually apply this understanding to solve some mathematical problems.

Fair (C+, C, C-)

Demonstrate a general understanding of the concepts, theories and techniques in integral calculus and linear algebra, and can sometimes apply this understanding to solve some mathematical problems.

Marginal (D)

Demonstrate a partial understanding of the concepts, theories and techniques in integral calculus and linear algebra, and can rarely apply this understanding.

Failure (F)

Demonstrate a little understanding or some misunderstanding of the concepts, theories and techniques in integral calculus and linear algebra, and can rarely or almost never apply this understanding.

Part III Other Information

Keyword Syllabus

a. Definite and indefinite integrals; Techniques of integration, integration by substitution, integration by parts; Improper integrals
b. Physical and geometric applications of integration
c. Vectors in R 2 and R 3 ; Scalar products, cross products, triple scalar products; Linear (in)dependence; Applications to equations of lines and planes
d. Matrices; Determinants, cofactor expansion; Systems of linear equations, Gaussian elimination, Cramer’ s rule; Matrix inverses, Gauss-Jordan elimination method
e. Arithmetic of complex numbers; Polar and Euler forms; De Moivre’ s theorem and its applications

Reading List

Compulsory Readings

	Title
1	Course Materials Provided

Additional Readings

	Title
1	Single Variable Calculus (7th edition) by J. Stewart, Pacific Grove, CA: Brooks/Cole, 2011.
2	C. Henry Edwards and David E. Penney, Calculus: Early Transcendentals, 7th ed., Pearson Prentice Hall, 2008
3	Robert A. Adams, Calculus: A Complete Course, 6th ed., Pearson Addison Wesley, 2006
4	Glyn James et al., Modern engineering mathematics, Harlow : Pearson Prentice Hall, 2008.