MA1300: ENHANCED CALCULUS AND LINEAR ALGEBRA I

Effective Term

Semester A 2024/25

Part I Course Overview

Course Title

Enhanced Calculus and Linear Algebra I

Subject Code

MA - Mathematics

Course Number

1300

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) HKDSE Mathematics Compulsory Part and Extended Part Module 1 (Level 5), or
(ii) HKDSE Mathematics Compulsory Part and Extended Part Module 2 (Levels 3 – 5); or equivalent

Precursors

Nil

Equivalent Courses

MA1200 Calculus and Basic Linear Algebra I

Exclusive Courses

MA1006 Calculus and Linear Algebra for Business
MA1508 Calculus

Part II Course Details

Abstract

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

· strengthen skills and methods essential for study of further mathematics,
· develop fluency in concepts of limits and techniques of differential calculus, and
· nurture skills in logical thinking and translation of ideas with formal mathematical language.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	implement mathematical methods of algebra, trigonometry and coordinate geometry proficiently.	16		x	x
2	explain properties of functions and manipulate expressions involving standard functions and their inverses.	16	x		x
3	apply concepts and theory of sequences to evaluate their limits.	20	x	x	
4	describe concepts on infinite series and test their convergence/divergence.	16	x		
5	explain at high level concepts of limit, continuity and differentiability of functions.	16	x		
6	perform techniques of differentiation to obtain derivatives of functions.	16		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	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	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 | after class |
| 4 | Math Help Centre | Learning activities in Math Help Centre provides students extra assistance in study. | 1, 2, 3, 4, 5, 6 | after-class,depending on need |

Additional Information for LTAs

Students are assigned to lecture sessions according to mathematical background and/or results in HKDSE mathematics. Students in Section B benefit from extra tuition hours.

Students are assigned to <u>Section A</u> if

·   HKDSE Mathematics Compulsory Part (Passed) + Module 2 (Levels 4 – 5)
·   New Foundation Year of CSE

Students are assigned to <u>Section B if:</u>

·   HKDSE Mathematics Compulsory Part (Passed) + Module 2 (Levels 1 – 3)
·   HKDSE Mathematics Compulsory Part (Passed) + Module 1 (Levels 5)

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Quizzes/Test(s)	1, 2, 3, 4, 5, 6	20	Questions are designed to see how well students have learned basic mathematical methods, concepts of functions, limits, continuity and differentiability, as well as techniques of differential calculus. These assessment tasks monitor students' progress and reveal gaps in knowledge.

2	Hand-in assignment(s)	1, 2, 3, 4, 5, 6	10	These are skills based assessment to see whether students are familiar with essential mathematical techniques, properties of functions, theory and methods of limits of sequences and series as well as techniques of differential calculus.

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(s)

Criterion

1.1 CAPACITY of EXPLAIN and APPLY concepts and methods of differential calculus.

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 differential calculus and master the mathematical techniques involved.

Excellent (A+, A, A-)

Demonstrates a thorough understanding of the concepts, theories and techniques in differential calculus 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 differential calculus 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 differential calculus and can sometimes apply this understanding to solve some mathematical problems.

Marginal (D)

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

Failure (F)

Demonstrate a little understanding or some misunderstanding of the concepts, theories and techniques in differential calculus 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 differential calculus 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 differential calculus 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 differential calculus and can sometimes apply this understanding to solve some mathematical problems.

Marginal (D)

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

Failure (F)

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

Part III Other Information

Keyword Syllabus

- Polynomials; Mathematical induction
- Functions and inverses
- Limits of sequences and infinite series
- Limits, continuity and differentiability of functions
- Techniques of differentiation, implicit, logarithmic and parametric differentiation

Reading List

Compulsory Readings

	Title
1	https://www.cityu.edu.hk/ma/programmes/undergraduate/non-BSCM-students/topics-recommended-readings-servicing-courses#heading4

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