MA1508: CALCULUS

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Calculus

Subject Code
MA - Mathematics
Course Number
1508

Academic Unit
Mathematics (MA)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
4

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

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
(i) HKDSE Mathematics Compulsory Part, or
(ii) HKDSE Mathematics Compulsory Part and Extended Part Module 1, or
(iii) HKDSE Mathematics Compulsory Part and Extended Part Module 2 (Levels 1 – 3); or equivalent

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
MA1200 Calculus and Basic Linear Algebra I
MA1201 Calculus and Basic Linear Algebra II
MA1300 Enhanced Calculus and Linear Algebra I
MA1301 Enhanced Calculus and Linear Algebra II

Part II Course Details

Abstract

This is the course on calculus designed for students pursuing studies in science and related fields requiring solid background in mathematics. It aims to

- equip students with mathematical skills and methods essential for study of calculus,
- develop fluency in concepts and techniques for **limits**, **differential calculus**, and **integral calculus**,
- provide students with mathematical training for all further studies in science and related fields.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain properties and theories of differential and integral calculus	10		x	
2	Explain concepts of limit, continuity, differentiability and integral of functions	10	x		
3	Perform techniques of differentiation to obtain derivatives and Taylor series expansions of functions	20	x	x	
4	Perform techniques of integration to evaluate integrals of functions	20	x	x	
5	Apply methods of differential and integral calculus to applications in science and engineering	20		x	x
6	The combination of CILOs 1 – 5	20	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.

Teaching and Learning Activities (TLAs)

	TLAs	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	3 hours in total

3	Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	2	2 hours in total
4	Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	3	2 hours in total
5	Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	4, 5	4 hours in total
6	Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	6	2 hours in total
7	Assignments	Learning through take-home assignments helps students implement basic concepts of functions and techniques of differential calculus, as well as apply knowledge of which to problems in science and engineering.	1, 2, 3, 4, 5, 6	after class
8	Online applications	Learning through online examples for applications helps students apply methods of differential calculus to practical problems in science and engineering.	4, 5, 6	after class

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	25	Questions are designed to see how well students have learned basic mathematical methods, concepts of functions, limits and continuity, as well as techniques and applications 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	5	These are skills based assessment to see whether students are familiar with essential mathematical methods.

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

Understanding of the basic concepts and theory of 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

Test the capacity of self-directed learning to understand the course material. Students are required to complete the hand-in assignment in time to the satisfaction of the Lecturer.

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. Examination

Criterion
The examination will consist of one 3-hour paper. The examination is designed to assess the proficiency and the degree of understanding and mastering the course materials.

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

A) Functions and inverses
B) Limits, continuity and differentiability of functions
C) Techniques of differentiation, chain rule, implicit and parametric differentiation
D) Applications of differentiation: rate of change, local extrema, optimization problems, Taylor series, l' Hôpital rule
E) Definite and indefinite integrals; techniques of integration: integration by substitution, integration by parts
F) Applications of integration: area, length of curve

Reading List

Compulsory Readings

	Title
1	Maurice D. Weir, Thomas Calculus: Early Transcendental, 10th ed., Pearson 2014
2	Stewart J., Calculus: Early Transcendentals, 8th ed., Cengage Learning, 2016

Additional Readings

	Title
1	Frank Ayres, Jr. and Elliott Mendelson, Calculus (Schaum's Outlines), 6th ed., McGraw Hill, 2013
2	Fred Safier, Precalculus (Schaum's Outlines), 3rd ed., McGraw Hill, 2013
3	Ron Larson and Bruce Edwards, Calculus I with Precalculus: A One-Year Course, 3rd ed., Brooks/Cole, 2012
4	C. Henry Edwards and David E. Penney, Calculus: Early Transcendentals, 7th ed., Pearson Prentice Hall, 2008
5	Robert A. Adams, Calculus: A Complete Course, 6th ed., Pearson Addison Wesley, 2006
6	Glyn James, Modern Engineering Mathematics, 4th ed., Pearson Prentice Hall, 2008