City University of Hong Kong
Course Syllabus

offered by College/School/Department of _Mathematics______
with effect from Semester __A____ 20_19_ / _20_

Part I Course Overview

Course Title:	**Multi-variable Calculus**
Course Code:	**MA2508**
Course Duration:	**One Semester**
Credit Units:	**4**
Level:	**B2**
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
Medium of Instruction:	**English**
Medium of Assessment:	**English**
Prerequisites: *(Course Code and Title)*	**Grade B or above in MA1201 Calculus & Basic Linear Algebra II and subject to approval from MA must be obtained; or** **Grade C- or above in MA1301 Enhanced Calculus & Linear Algebra II; or** **Grade C- or above in both MA1508 Calculus and MA1503 Linear Algebra with Applications**
Precursors: *(Course Code and Title)*	**Nil**
Equivalent Courses: *(Course Code and Title)*	**Nil**
Exclusive Courses: *(Course Code and Title)*	**Nil**

Part II Course Details

1. Abstract
(A 150-word description about the course)

This course introduces fundamental mathematical methods and analysis in advanced calculus. It will help students to understand the basic concepts, fundamental theory and identify the applications of multi-variable calculus. It trains students in the ability to think quantitatively and analyze problems critically.

2. Course Intended Learning Outcomes (CILOs)
(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs#	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	evaluate limits, partial derivatives, and multiple integrals for functions of several variables.	30%		✓	
2.	compute line and surface integrals.	20%		✓	
3.	apply integral theorems of vector analysis to describe some physical problems.	10%	✓		✓
4.	explain basic concepts of multi-variable calculus, create and construct mathematical models through multi-variable calculus and vector analysis, and properly apply to some problems in science and engineering.	20%	✓	✓	✓
5.	the combination of CILOs 1-4	20%	✓	✓	✓
	** If weighting is assigned to CILOs, they should add up to 100%.*	100%			

 # Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

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 self-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.

3. Teaching and Learning Activities (TLAs)
(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4	5		
Lectures	Learning through **teaching** is primarily based on lectures.	✓	✓	✓	✓	✓	39 hours in total	Lectures
Tutorials	Learning through **tutorials** is	✓					4 hours	Tutorials
			✓				4 hours	

	primarily based on interactive problem solving allowing instant feedback.			✓			2 hours	
					✓		3 hours	
Assignments	Learning through **take-home assignments** helps students understand basic mathematical concepts and fundamental theory of multi-variable calculus, and apply mathematical methods and analysis from advanced calculus to some applications.	✓	✓	✓	✓	✓	after-class	Assignments
Online applications	Learning through **online examples for applications** helps students create and formulate mathematical models and apply to some problems in science and engineering.				✓		after-class	Online applications
Math Help Centre	Learning activities in **Math Help Centre** provides students extra help.	✓	✓	✓			after-class	Math Help Centre

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

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 Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4	5			
Continuous Assessment: _30___%								
Test	✓	✓	✓				30%	Questions are designed for the first part of the course to see how well the students have learned the basic concepts, fundamental theory and recognized the applications of multi-variable calculus.
Hand-in assignments	✓	✓	✓	✓				These are skills based assessment to enable

								students to demonstrate the basic concepts and fundamental theory of multi-variable calculus and identify the applications.
Formative take-home assignments	✓	✓	✓	✓			0%	The assignments provide students chances to demonstrate their achievements on multi-variable calculus learned in this course.
Examination: (duration: 3 hrs)	✓	✓	✓	✓	✓		70%	Examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be skills and understanding based to assess the student's versatility in multi-variable calculus.
** The weightings should add up to 100%.*							100%	

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Test	ABILITY to APPLY and EXPLAIN the methodology of limits, partial derivatives and multiple integrals for functions of several variables	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Hand-in assignments	CAPACITY to evaluate limits, partial derivatives and multiple integrals for functions of several variables	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Formative take-home assignments	CAPACITY for SELF-DIRECTED LEARNING to apply principles of multi-variable calculus to some problems in science and engineering	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Examination	ABILITY to DEVELOP mathematical models through multi-variable calculus and SOLVE problems with various methods	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

- Three-dimensional coordinate systems, equations for lines and planes, quadric surfaces
- Definitions of multi-variable functions, concepts of limit and continuity, partial derivatives of multi-variable functions, calculations of partial derivatives and their applications (e.g., maximum and minimum)
- Definitions of double integrals and triple integrals, evaluations of double and triple integrals in rectangular and other coordinates, applications of double and triple integrals (e.g., mass of a plate)
- Definition of vector fields, curl and divergence, definitions and evaluations of line and surface integrals, Green's theorem, Stokes' theorem and Gauss's theorem

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	J. Stewart, "Multivariate Calculus", fifth ed., Brooks/Cole, 2003.
2.	
3.	
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2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	W. Rudin, Principles of mathematical analysis, New York: McGraw-Hill, c1976.
2.	M.P. do Carmo, Differential geometry of curves and surfaces, Englewood Cliffs, N.J.: Prentice-Hall, c1976.
3.	M. Spivak, Calculus on manifolds: a modern approach to classical theorems of advanced calculus, New York: W.A. Benjamin, 1965.
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