City University of Hong Kong
Course Syllabus

offered by College/School/Department of _Mathematics_____
with effect from Semester __A____ 20_20_ / _21_

Part I Course Overview

Course Title:	**Multi-variable Calculus and Linear Algebra**
Course Code:	**MA2001**
Course Duration:	**1 semester**
Credit Units:	**3 CUs**
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)*	**MA1201 Calculus and Basic Linear Algebra II / MA1301 Enhanced Calculus and Linear Algebra II; or equivalent**
Precursors: *(Course Code and Title)*	**Nil**
Equivalent Courses: *(Course Code and Title)*	**Nil**
Exclusive Courses: *(Course Code and Title)*	**MA2158 Linear Algebra and Calculus**

Part II Course Details

1. Abstract

(A 150-word description about the course)

This course aims to introduce important ideas in Linear Algebra and Advanced Calculus necessary for an understanding of their application to Science and Engineering. It will help students develop the ability to think quantitatively and analyse 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.	explain clearly mathematical concepts from linear algebra, and advanced calculus.	15%	✓	✓	
2.	compute eigenvalues and eigenvectors of matrices and implement eigenvalue decompositions.	20%	✓	✓	
3.	evaluate partial derivatives, local extrema and Taylor series of multivariate functions.	30%	✓	✓	✓
4.	evaluate multiple integrals, line and surface integrals, and perform the theorems of Green, Divergence and Stokes.	30%	✓	✓	✓
5.	apply mathematical and computational methods to a range of applications involving linear algebra and multi-variable calculus.	10%	✓	✓	✓
	** 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			
Lectures	**Learning through teaching is primarily based on lectures.**	✓	✓	✓	✓	✓		39 hours in total
Tutorials	Learning through **tutorials** is		✓					2 hours
				✓				4 hours

	primarily based on interactive problem solving allowing instant feedback.				✓			5 hours
		✓				✓		2 hour
Take-home assignments	Learning through **take-home assignments** helps students understand basic concepts and techniques of linear algebra, multi-variable calculus and their applications.	✓	✓	✓	✓	✓		after-class
Online applications	Learning through **online examples for applications** helps students apply mathematical and computational methods to some problems in applications.					✓		after-class
Math Help Centre	Learning activities in **Math Help Centre** provides students extra help.	✓	✓	✓	✓	✓		after-class

4. Assessment Tasks/Activities (ATs)

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

30% Coursework

70% Examination (Duration: 2 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	✓	✓	✓	✓			15-20%	Questions are designed for the first part of the course to see how well the students have learned concepts and techniques of linear algebra and multi-variable calculus.
Hand-in assignments	✓	✓	✓	✓	✓		0-15%	These are skills based assessment to help students demonstrate advanced concepts and techniques of linear

								algebra, multi-variable calculus and some applications in science and engineering.
Formative take-home assignments	✓	✓	✓	✓	✓		0-10%	The assignments provide students' chances to demonstrate their achievements on linear algebra and multi-variable calculus learned in this course.
Examination: _70___% (duration: 2 hrs , if applicable)								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 linear algebra and 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	Intermediate stage: ability to understand the concepts and techniques of linear algebra and multi-variable calculus	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Hand-in assignments	Carefully selected fundamental problems to test students' ability to demonstrate advanced concepts and apply analysis techniques to science and Engineering	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Formative take-home assignments	Exercises and practices to demonstrate students' achievements on linear algebra and multi-variable calculus learned in this course	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Examination	Ability to demonstrate their versatility in linear algebra and multi-variable calculus	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.)

Linear Algebra (3 weeks): Orthogonality; Eigenvalues and eigenvectors; Eigenvalue decompositions.

Multi-variable Calculus (10 weeks): Functions of several variables; Partial differentiation; Multi-variable Taylor series; Multiple integration; Gradient, divergence and curl; Line and surface integrals; Theorems of Gauss, Stokes and Green.

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.	http://www6.cityu.edu.hk/ma/ug/serv/ma2001.htm
2.	
3.	
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2.2 Additional Readings

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

1.	Elements of Advanced Engineering Mathematics by Peter V. O'Neil, Cengage Learning, 2011
2.	Linear Algebra and Its Applications, 4/E, by David C. Lay, Pearson, 2011
3.	Thomas' Calculus, Multivariable (12th Edition) by George B. Thomas Jr. , Maurice D. Weir, Joel R. Hass, 2009
4.	Multivariable Calculus with Matrices (6th ed.) by C. Henry Edwards and David E. Penney, Prentice Hall, 2002