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:	**Mathematical Methods for Engineering**
Course Code:	**MA2181**
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)*	**MA2177 Engineering Mathematics and Statistics**

Part II Course Details

1. Abstract

(A 150-word description about the course)

This course aims to develop a basic understanding of a range of mathematics tools with emphasis on engineering applications. It is intended for students to solve problems with techniques from advanced linear algebra, ordinary differential equations and multi-variable differentiation. Fourier series and Laplace transforms are also introduced. The course helps students develop skills 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 at high levels concepts from advanced linear algebra and multi-variable differentiation.	15%	x	x	
2.	compute eigenvalues and eigenvectors of matrices, and solve first- and higher order ordinary differential equations.	25%	x	x	
3.	evaluate partial derivatives of multivariate functions.	25%	x	x	
4.	implement basic operations in Fourier series and Laplace transforms.	20%	x	x	
5.	apply mathematical and computational methods to a range of problems in science and engineering.	15%	x	x	x
** 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
Tutorials	Learning through **tutorials** is primarily based on interactive problem solving allowing instant		✓					2 hours
				✓				2 hours
					✓			2 hours
						✓		1 hour

	feedback.							
Assignments	Learning through **take-home assignments** helps students understand basic concepts and techniques of advanced linear algebra, ordinary differential equations and multi-variable differentiation, and some applications in science and engineering.	✓	✓	✓		✓		after-class
Online applications	Learning through **online examples for applications** helps students apply mathematical and computational methods to some problems in engineering 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	✓	✓	✓				15-30%	Questions are designed for the first part of the course to see how well the students have learned concepts and techniques of advanced linear algebra, ordinary differential equations and multi-variable differentiation.

Hand-in assignments	✓	✓	✓	✓	✓		0-15%	These are skills based assessment to see whether the students are familiar with advanced concepts and techniques of linear algebra, ordinary differential equations, multi-variable differentiation, Laplace transforms, Fourier series and some applications in engineering.
Formative take-home assignments	✓	✓	✓	✓	✓		0%	The assignments allow students to demonstrate their achievements on advanced linear algebra, ordinary differential equations, multi-variable differentiation and their applications in engineering 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 advanced linear algebra, ordinary differential equations, multi-variable

		differentiation, Laplace transforms and Fourier series.
** 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	Utilize concepts from advanced linear algebra, ordinary differential equations and eigenvalues and eigenvectors to solve problems relevant to engineering.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Hand-in assignments	Evaluate and implement Fourier series, Laplace transforms and techniques from multivariate calculus.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Formative take-home assignments	Select and apply various methods to solve problems relevant to engineering.	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Examination	Design solution strategies and then utilize appropriate methods to solve science and engineering problems.	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.)

Eigenvalues and eigenvectors. First- and higher order ordinary differential equations. Partial differentiation. Laplace transforms. Fourier series.

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.	*Calculus – Early Transcendentals* (7th Ed.) by C. Henry Edwards & David E. Penny
2.	*Linear Algebra – A Pure and Applied First Course* (1st Ed.) by Edgar G. Goodaire
3.	*Differential Equations and Boundary Value Problems* (4th Ed.) by C. Henry Edwards & David E. Penny
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2.2 Additional Readings

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

1.	*Advanced Engineering Mathematics* (9th Ed.) by Erwin Kreyszig
2.	
3.	
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