City University of Hong Kong
Course Syllabus

offered by College/School/Department of _Mathematics_____
with effect from Semester __B____ 20_17_ / _18_

Part I Course Overview

Course Title:	**Numerical Methods for Differential Equations**
Course Code:	**MA3514**
Course Duration:	**One semester**
Credit Units:	**3**
Level:	**B3**
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)*	**MA3511 Ordinary Differential Equations**
Precursors: *(Course Code and Title)*	**MA3513 Elementary Numerical Methods**
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 aims to apply numerical methods and scientific computing techniques for ordinary and partial differential equations. It trains students to design computer programs and apply them to solve differential equations.

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 mathematical ideas of numerical methods in solving ordinary and partial differential equations.		✓	✓	
2.	implement computing software packages (including MATLAB) as differential equation solvers.		✓	✓	
3.	evaluate solutions of differential equations with appropriate software package(s).		✓	✓	
4.	apply numerical and computational methods for solving initial and boundary value problems.		✓	✓	
5.	the combination of CILOs 1-4		✓	✓	✓
** 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		
Lecture	Learning through **teaching** is primarily based on lectures.	Y	Y	Y	Y	Y		39 hours in total
Take-home assignments	Learning through **take-home assignments** helps students understand basic concepts and	Y	Y	Y	Y			after-class

	numerical techniques for solving initial value and boundary value problems, with implementation in analyzing concrete problems.							
Online applications	Learning through **project(s)** helps students apply numerical and computational methods in solving more sophisticated ordinary/partial differential equations. It also helps students to communicate and collaborate effectively in the team.		Y	Y	Y			after-class
Math Help Centre	Learning activities in **Math Help Centre** provides students extra help.	Y		Y	Y			after-class
Lecture	Learning through **teaching** is primarily based on lectures.	Y	Y	Y	Y	Y		39 hours in total

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	Y		Y	Y			15-30%	Questions are designed for the first part of the course to see how well the students have learned mathematical concepts and techniques of solving initial value problems for ordinary differential equations numerically.
Hand-in assignments	Y	Y	Y	Y			0-15%	These are skills based assessment to enable students to demonstrate

								techniques of solving differential equations via numerical methods and analyzing solutions with the aid of computing software packages.
Project(s)		Y	Y	Y			0-15%	Students are assessed on their ability in applying numerical and computational methods to solve more sophisticated differential equations, as well as on the presentation of numerical results with analysis.
Formative take-home assignments	Y	Y	Y	Y			0%	The assignments provide students chances to demonstrate their achievements on solving and analyzing solutions of initial value and boundary value problems numerically.
Examination: _70___% (duration: 3 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 numerical methods for differential equations.
** 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 develop accurate and effective numerical methods and compute correctly	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Hand-in assignments	Ability to develop accurate and effective numerical methods and compute correctly	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Projects	Ability to implement numerical methods of differential equation in MATLAB	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Examination	Ability to develop accurate and effective numerical methods and compute correctly	High	Significant	Moderate	Basic	Not even reaching marginal levels
5. Formative take-home assignments	Ability to develop accurate and effective numerical methods and compute correctly	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.)

Numerical Methods for Initial Value Problems of ODE's. Finite Difference Methods for Two-Point Boundary Value Problems. Finite Difference Methods for Partial Differential Equations. Finite Element Methods for Two-Point Boundary Value Problems

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.	Notes from the instructor
2.	Numerical Methods for Ordinary Differential Equations: Initial Value Problems; D. Griffiths and D J Higham; Springer 2010
3.	Introduction to Numerical Methods in Differential Equations, M Holmes, Springer, 2007
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2.2 Additional Readings

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

1.	
2.	
3.	
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