

City University of Hong Kong
Course Syllabus

offered by College/School/Department of Mathematics
with effect from Semester A 20 22 / 23

Part I Course Overview

Course Title: Ordinary Differential Equations

Course Code: MA3511

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: MA2508 Multi-variable Calculus; and
(Course Code and Title) MA2503 Linear Algebra

Precursors: Nil
(Course Code and Title)

Equivalent Courses: Nil
(Course Code and Title)

Exclusive Courses: Nil
(Course Code and Title)

Part II Course Details

1. Abstract

(A 150-word description about the course)

This course introduces fundamental mathematical methods and analysis in ordinary differential equations and basic knowledge of partial differential equations. It will help students develop skills in solving ordinary differential equations by analytical methods and solving simple partial differential equations by the method of separation of variables. 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.	solve several classes of first order ordinary differential equations, higher order equations with constant coefficients, and systems of linear differential equations.	10%	Y		
2.	develop skills in making mathematical development for objects which cannot be solved analytically, through the study of solutions of second order ordinary differential equations with varying coefficients.	20%	Y	Y	
3.	evaluate series solutions of ordinary differential equations.	20%	Y	Y	
4.	solve simple partial differential equations by the method of separation of variables.	20%	Y	Y	
5.	explain at high levels concepts and ideas from differential equations, and create advanced mathematical models to a range of problems in science and engineering involving differential equations.	30%		Y	Y
		100%			

* If weighting is assigned to CILOs, they should add up to 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 fundamental mathematical methods and analysis in ordinary differential equations and solve simple partial differential equations by the method of separation of variables.	Y	Y	Y	Y	Y		after-class
Online applications	Learning through online examples for applications helps students create and formulate mathematical models by means of differential equations and apply to some problems in science and engineering.					Y		after-class
Math Help Centre	Learning activities in Math Help Centre provides students extra help.	Y	Y	Y	Y			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: <u>30</u> %								
Test	Y	Y					15%	Questions are designed for the first part of ordinary differential equations to see how well the students have learned the basic concepts, fundamental theory, analytical methods and recognized the applications.
Hand-in assignments	Y	Y	Y	Y	Y		15%	These are skills based assessment to enable students to demonstrate the basic concepts,

								techniques and fundamental theory of differential equations and identify the related applications.
Formative take-home assignments	Y	Y	Y	Y			0%	The assignments provide students chances to demonstrate their achievements on differential equations learned in this course.
Examination: (duration: 2 hrs)	Y	Y	Y	Y	Y		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 ordinary differential equations and elementary partial 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 understand the fundamental theory, analytical methods of ordinary differential equations and recognize the applications	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Hand-in assignments	Ability to learn the basic concepts, techniques and fundamental theory of differential equations and identify the related applications	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Examination	Ability to solve problems in ordinary differential equations and elementary partial differential equations	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Formative take-home assignments	Ability to demonstrate students' achievements on differential equations learned in this course	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.)

- First order ordinary differential equations. Linear equations. Separable equations. Homogeneous equations. Exact equations and integrating factors.
- Second and higher order linear equations. Initial value problems. Existence and uniqueness. Wronskian and linear dependence. Reduction of order. Method of variation of parameters. Constant coefficient equations. Method of undetermined coefficients.
- Series solutions of second order linear equations. Euler equations. Bessel's equations.
- Systems of differential equations. Phase portraits (if time permits).
- Fourier series. Separation of variables for simple partial differential equations (if time permits).

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.	W. Boyce and R. DiPrima, "Elementary Differential Equations", Springer 2008, ISBN: 978-0-387-71275-8
2.	
3.	
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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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