

# MA3001: DIFFERENTIAL EQUATIONS

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## Effective Term

Semester A 2022/23

## Part I Course Overview

### Course Title

Differential Equations

### Subject Code

MA - Mathematics

### Course Number

3001

### Academic Unit

Mathematics (MA)

### College/School

College of Science (SI)

### Course Duration

One Semester

### Credit Units

3

### Level

B1, B2, B3, B4 - Bachelor's Degree

### Medium of Instruction

English

### Medium of Assessment

English

### Prerequisites

MA2001 Multi-variable Calculus and Linear Algebra or equivalent

### Precursors

Nil

### Equivalent Courses

Nil

### Exclusive Courses

Nil

## Part II Course Details

### Abstract

This course aims to investigate both the occurrence of differential equations in science and engineering, and the methods available for their solutions. It is intended for students to learn methods and techniques of ordinary and partial differential equations. It will help students develop skills and the ability to think quantitatively and analyse problems critically.

### Course Intended Learning Outcomes (CILOs)

CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	explain at high-level concepts from differential equations and transforms.	x	x	
2	implement basic operations in Fourier series and Laplace transforms.	x	x	
3	solve first and second order ordinary differential equations and systems of linear differential equations.		x	
4	solve linear partial differential equations: diffusion, wave and Laplace equations.		x	
5	develop advanced mathematical models through differential equations, and appropriately apply advanced mathematical and computational methods to a range of problems in engineering involving differential equations.		x	x

#### 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 real-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.

### Teaching and Learning Activities (TLAs)

TLAs	Brief Description	CILO No.	Hours/week (if applicable)	
1	Lectures	Learning through teaching is primarily based on lectures.	1, 2, 3, 4, 5	39 hours in total
2	Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	2	3 hours

3	Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	3	5 hours
4	Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	4	3 hour
5	Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	1, 5	2 hours
6	Take-home assignments	Learning through take-home assignments helps students understand basic concepts and techniques of differential equations, transforms and some applications in engineering.	1, 2, 3, 4, 5	after-class
7	Online applications	Learning through online examples for applications helps students apply mathematical and computational methods to some problems in engineering applications.	5	after-class

**Assessment Tasks / Activities (ATs)**

ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)	
1	Test	2, 3, 4	20	Questions are designed for the first part of the course to see how well the students have learned concepts and techniques of differential equations.
2	Hand-in assignments	1, 2, 3, 4, 5	10	These are skills based assessment to see whether the students are familiar with advanced concepts and techniques of ordinary and partial differential equations, and some applications in engineering.

3	Formative take-home assignments	1, 2, 3, 4, 5	0	The assignments provide students' chances to demonstrate their achievements on ordinary and partial differential equations, and their applications in engineering learned in this course.
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**Continuous Assessment (%)**

30

**Examination (%)**

70

**Examination Duration (Hours)**

2

**Additional Information for ATs**

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 Rubrics (AR)****Assessment Task**

1. Test

**Criterion**

ABILITY to SOLVE in DETAIL and with ACCURACY the posed QUESTIONS

**Excellent (A+, A, A-)**

High

**Good (B+, B, B-)**

Significant

**Fair (C+, C, C-)**

Moderate

**Marginal (D)**

Basic

**Failure (F)**

Not even reaching marginal levels

**Assessment Task**

2. Hand-in assignments

**Criterion**

ABILITY to SOLVE in DETAIL and with ACCURACY the posed QUESTIONS

**Excellent (A+, A, A-)**

High

**Good (B+, B, B-)**

Significant

**Fair (C+, C, C-)**

Moderate

**Marginal (D)**

Basic

**Failure (F)**

Not even reaching marginal levels

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**Assessment Task**

3. Examination

**Criterion**

ABILITY to SOLVE in DETAIL and with ACCURACY the posed QUESTIONS

**Excellent (A+, A, A-)**

High

**Good (B+, B, B-)**

Significant

**Fair (C+, C, C-)**

Moderate

**Marginal (D)**

Basic

**Failure (F)**

Not even reaching marginal levels

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**Assessment Task**

4. Formative take-home assignments

**Criterion**

ABILITY to SOLVE in DETAIL and with ACCURACY the posed QUESTIONS

**Excellent (A+, A, A-)**

High

**Good (B+, B, B-)**

Significant

**Fair (C+, C, C-)**

Moderate

**Marginal (D)**

Basic

**Failure (F)**

Not even reaching marginal levels

**Part III Other Information****Keyword Syllabus**

Ordinary differential equations (7 weeks): First order differential equations, Second and higher order linear differential equations; Laplace transform; System of linear differential equations.

Partial differential equations (6 weeks): Diffusion, wave and Laplace equations; Initial value problems; Fourier series; Boundary value problems.

**Reading List****Compulsory Readings**

Title	
1	Mathematics for Engineering and Science, Department of Mathematics, City University of Hong Kong, Prentice Hall, Pearson Education South Asia, 2008

**Additional Readings**

Title	
1	Nil