

# MA2158: LINEAR ALGEBRA AND CALCULUS

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## Effective Term

Semester A 2025/26

## Part I Course Overview

### Course Title

Linear Algebra and Calculus

### Subject Code

MA - Mathematics

### Course Number

2158

### 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

MA1201 Calculus and Basic Linear Algebra II / MA1301 Enhanced Calculus and Linear Algebra II; or equivalent

### Precursors

Nil

### Equivalent Courses

Nil

### Exclusive Courses

MA2001 Multi-variable Calculus and Linear Algebra

## Part II Course Details

### Abstract

This course aims to develop mathematical concepts and techniques in advanced linear algebra, multi-variable calculus and Fourier series as well as their applications in science and engineering. It provides students 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 levels concepts from advanced linear algebra                                                                                                                   | 10                  |        |        | x      |
| 2     | compute eigenvalues and eigenvectors of matrices                                                                                                                               | 20                  |        | x      |        |
| 3     | evaluate multiple integrals of multivariate functions                                                                                                                          | 20                  |        | x      |        |
| 4     | solve first and second order ordinary differential equations                                                                                                                   | 20                  |        | x      |        |
| 5     | apply mathematical and computational methods to a range of application problems involving advanced linear algebra, ordinary differential equations and multi-variable calculus | 20                  | x      | x      | x      |
| 6     | the combination of CILOs 1-5                                                                                                                                                   | 10                  | x      | 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.

### Learning and Teaching Activities (LTAs)

| LTAs |           | Brief Description                                                                                       | CILO No.         | Hours/week (if applicable) |
|------|-----------|---------------------------------------------------------------------------------------------------------|------------------|----------------------------|
| 1    | Lectures  | Learning through teaching is primarily based on lectures.                                               | 1, 2, 3, 4, 5, 6 | 39 hours in total          |
| 2    | Tutorials | Learning through tutorials is primarily based on interactive problem solving allowing instant feedback. | 2                | 4 hours                    |
| 3    | Tutorials | Learning through tutorials is primarily based on interactive problem solving allowing instant feedback. | 3                | 4 hours                    |

|   |                     |                                                                                                                                                                                                                                           |               |             |
|---|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------|
| 4 | Tutorials           | Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.                                                                                                                                   | 1, 5          | 3 hours     |
| 5 | Tutorials           | Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.                                                                                                                                   | 4             | 2 hours     |
| 6 | Assignments         | Learning through take-home assignments helps students understand basic concepts and techniques of advanced linear algebra, ordinary differential equations and multi-variable calculus, and some applications in science and 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 applications.                                                                                           | 5             | after-class |
| 8 | Math Help Centre    | Learning activities in Math Help Centre provides students extra help.                                                                                                                                                                     | 2, 3, 4       | after-class |

**Assessment Tasks / Activities (ATs)**

| ATs |                      | CILO No.   | Weighting (%) | Remarks ("-" for nil entry)                                                                                                                                                               | Allow Use of GenAI? |
|-----|----------------------|------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| 1   | Quizzes/Test/Midterm | 2, 3, 4, 6 | 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 and ordinary differential equations. | No                  |

|   |                                 |                  |   |                                                                                                                                                                                                                                                                   |     |
|---|---------------------------------|------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 2 | Hand-in assignments             | 1, 2, 3, 4, 5, 6 | 0 | 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 calculus and Fourier series and some applications in science and engineering. | Yes |
| 3 | Formative take-home assignments | 1, 2, 3, 4, 5, 6 | 0 | The assignments provide students chances to demonstrate their achievements on linear algebra, ordinary differential equations and multi-variable calculus learned in this course.                                                                                 | Yes |

**Continuous Assessment (%)**

30

**Examination (%)**

70

**Examination Duration (Hours)**

2

**Minimum Examination Passing Requirement (%)**

30

**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. Quizzes/Test/Midterm

**Criterion**

Ability to apply and explain the concepts, methodology and procedure

**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**

2. Hand-in assignments

**Criterion**

Ability to apply and explain the concepts, methodology and procedure

**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. Formative take-home assignments

**Criterion**

Ability to apply the methodology and procedure for analysing real life problems

**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**

## 4. Examination

**Criterion**

Ability to apply and explain the concepts, methodology and procedure

**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**

Eigenvalues and eigenvectors. First-and second-order ordinary differential equations and applications. Multiple integration. Fourier series.

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

| Title |                                                                                                                                                                                                                                                                                                                             |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | For further detailed information, please refer to <a href="https://www.cityu.edu.hk/ma/programmes/undergraduate/non-BSCM-students/topics-recommended-readings-servicing-courses#heading9">https://www.cityu.edu.hk/ma/programmes/undergraduate/non-BSCM-students/topics-recommended-readings-servicing-courses#heading9</a> |

**Additional Readings**

| Title |     |
|-------|-----|
| 1     | Nil |