**City University of Hong Kong**
**Course Syllabus**

**offered by College/School/Department of _Mathematics_____**
**with effect from Semester __A____ 20_22_ / _23_**

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**Part I Course Overview**

| | |
|---|---|
| **Course Title:** | **Basic Engineering Mathematics I** |
| **Course Code**: | **MA0101** |
| **Course Duration:** | **1 semester** |
| **Credit Units**: | **3 CUs** |
| **Level**: | **A1** |
| **Proposed Area:** *(for GE courses only)* | ☐ Arts and Humanities<br>☐ Study of Societies, Social and Business Organisations<br>☐ Science and Technology |
| **Medium of Instruction:** | **English** |
| **Medium of Assessment:** | **English** |
| **Prerequisites**: *(Course Code and Title)* | **HKDSE Mathematics Compulsory Part (Level 2 or above), or HKCEE Mathematics (Grade E or above) or equivalent** |
| **Precursors**: *(Course Code and Title)* | **Nil** |
| **Equivalent Courses**: *(Course Code and Title)* | **BST10514 Engineering Mathematics and Computation 1/ BST10126 Computational Mathematics** |
| **Exclusive Courses**: *(Course Code and Title)* | **Nil** |

## Part II Course Details

### 1. Abstract

*(A 150-word description about the course)*

This course aims to:

- provide students with a basic understanding of complex numbers, vector algebra and calculus,
- enable students to understand mathematical formulations and its engineering applications, and
- develop students' skills to analyze engineering problems quantitatively.

### 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. | manipulate expressions and equations involving complex numbers. | 15% | | ✓ | |
| 2. | implement basic operations in vector algebra, dot and cross products. | 15% | | ✓ | |
| 3. | perform techniques of differentiation to obtain derivatives and Taylor series expansions of functions. | 25% | | ✓ | |
| 4. | perform techniques of integration to evaluate integrals of functions. | 25% | | ✓ | |
| 5. | apply methods of differential and integral calculus to a range of geometrical and engineering problems. | 20% | | ✓ | |
| | | 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 | | |
| Lectures | Learning through **teaching** is primarily based on lectures. | ✓ | ✓ | ✓ | ✓ | ✓ | | 32.5 hours in total |

| | | | | | | | | |
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| Tutorials | Learning through **tutorials** is primarily based on interactive problem solving allowing instant feedback. | ✓ | | | | | | 3 hours |
| | | | ✓ | | | | | 2 hours |
| | | | | ✓ | | | | 3 hours |
| | | | | | ✓ | | | 3 hours |
| | | | | | | ✓ | | 2 hours |
| Assignments | Learning through **take-home assignments** helps students understand basic concepts and techniques of complex numbers, vector arithmetic and calculus, 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 |

## 4. Assessment Tasks/Activities (ATs)

*(ATs are designed to assess how well the students achieve the CILOs.)*

40% Coursework

60% 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: _40___% | | | | | | | | |
| Test | ✓ | ✓ | ✓ | | | | 20-40% | Questions are designed for the first part of the course to see how well the students have learned concepts and techniques of complex numbers, vector algebra and differential calculus. |
| Hand-in assignments | ✓ | ✓ | ✓ | ✓ | ✓ | | 0-20% | These are skills based assessment to see whether the students are familiar with concepts and techniques of complex numbers, vector |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | arithmetic, differential and integral calculus as well as some applications in engineering. |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Examination: _60___% (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 complex numbers, vector algebra, elementary calculus as well as their applications in geometrical and physical problems. |
| ** 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 concepts and techniques of complex numbers, vector algebra and differential calculus | High | Significant | Moderate | Basic | Not even reaching marginal levels |
| 2. Hand-in assignments | Ability to explain concepts and techniques of complex numbers, vector arithmetic, differential and integral calculus as well as some applications in engineering. | High | Significant | Moderate | Basic | Not even reaching marginal levels |
| 3. Examination | Ability to the show student's versatility in complex numbers, vector algebra, elementary calculus as well as their applications in geometrical and physical 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.)*

A) Complex numbers: polar form and Cartesian form, Euler relation;

B) Vectors: dot product, cross product; triple scalar product

C) Differentiation: product rule, quotient rule, chain rule, Leibnitz rule; Applications: local extrema, Taylor series;

D) Definite and indefinite integrals: integration by substitution, integration by parts; Applications: area of the region bounded by the curves.

## 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. | Glyn James, Modern Engineering Mathematics, 4th ed., Pearson Prentice Hall, 2008 |
| 2. | |
| 3. | |
| … | |

### 2.2 Additional Readings

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

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|---|---|
| 1. | |
| 2. | |
| 3. | |
| … | |