

# GE1358: COORDINATE GEOMETRY

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## Effective Term

Semester A 2022/23

## Part I Course Overview

### Course Title

Coordinate Geometry

### Subject Code

GE - Gateway Education

### Course Number

1358

### 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

### GE Area (Primary)

Area 3 - Science and Technology

### Medium of Instruction

English

### Medium of Assessment

English

### Prerequisites

Nil

### Precursors

Nil

### Equivalent Courses

MA1501 Coordinate Geometry

### Exclusive Courses

Nil

## Part II Course Details

### Abstract

This course introduces students to coordinate geometry, which is closely related to art, design, architecture, computer graphics. The content includes curves in two-dimensional space, curves in three-dimensional space, surfaces in three-dimensional space. The emphasis is on developing the concept of coordinate representation of some basic geometric objects in both two- and three-dimensional spaces and understanding how to compute some important geometric quantities like distance, normal vector, etc.

### Course Intended Learning Outcomes (CILOs)

| CILOs |  | Weighting (if DEC-A1 DEC-A2 DEC-A3 app.) |   |   |  |
|-------|--|--|---|---|--|
| 1     | Explain the concept of Cartesian coordinate, polar coordinate, and their usage for two dimensional curves  |  | x | x |  |
| 2     | Explain the concept of curves based on Cartesian coordinate and parameterization, describe the tangent vector along curves, and explain how to compute distance between two non-intersected straight lines |  | x | x |  |
| 3     | Explain the concept of surface based on Cartesian coordinate, cylindrical and spherical coordinates, describe the normal vector and tangent plane of surfaces, explain the angle between two planes        |  | 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    | Lecture               | Learning through teaching is primarily based on lectures.  | 1, 2, 3                    | 39 hours in total |
| 2    | Take-home assignments | Learning through take-home assignments helps students understand basic concepts and techniques of coordinate geometry. | 1, 2, 3                    | After-class       |

|   |                  |   |         |             |
|---|------------------|---|---------|-------------|
| 3 | Math Help Centre | Learning activities in Math Help Centre provides students extra help. | 1, 2, 3 | After-class |
|---|------------------|---|---------|-------------|

**Assessment Tasks / Activities (ATs)**

| ATs | CILO No.                    | Weighting (%) | Remarks (e.g. Parameter for GenAI use) |  |
|-----|-----------------------------|---------------|--|--|
| 1   | One Test                    | 1, 2, 3       | 18                                     | Questions are based on curves in both two- and three-dimensional spaces, and surfaces to assess students' understanding of basic concepts and skills |
| 2   | Class Exercises             | 1, 2, 3       | 3                                      | The questions enable students to apply basic concepts and techniques of coordinate geometry to a range of mathematical problems.                     |
| 3   | Three Take-home Assignments | 1, 2, 3       | 9                                      | The assignments provide students chances to demonstrate their achievements on techniques of coordinate geometry learned in this course.              |

**Continuous Assessment (%)**

30

**Examination (%)**

70

**Examination Duration (Hours)**

2

**Additional Information for ATs**

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 apply the fundamental concepts and methodology of coordinate geometry to solve a range of mathematical 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

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**Assessment Task**

2. Hand-in assignments

**Criterion**

Ability to understand the basic concepts and techniques of coordinate geometry

**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 demonstrate students' achievements on the methods of coordinate geometry learned in this course

**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. Examination

**Criterion**

Ability to solve problems of curves and surfaces in two and three dimensional space

**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**

- Points and Lines in Space: point, line, plane, circle, distance
- Transforms and Coordinates: parameterization, polar coordinate, cylindrical and spherical coordinates
- The Conics: cylinder, sphere, ellipsoid, saddle, hyperbolas
- Curves and Surfaces: intersection between curves and surface, surfaces in three dimensional space
- Geometry: Art, Design and Architecture.

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

| Title |  |
|-------|--|
| 1     | Coordinate Geometry (by Luther Pfahler Eisenhart) Dover Publications (March 4, 2005) |

**Additional Readings**

| Title |  |
|-------|--|
| 1     | The Complete Guide to Perspective Drawing: From One-Point to Six-Point (by Craig Attebery) Routledge (May 10, 2018)            |
| 2     | Drawing Geometry: A Primer of Basic Forms for Artists, Designers and Architects (by Jon Allen) Floris Books (October 15, 2007) |
| 3     | Geometry and the Visual Arts (by Dan Pedoe) Dover Publications (March 17, 2011)  |

**Annex (for GE courses only)**

**A. Please specify the Gateway Education Programme Intended Learning Outcomes (PILOs) that the course is aligned to and relate them to the CILOs stated in Part II, Section 2 of this form:**

Please indicate which CILO(s) is/are related to this PILO, if any (can be more than one CILOs in each PILO)

**PILO 1: Demonstrate the capacity for self-directed learning**

1, 2, 3

**PILO 2: Explain the basic methodologies and techniques of inquiry of the arts and humanities, social sciences, business, and science and technology**

1, 2, 3

**PILO 3: Demonstrate critical thinking skills**

1, 2, 3

**PILO 4: Interpret information and numerical data**

1, 2, 3

**PILO 5: Produce structured, well-organised and fluent text**

1, 2, 3

**PILO 6: Demonstrate effective oral communication skills**

1, 2, 3

**PILO 7: Demonstrate an ability to work effectively in a team**

1, 2, 3

**B. Please select an assessment task for collecting evidence of student achievement for quality assurance purposes. Please retain at least one sample of student achievement across a period of three years.**

**Selected Assessment Task**

Examination Papers