

MA4527: COMPUTATIONAL GEOMETRY

Effective Term

Semester A 2025/26

Part I Course Overview

Course Title

Computational Geometry

Subject Code

MA - Mathematics

Course Number

4527

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

MA2504 Discrete Mathematics, or
MA2509 Discrete Mathematics

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

This course provides an account of fundamental concepts of quantitative geometry and graphical techniques of geometric construction with experiments using computers. It helps students design algorithms and analyze their efficiency in solving geometric problems.

Course Intended Learning Outcomes (CILOs)

CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1 evaluate fractal dimension and apply the Iterative Function System in generating fractals which resemble real-world objects.	15	x		
2 design and implement algorithms of triangulation and of two-dimensional convex hull generation in geometric problems.	20		x	x
3 characterize invariance properties of Euclidean geometry by groups of transformations.	10	x		
4 describe and construct basic geometric shapes and concepts by computational means.	15		x	
5 explain fundamental properties of Delaunay triangulation and sketch Voronoi diagrams.	20		x	x
6 the combination of CILOs 1-5	20	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 Take-home Assignments	Learning through take-home assignments helps students apply principles and techniques of computational geometry to problems on fractals, triangulation of polygons and convex hulls.	1, 2, 3, 4, 5	after-class

3	Project	Learning through project helps students implement mathematical and computational ideas of geometry to construct models/create computer graphics. It also helps students to communicate and collaborate effectively in the team.	6	after-class
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Assessment Tasks / Activities (ATs)

ATs	CILO No.	Weighting (%)	Remarks ("- " for nil entry)	Allow Use of GenAI?	
1	Test	1, 2	15	Questions are designed for the first part of the course to see how well students have learned concepts of fractals as well as algorithms for triangulation of polygons and making of convex hulls.	No
2	Hand-in assignments	1, 2, 3, 4, 5	5	These are skills based assessment which enables students to design and implement methods of computational geometry in problems of fractals, triangulations, convex hulls and Voronoi diagrams.	Yes
3	Project	6	10	Students are assessed on their ability in applying concepts and techniques of computational geometry to model construction, as well as on its presentation with analysis.	Yes

4	Formative take-home assignments	1, 2, 3, 4, 5	0	The assignments provide students chances to demonstrate their achievements on computational geometry learned in this course.	Yes
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Continuous Assessment (%)

30

Examination (%)

70

Examination Duration (Hours)

3

Minimum Examination Passing Requirement (%)

30

Additional Information for ATs

30% Coursework 70% Examination (Duration: 3 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 in problem solving

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

Understanding of concepts and applications

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

3. Project

Criterion

Creativity and Team work ability

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. Formative take-home assignments

Criterion

Study attitude

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

5. Examination

Criterion

Comprehensive ability in independent problem solving

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

Fractal geometry. Triangulation of Points and Polygons, Convex Hulls, Voronoi Diagrams and Delaunay Triangulations. Line Arrangements. Application to Computer Graphics.

Reading List

Compulsory Readings

Title	
1	Nil

Additional Readings

Title	
1	Nil