

MA4534: COMPUTER GRAPHICS AND GEOMETRY

Effective Term

Semester A 2025/26

Part I Course Overview

Course Title

Computer Graphics and Geometry

Subject Code

MA - Mathematics

Course Number

4534

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

MA2503 Linear Algebra / MA1503 Linear Algebra with Applications; and
MA2508 Multi-variable Calculus

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

This course introduces the basics of curves and surfaces generations in computer aided geometric designs. It helps students understand how complex objects are modeled in the computer and how to generate computer images that resemble real-world objects.

Course Intended Learning Outcomes (CILOs)

CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	characterize invariance properties of Euclidean geometry by groups of transformations.	15	x	
2	state and prove rigorously geometric properties of convex sets and polyhedral.	15		x
3	explain differential properties of curves/surfaces by differential geometry and its application in computer-aided designs.	20		x
4	describe basic properties of Bézier curves and generate such curves via computer graphics.	15	x	x
5	evaluate fractal dimension and apply the Iterative Function System in generating fractals which resemble real-world objects.	15	x	
6	the combination of CILOs 1-5	20	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
2	Take home assignments	Learning through take-home assignments helps students understand geometric properties of solids and differential properties of curves/surfaces, as well as apply knowledge of which in computer-aided designs.	39 hours in total
			after-class

3	Project(s)	Learning through project(s) helps students implement mathematical knowledge and computing techniques of geometry to construct models/generate computer graphics. It also helps students to communicate and collaborate effectively in the team.	3, 4	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, 3	15	Questions are designed for the first part of the course to see how well students have learned basic properties of geometric shapes, differential properties of curves/surfaces and their applications in generating computer graphics.	No
2	Hand-in assignments	1, 2, 3, 4, 5	5	These are skills based assessment which enables students to apply knowledge of curves, surfaces and solids in geometric problems, as well as to understand non-classical geometry via fractals.	Yes

3	Project	3, 4	10	Students are assessed on their ability in applying techniques of computational geometry to model construction/ graphics generation, 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

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

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

Transformations, convex sets, polyhedral, platonic solids, curves in space, Bézier curves, B-spline, fractal dimension, iterated function systems.

Reading List

Compulsory Readings

Title	
1	Nil

Additional Readings

	Title
1	Nil