

EE5808: TOPICS IN COMPUTER GRAPHICS

Effective Term

Semester B 2024/25

Part I Course Overview

Course Title

Topics in Computer Graphics

Subject Code

EE - Electrical Engineering

Course Number

5808

Academic Unit

Electrical Engineering (EE)

College/School

College of Engineering (EG)

Course Duration

One Semester

Credit Units

3

Level

P5, P6 - Postgraduate Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

Nil

Precursors

Mathematical knowledge reaching the equivalent of
[MA3150 Advanced Mathematical Analysis, or MA3151 Advanced Engineering Mathematics] and
[MA3160 Probability and Stochastic Processes or EE3313 Applied Queueing Systems]

Programming Knowledge reaching the equivalent of
[CS2363 Computer Programming or equivalent] and
[EE2331 Data Structure and Algorithms or equivalent]

C Programming is required

Equivalent Courses

Nil

Exclusive Courses

EE4208 Computer Graphics for Engineers

Part II Course Details**Abstract**

This course aims to provide students with an in depth critical understanding of the principles, concepts, and advanced techniques of computer graphics.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 DEC-A2 DEC-A3 app.)			
1	Apply 3D object representation techniques to build up a graphics scene.		x	x	
2	Model and view articulated objects by hierarchical structuring techniques and coordinate transform.		x	x	
3	Apply lighting, shading and rasterization techniques to create a 2D image.		x	x	
4	Apply texture mapping and animation techniques		x	x	
5	Apply and evaluate advanced graphics techniques.		x	x	
6	Create an animation or a game using computer graphics.				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	Lecture	Students will engage in formal lectures to gain knowledge about the course	1, 2, 3, 4, 5	2 hrs/wk

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Tests (min.: 2)	1, 2, 3, 4	30	
2	#Assignments/Projects (min.: 3)	1, 2, 3, 4, 5, 6	20	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

Remark: To pass the course, students are required to achieve at least 30% in course work and 30% in the examination. # may include homework, tutorial exercise, project/mini-project, presentation

Assessment Rubrics (AR)**Assessment Task**

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Achievements in CILOs

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal level

Assessment Task

Coursework (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Achievements in CILOs

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal level

Assessment Task

Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Achievements in CILOs

Excellent

(A+, A, A-) High

Good

(B+, B) Medium

Marginal

(B-, C+, C) Low

Failure

(F) Not even reaching marginal level

Assessment Task

Coursework (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Achievements in CILOs

Excellent

(A+, A, A-) High

Good

(B+, B) Medium

Marginal

(B-, C+, C) Low

Failure

(F) Not even reaching marginal level

Additional Information for AR

Constructive Alignment with Programme Outcomes

PILO 1 - The student will acquire an ability to describe current and anticipated trends in computer graphics through an overview of the field as well as an in depth understanding of selected topics through lectures, tutorials and the mini project.

PILO 2 - The student will be able to evaluate and analyze new technologies in computer graphics through an understanding of the performance and limitations of current computer graphics technology through lectures, tutorials and the mini project.

PILO 3 - The student will be able to apply specialist knowledge in the mini projects.

PILO 4 - The student will be able to assess, evaluate and formulate solutions to problems or specifications in computer graphics through theoretical and practical knowledge learnt during lectures, tutorials and the mini project.

Part III Other Information

Keyword Syllabus

Introduction

Graphics pipeline. Graphics applications. Commercial graphics libraries and packages.

Three Dimensional Object Representations

Object representation methods such as polygon mesh, superquadrics, sweep representation, constructive solid geometry, splines, fractals, and particle systems.

Three Dimensional Geometrical and Modelling Transformation

Homogeneous coordinates. Linear transformations. Composite transformations.

Coordinate system transformations. Hierarchy of transformations and level of details.

Three Dimensional Viewing

Viewing coordinate system. Transformation from world to viewer Coordinates. Parallel and perspective projection.

Clipping.

Illumination Models and Surface Rendering

Light sources. Reflections: ambient, diffuse, specular. Polygon rendering methods: flat, Gouraud, Phong. Texture mapping.

Bump mapping Image based rendering. Colour Models. Shadow generation on plane. Shadow mapping.

Visible Surface Detection

Back face culling. Z-buffer Algorithm. Ray Casting.

Animation

Key frame and parameterised systems. Morphing. Physical motion simulation.

Advanced Graphics Techniques

Specialist advanced techniques: e.g. global illumination methods (ray tracing and radiosity), shader, modelling techniques for specific objects, advanced animation techniques, speedup techniques by GPU and special architecture. Trend in research and application.

Reading List

Compulsory Readings

Title	
1	S. Guha, Computer Graphic through OpenGL, 4th Edition, CRC Press (2023) [E-book]
2	D. Hearn, M.P. Baker, W.R. Carithers, Computer Graphics with OpenGL, 4th Edition, Pearson (2011)

Additional Readings

Title	
1	Nil