City University of Hong Kong
Course Syllabus

offered by College/School/Department of Electronic Engineering
with effect from Semester B in 2017/2018

Part I Course Overview

Course Title:	Computer Graphics for Engineers
Course Code:	EE4208
Course Duration:	One Semester (13 weeks)
Credit Units:	3
Level:	B4
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	[MA2001 Multi-variable Calculus and Linear Algebra or MA2170 Linear Algebra and Multi-variable Calculus or MA2149 Mathematical Analysis] and [CS2311 Computer Programming or CS2363 Computer Programming or equivalent]
Precursors: *(Course Code and Title)*	EE2331 Data Structure and Algorithms or equivalent
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

The aim of this course is to provide students with an understanding of the principles, concepts, and techniques of computer graphics from an engineering viewpoint.

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.	Apply 3D object representation techniques to build up a graphics scene		√	√	
2.	Model and view articulated objects by hierarchical structuring techniques and coordinate transform		√	√	
3.	Apply lighting, shading and rasterization techniques to create a 2D image		√	√	
4.	Apply texture mapping and animation techniques		√	√	
5.	Create an animation or a game using computer graphics				
	** If weighting is assigned to CILOs, they should add up to 100%.*	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	Key concepts are described and explained	√	√	√	√			2 hrs/week
Tutorials	Key concepts are illustrated by examples and programming exercises	√	√	√	√			1 hr/week
Mini project	Each student does a project creating their own original animation or game using techniques learnt in the course					√		

4. Assessment Tasks/Activities (ATs)

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

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4	5			
Continuous Assessment: 40%								
Quizzes	√	√	√	√				
At least 3 assignments (mini project, assignments, etc)					√			
Written exam: 60% (duration: 2hrs, if applicable)								
							100%	

** The weightings should add up to 100%.*

Remark:

To pass the course, students are required to achieve at least 30% in course work and 30% in the examination.

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. Examination	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Coursework	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal levels

6. Constructive Alignment with Major Outcomes

(Please state how the course contribute to the specific MILO(s))

MILO	How the course contribute to the specific MILO(s)
1	An ability to apply knowledge of mathematics, science and engineering: The course provides ample opportunity to apply knowledge of mathematics, science and engineering in the area of the computer graphics. This is achieved through practice in tackling tutorial questions and measured through quizzes and projects.
3	An ability to design a system, component, or process that conforms to a given specification within realistic constraints: This course trains students to create a 3D movie with a specification.
5	An ability to identify, evaluate, formulate and solve engineering problems: This course trains students to create a 3D animation or game. The outcome is measured by the quality and the techniques applied in the project.
10	An ability to use necessary engineering tools: This course trains students to use engineering tools in the form of a graphics programming language. The outcome is measured by the quality and the techniques applied in the project.

Part III Other Information (more details can be provided separately in the teaching plan)

1. **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.

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.	D. Hearn, M.P. Baker, W.R. Carithers, Computer Graphics with OpenGL, 4th Edition, Pearson (2011)

2.2 Additional Readings

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

1.	E. Angel, D. Shreiner, Interactive Computer Graphics: A Top-down Approach with Shader-based OpenGL, Addison-Wesley (2012).
2.	A. Watt, 3D Computer Graphics, Addison-Wesley (2000).
3.	G. Sellers, R. S. Wright, N. Haemel, OpenGL Superbible: Comprehensive Tutorial and Reference, Addison-Wesley (2014).