

Liverpool John Moores University

Title: MATHEMATICS AND COMPUTER GRAPHICS
Status: Definitive
Code: **5002BECK** (118372)
Version Start Date: 01-08-2016

Owning School/Faculty: Applied Mathematics
Teaching School/Faculty: Beckett College London

Team	Leader
Paul Strickland	Y

Academic Level: FHEQ5 **Credit Value:** 24 **Total Delivered Hours:** 72

Total Learning Hours: 240 **Private Study:** 168

Delivery Options

Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	24
Tutorial	24
Workshop	24

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Report	AS1	Mathematical principles for computer graphics and computer game application.	50	
Artefacts	AS2	Implementation of an interactive computer graphics application.	50	

Aims

To provide mathematical knowledge essential in computer games development.
To explain the underpinning concepts within computer graphics.
To teach computer graphics operations using a modern graphical API.
To develop programming skills in computer graphics.

Learning Outcomes

After completing the module the student should be able to:

- 1 Perform basic algebraic manipulations and solve linear, quadratic and simultaneous equations.
- 2 Apply the ideas of vector geometry to spatial problems.
- 3 Apply the ideas of matrices to linear transformations in the plane.
- 4 Explain the principles behind 2D and 3D computer graphics.
- 5 Use a modern graphics API to develop an interactive graphical application.

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Mathematical principles	1	2	3
Implementation	4	5	

Outline Syllabus

Elementary numerical and algebraic processes: fractions, indices, algebraic manipulation.

Two-dimensional Cartesian co-ordinates, equation of a straight line and quadratic curve, solution of linear equations containing one and two variables.

Elementary trigonometry and trigonometric functions.

Vectors in 2 and 3 dimensions, vector algebra including scalar and cross products, parametric equations of lines, planes and simple curves. Left- and right-handed axes.

Matrices for two & three dimensional transformations.

Simple differentiation techniques.

Tangents and normals, line, curve and plane intersections.

Logic algebra: simple propositional and predicate logic.

Introduction to Computer Graphics: History and definition of terms of 2D and 3D graphics technologies.

Introduction to Real-time computing for graphics: the update/render loop.

Overview of modern graphics APIs and application to modern hardware.

Applying Mathematics to graphics: Transforms and Matrices.

Introduction to the rendering pipeline: Coordinates and Model, World and Screen Spaces.

Cameras and Graphical Projections: Perspective, Parallel (3D) and Orthographic (2D).

The four modes of rendering: Immediate, Display Lists, Vertex Buffer Objects (VBO), Deferred Rendering.

Representations of 2D/3D Data and using Object-Oriented Programming in Graphics.

Changing the Aesthetics of Geometry:

Working with Colour (Colour Models and Gamuts).

Intro to Lighting (Flat, Gouraud and Phong).

Intro to Materials (Reflective and Emissive Properties).

Introduction to Images (Bitmaps, Compressed Images, Loading Images).

Introduction to Asset Pipelines (Resource Loading, Import/Export Operations).

Intro to Texturing (Texels in 2D and 3D).

Interactions within the scene:

Handling User Input.

Basic Real Time Animation (Translation, Rotation, Scaling of Rigid Body).

Learning Activities

Lectures incorporating demonstrations will be followed by tutor-led practical sessions. These will be supported by practical hands-on work in the laboratory.

Notes

This module introduces students to the concept of computer graphics including the required mathematical understanding such as linear algebra, vector geometry and matrix operations. The module will use a modern graphics API such as OpenGL to illustrate the graphics concept and at the same time teaches students on how to use the API to develop graphics applications.