

MODULE SPECIFICATION

DUBLIN CITY UNIVERSITY

Module Title:	Graphics and Visualisation													
Module Code:	EE563													
Delivery:	Semester 2													
School:	Electronic Engineering													
Module Coordinator:	Derek Molloy & Robert Sadleir													
Office Number:	S356 & S359													
Level:	5	Credits: 7.5												
Pre-requisite(s):	Working knowledge of C/C++/Java													
Co-requisites(s):	None													
Module Motivation:	<p>This course examines scientific visualisation and the visualisation process from an Engineering viewpoint. Topics to be examined include an introduction to computer graphics (2-D & 3-D), volume and surface visualisation, computer graphics frameworks, real-time visualisation techniques, acquisition and visualisation systems. The module aims to provide an evolving up-to-date snapshot of leading edge visualisation methodologies and techniques, focusing on research literature. The course will emphasise a practical approach, through assignments and a computer based examination process.</p>													
Learning Outcomes:	<p>Having successfully completed this subject, the student will be able to:</p> <ul style="list-style-type: none">• Analyse a visualisation problem and decide which algorithms can be best used to implement a solution.• Create geometry manipulation algorithms from first principles.• Design a scene graph implementation suitable for maintaining and manipulating data structure and state.• Optimise the scene graph and space for real-time implementation.• Implement the solution using the Java3D or C++ languages.													
Indicative Time Allowances:	<table><tr><td>Lectures:</td><td>36</td></tr><tr><td>Tutorials:</td><td>0</td></tr><tr><td>Laboratories:</td><td>0</td></tr><tr><td>Assignments:</td><td>30</td></tr><tr><td>Independent Learning Time:</td><td>46.5</td></tr><tr><td>TOTAL:</td><td>112.5</td></tr></table>		Lectures:	36	Tutorials:	0	Laboratories:	0	Assignments:	30	Independent Learning Time:	46.5	TOTAL:	112.5
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Note:	Assume that an A (double) module load represents approximately 150 hour's													

work and a B (single) module represents approximately 75 hour's work. This includes all teaching, assignments, lab work and an estimated private study/learning time associated with the module.

Indicative Syllabus:

- Mathematical Fundamentals of Computer Graphics
 - Manipulation of 2-D & 3-D structures
 - Transformations, Vector Geometry, Matrix Algebra, Ray Geometry, Aliasing.
- Concepts in 3-D Graphics
 - Creating Geometry, Transformations, Lighting, Textures, User Interaction
 - 3-D Content Specification using Scene Graphs (Introduction to Java3D)
 - Geometry Definition (points, voxels, B-Splines, NURBS, Primitives, Meshes, Surfaces)
- Rendering Techniques
 - Volume Rendering (raycasting, splatting, shear-warp, texture-mapping)
 - Surface Extraction and Surface Rendering.
 - Colour Models, Shading, Texturing, Non-photorealistic rendering
- The Graphics Pipeline
 - Coordinate Systems
 - View Space (algorithms for culling, clipping)
 - Hardware (GPUs, Geforce/ATI)
- Scene Graph Theory
 - Data Representation (DAGs, object-oriented Structure, recursion)
 - Efficiency and Acceleration Algorithms
- Real-Time Rendering
 - Space Subdivision (octrees, BSP trees)
 - Polygon Mesh Optimisation (LOD)
- Computer Animation
 - Rigid Body Animation, Hierarchical Motion
 - Dynamics, Collision Detection
 - Particle Simulation
- Visualisation System and Technologies
 - Medical Visualisation Systems, Stereo Graphic Systems, GIS
 - 3-D Acquisition – Medical Imaging Modalities, Motion Capture.

Assignments:

(a) Two assignments, one requiring an implementation of a scene using Java3D and the second requiring the implementation of a particular research algorithm in an open-source environment.

Assessment:

Assignments: 25%
Exam: 75%

Recommended Texts:

- *Computer Graphics: Principles and Practice - Second Edition in C* by J. D. Foley, A.

van Dam, S.K. Feiner, J.F. Hughes, Addison-Wesley, 1995

- *Real-Time Rendering – Second Edition* by Tomas Moller, Eric haines, Tomas Akeniense-Moller, AK Peters Ltd, 2002.
- *3D Computer Graphics – Third Edition* by Alan Watt, Addison-Wesley, 2000.

Reference Texts:

- *EE563 Graphics and Visualisation Course Notes:* by Robert Sadleir and Derek Molloy, 2006.

List of programmes:

- Master of Engineering in Electronic Systems and Telecommunications
- Graduate Diploma and Certificate in Engineering in Electronic Systems

Programme Reference Number:

Date of Last Revision: 23/June/06