School of Computer Science and Statistics

B.A. (Mod) Computer Science

ECTS Module Descriptor 2011-12

Module Code	CS4052/CS4D3
Module Title	Computer Graphics
Pre-requisites	C or C++ programming, freshman mathematics
ECTS	5
Chief Examiner	PROF CAROL O'SULLIVAN
Teaching Staff	PROF CAROL O'SULLIVAN
Delivery	Lectures/week: 2, Tutorials/week: 1 There are 10 labs covering aspects of 3D modeling, OpenGL, curves and surfaces. Attendance to all labs is compulsory.
Aims	Computer Graphics is a final year option which may be taken by students of Engineering, Computer Science and Mathematics. The objective of this course is to equip the students with the fundamental understanding of the major elements of Computer Graphics and explore related areas including geometric modelling, rendering and animation. The main focus of the course is on the mathematics and algorithms used in the synthesis of computer graphics imagery and animation, and their practical application. Students are introduced to the standard architectures of modern graphical applications including details on the underlying hardware and low-level software components common to all such systems. The course is intended to enable students to bridge the gap between these low-level fundamental, components common to all computer applications, and the high-level abstract output in most interactive graphical applications. Students are also introduced to OpenGL, a modern high-level graphics API which is widely used for 3D Design and Visualisation, along with the industry standard modelling software, 3D Studio Max, and this software is used throughout the course to demonstrate concepts and to allow the students to develop their own 3D models, scenes and applications.

Learning Outcomes	When students have successfully completed this module they should be able to: 1. Write graphical programs, using OpenGL or a similar graphics API, of moderate complexity; 2. Select an object or scene representation, create a model using modelling software, and export this model for use in an interactive application; 3. Discriminate between the different rendering choices for displaying objects, such as global or local illumination algorithms, and select the correct solution for the application area; 4. Derive and solve the mathematical formulations that underpin the practical aspects of creating, animating and rendering objects and scenes.
Syllabus	Specific topics addressed in this module include: • An introduction to computer graphics; problem domain and applications; • Modelling - data sources and acquisition; modelling software; representation schemes; • Linear algebra - two and three dimensional transforms; geometric operations; hierarchical 3D transformations; • The computer graphics pipeline and the OpenGL API for 3D computer graphics; • Projection and viewing; window to viewport transformation; • Illumination models and rendering algorithms; colour, shading algorithms (Gouraud and Phong), local and global illumination;
Assessment	Assessment is by examination and practical coursework. End-of-year examination contributes 80% of the final mark, whilst the total coursework contributes the remaining 20%. The practical exercises are conducted individually by each student and involve the development of a real-time, interactive application that involves navigating and manipulating a 3D environment.
Bibliography	No course text, although students are encouraged to use appropriate texts and reference documentation, where necessary. For example: 1. *Introduction to Computer Graphics*, Foley, Van Dam, Feiner, Hughes and Phillips 2. *OpenGL Programming Guide: The Official Guide to Learning OpenGL*, (5th edition), Dave Shreiner, Mason Woo, Jackie Neider and Tom Davis
Website	The course material is provided on the website: http://isg.cs.tcd.ie/cosulliv/teaching.html