Module Code: CS4052
Module Name: Computer Graphics

ECTS weighting: 5 ECTS
Semester/term taught: Michaelmas term

Contact Hours:
Lecture hours: 2
Lab hours: 1
Tutorial hours: 0
Total hours: 3

Comments: Attendance at all lectures, labs and tutorials is compulsory.

Module Personnel:
Lecturing staff: Prof Aljosa Smolic

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.
5. Critically appraise current computer graphics topics.

Module Learning Aims:
Computer Graphics is a final year option which may be taken by students of Engineering, Computer Science and Mathematics.

The objective of this module 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 module 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 module 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 module to demonstrate concepts and to allow the students to develop their own 3D models, scenes and applications.

### Module Content

Specific topics addressed in this module include:

1. An introduction to computer graphics; problem domain and applications;
2. Modelling - data sources and acquisition; modelling software; presentation schemes;
3. Linear algebra - two and three dimensional transforms; geometric operations; hierarchical 3D transformations;
4. The computer graphics pipeline and the OpenGL API for 3D computer graphics;
5. Projection and viewing; window to viewport transformation;
6. Illumination models and rendering algorithms; colour, shading algorithms (Gouraud and Phong), local and global illumination;

### Recommended Reading List

Course Text:


Students are also encouraged to use appropriate texts and reference documentation, where necessary. For example:

1. *Introduction to Computer Graphics*, Foley, Van Dam, Feiner, Hughes and Phillips

### Module Pre Requisite

C or C++ programming, freshman mathematics

### Module Co Requisite

### Assessment Details

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.

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