Pre-Requisite Modules code(s)	Co-Requisite Modules code(s)	ECTS credits	Module Code	**Module Title**
CMPU4030		5	CMPU4031	Games Engines 2

8.9.2. Games Engines 2

Module author: Dr Bryan Duggan

Module Description:

The purpose of this module is to build on the skills learned in Game Engines 1 so that students can learn how *higher order* behaviours are implemented in computer games. This course begins by exploring perception and path finding and continues with a comparison of techniques used to implement higher order NPC (Non Player Character) decision making. This course has a strong practical and technical focus and gives students the opportunity to learn practical games development at a low level.

Module aim

The aim of this course is to build on the knowledge learned in Game Engines 1 so that students can learn how higher order behaviours are implemented in computer games.

Learning Outcomes:

- Compare approaches to implementing perception and propose optimised solutions to perception problems.
- Critically analyse how perception is implemented in commercial computer games.
- Program simulations using steering behaviours
- Implement a variety of path following and path finding algorithms.
- Demonstrate an understanding of the issues involved in practical, optimised path finding.
- Use UML and object orientated design to model both technical architectures and behaviours in computer games.
- Propose architectures for NPC higher order decision making.
- Critically analyse how the techniques learned on the course are used in commercial games.

Learning and Teaching Methods:

Class time is split into a series of interactive “studio classroom” based lectures and practical problem solving in labs. In lectures, students have access to a PC, with appropriate software and development kits, so that material and examples can be examined in a live environment. In addition, students will be expected to proactively and independently seek out resources on the internet and from the library to supplement their own learning.

A Virtual Learning Environment (VLE) will be employed to distribute all teaching materials and to support student interaction with both other students and academic staff. Where new material is not presented in lectures, such material will be made available through the VLE and students are expected to proactively use this resource.

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Module content:

Perception

Audio perception models, visual perception models, algorithms for visual perception, algorithms for intersection of lines, rays and planes.

Steering behaviours

Unit steering behaviours (seek, pursuit, arrive path following, obstacle avoidance, interpose, hide). Group behaviours (separation, alignment, cohesion, flocking). Combining steering behaviours (weighted sum, prioritised dithering, spatial partitioning).

Path following and path finding

Graphs, breath first search, depth first search, Djikstra's shortest path, the A* algorithm, data structures, optimisations, path smoothing.

Higher order NPC decision making

Finite state machines, concepts and examples, state transition diagrams, the state machine design pattern, goal driven agent architectures, composite goals, sub goals, goal arbitration.

Module Assessment

This module has a 50% weighting for the examination and a 50% weighting for the continuous assessment. Continuous assessment will consist of a single significant assignment, which may be individual or team based. Students will be expected to document and present their assignment work in the form of an ePortfolio or a blog. Students will be expected to enter their assignments into national and international competitions such as the XNA Ireland Challenge and the Imagine Cup. While it is important that students can demonstrate their technical ability through continuous assessment, it is equally important that they demonstrate both an understanding of the mathematical concepts and an appreciation for how the techniques learned on the course are used in commercial games. This will be assessed in the examination. Students will not be required to write code in the examination, but will be required to solve problems using the mathematics and physics concepts learned and to critically analyse examples of the techniques learned on the course in commercial games.

The suggested method of assessing the individual learning outcomes for the module is as follows:

Essential Reading:

- Mat Buckland (2005), Programming Game AI by Example, Worldware Publishing Inc.

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Supplemental Reading:

- AI Game Development: Synthetic Creatures with Learning and Reactive Behaviors, Alex J. Champandard, New Riders Games (December 6, 2003)
- Pierre Rautenbach (2008) 3D Games Programming: Using DirectX 10 and Open GL, Cengage Learning Business Press

Web references, journals and other:

- http://gamedevelopers.ie
- http://gamesfleadh.ie
- http://imaginecup.com
- http://dreamspark.com
- http://seriousgames.ie

Further Details:

- 4 hours per week for one semester

Date of Academic Council approval ……..