

Subject Description Form

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| Subject Code | COMP5533 |
| Subject Title | Game Engine and Programming |
| Credit Value | 3 |
| Level | 5 |
| Pre-requisite/ Co-requisite/ Exclusion | Nil (but basic knowledge of programming is preferable) |
| Objectives | <p>The objectives of this subject are to:</p> <ol style="list-style-type: none"> 1. provide students with a broad view of both theoretical and practical issues in game engine and programming for the design of computer games and digital visual entertainment. 2. equip students with knowledge and understanding of the nature of interactive computer games, graphics and mixed reality applications, rendering and animations in 2D/3D video games. 3. equip students with sound skills in design, development and evaluation of computer games. |
| Intended Learning Outcomes <i>(Note 1)</i> | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> a) grasp and consolidate the main concepts (game hardware, graphics models and rendering techniques) that influence game engine and programming; b) have a deep understanding of how overall hardware and software architecture impact game engine and interactive games; c) critically review and compare different evaluation and testing approaches for game design, both quantitative and qualitative; d) apply graphics and game engine theory, principles and practices to 2D/3D video game design to develop creative solutions; and e) systematically implement and analyze an interactive computer game via appropriate development and playability evaluations. |
| Subject Synopsis/ Indicative Syllabus <i>(Note 2)</i> | <p>Nature of Game Engine and Programming Definitions and importance of game engine; history and development of computer games; roles various disciplines play within video games.</p> <p>Game Hardware Game console; graphics processing unit (GPU); Moore's law; GPU and shader programming; game programming; OpenGL vs DirectX; general-purpose graphics processing unit (GPGPU);</p> |

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| | <p>game-related applications.</p> <p>Game Design Theory and Guidelines User-centered game design; game genres; game environments; game goals; game assets: models and materials; game mechanics; game story and structure; guidelines supporting game design.</p> <p>Computer Graphics and Rendering Techniques Game architecture; 2D/3D object modelling; rendering; ray tracing; animation; collision detection; texturing, and visual appearance.</p> <p>Development and Applications Development rationale; interactive 2D/3D video game design; game user interface; multi-user games; virtual and augmented reality for games.</p> <p>Evaluation Methods for Games Role of game evaluations; quantitative and qualitative techniques; evaluating game design; evaluating through user participation; evaluating implementations; observational methods; query techniques.</p> <p>Selected Topics in Advanced Computer Games Potential topics include: Human-NPC (non-player character) interaction; serious games and persuasive games; game art and experimental game design; game AI; non-photorealistic rendering in games.</p> | | |
| <p>Teaching/Learning Methodology (Note 3)</p> | <p>Lectures, Tutorials and Labs The subject material will be delivered through lectures, tutorials and labs. Lectures will provide the main body of the subject materials. Where possible, guest lectures and/or case studies will be utilized to give the subject materials more relevancy to real-world scenarios. Tutorials and labs will provide students with more in-depth opportunities to explore the lecture materials and practice the lecture concepts. Where possible, a hands-on, interactive approach will be applied.</p> <p>Projects and Assignments Projects and assignments will provide students with in-depth opportunities to practice the lecture concepts, as well as to assess their ability to apply these concepts in practical scenarios.</p> <p>Examinations and Tests Examinations and tests will assess students on their grasp of subject materials.</p> | | |
| <p>Assessment Methods in Alignment with Intended Learning Outcomes</p> | <p>Specific assessment methods/tasks</p> | <p>% weighting</p> | <p>Intended subject learning outcomes to be assessed (Please tick as appropriate)</p> |

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| (Note 4) | | | a | b | c | d | e |
| | 1. Projects, Assignments and Tests | 60 | ✓ | ✓ | ✓ | ✓ | ✓ |
| | 2. Examination | 40 | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Total | 100% | | | | | |
| | Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: The assignments, tests and examinations will assess students’ ability to understand and describe the concepts behind game engine and programming, as well as various techniques and methods that are used to develop and assess computer games. Projects will require students to demonstrate abilities to apply the subject concepts in designing, implementing and analyzing computer games. | | | | | | |
| Student Study Effort Expected | Class contact: | | | | | | |
| | ▪ Lectures, tutorials, workshops, and labs | | | | | 39 Hrs. | |
| | Other student study effort: | | | | | | |
| | ▪ Assignments, Coursework, Reading, Exams | | | | | 66 Hrs. | |
| | Total student study effort | | | | | 105 Hrs. | |
| Reading List and References | <ul style="list-style-type: none">• J. Schell, <i>The Art of Game Design: A Book of Lenses</i>, 3rd Edition, Boca Raton, FL: A K Peters/CRC Press, 2019.• J. Gregory, <i>Game Engine Architecture</i>, 3rd Edition, Boca Raton, FL: A K Peters/CRC Press, 2018.• T. Akenine-Möller, E. Haines, N. Hoffman, A. Pesce, M. Iwanicki, and S. Hillaire, <i>Real-Time Rendering</i>, 4th Edition, Boca Raton, FL: A K Peters/CRC Press, 2018.• S. Marschner, P. Shirley, M. Ashikhmin, M. Gleicher, N. Hoffman, G. Johnson, T. Munzner, E. Reinhard, W. B. Thompson, P. Willemsen, and B. Wyvill, <i>Fundamentals of Computer Graphics</i>, 5th Edition, Boca Raton, FL: A K Peters/CRC Press, 2021.• R. Parent, <i>Computer Animation: Algorithms and Techniques</i>, 3rd Edition, Burlington, MA: Morgan Kaufmann, 2012.• ACM Transactions on Graphics• IEEE Transactions on Games• ACM SIGGRAPH• ACM Symposium on Interactive 3D Graphics• IEEE Transactions on Visualization and Computer Graphics | | | | | | |

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| | <ul style="list-style-type: none"> • ACM CHI Conference on Human Factors in Computing Systems • ACM/Eurographics Symposium on Computer Animation • ACM Symposium on Virtual Reality Software and Technology • IEEE International Symposium on Mixed and Augmented Reality • IEEE Virtual Reality • Computer Aided Geometric Design • Computer Graphics Forum • Computers & Graphics • Graphical Models • Computer Animation and Virtual Worlds |
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