Subject Description Form

<table>
<tr><td>Subject Code</td><td>COMP4422</td></tr>
<tr><td>Subject Title</td><td>Computer Graphics</td></tr>
<tr><td>Credit Value</td><td>3</td></tr>
<tr><td>Level</td><td>4</td></tr>
<tr><td>Pre-requisite / Co-requisite / Exclusion</td><td>Pre-requisite: COMP2011/COMP2013</td></tr>
<tr><td>Objectives</td><td>The objectives of this subject are to:
1. learn basic and fundamental computer graphics techniques;
2. learn 2D/3D image synthesis techniques; and
3. understand 3D modelling, design and visualisation.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
<u>Professional/academic knowledge and skills</u>
(a) gain proficiency in 3D computer graphics API programming;
(b) have a good understanding of the interactive computer graphics architecture;
(c) grasp in-depth knowledge of display systems, image synthesis, shape modelling, and interactive control of 3D computer graphics applications;
(d) broaden their perspective of modern computer system with modelling, analysis and interpretation of 2D and 3D visual information; and
<u>Attributes for all-roundedness</u>
(e) comprehend and appreciate the development and advancement of computer graphics technologies, including advanced technologies for 3D modelling and high performance rendering (life-long learning).</td></tr>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td><table><tr><th>Topic</th></tr><tr><td>1. Basic Introduction to Human Vision, Displays, Graphics Pipeline</td></tr><tr><td>2. GPUs, CG Processing, Frame Buffers and APIs</td></tr><tr><td>3. 2D Modelling, Primitives and Rasterisation</td></tr><tr><td>4. Polygon Geometry</td></tr><tr><td>5. Geometric Transformations</td></tr><tr><td>6. Two-dimensional Viewing and Clipping</td></tr><tr><td>7. Three-dimensional Viewing and Projections</td></tr><tr><td>8. Three-dimensional Object Representations</td></tr></table></td></tr>
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	9. Visible Surface Detection **10. Illumination Models** **11. Shading Models** **12. Colour Models** **13. Hierarchical Modelling** **14. Three-dimensional Scene Rendering** **Project Experiments**: Project exercises will normally be conducted using the currently available computer graphics API such as OpenGL, OpenCV, CUDA, DirectX, etc. The students will be exposed to basic frame-buffer control, pixel processes, rasterisation, 2D drawings, 3D transformations, projections, scene hierarchy, modelling objects, colour and interactive animation, etc. **Case Study**: If applicable, case studies may be conducted on modelling and design systems that are used in commercial applications.
Teaching/ Learning Methodology	The teaching methodology is based on these main activities: 1. Lecture delivery 2. Interactive exchange with students in class 3. Project/lab exercises consisting of hands-on programming exercises and tests 4. Tutorial sessions in and/or outside the lecture and laboratory sessions 5. Exposition and training sessions on a commercial grade studio package 6. Sessions on 2D/3D artistic design and special effects 7. Office hours questions, answers and clarification of materials 8. Discussion sessions with optional additional workshops, lectures and labs The learning methodology will be based on: 1. Lecture notes 2. Project notes and programming exercises 3. Reference book materials 4. Additional reference materials 5. Web links to active tutorials and other presentation materials There will be group interactions and supervised discussion sessions.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
Continuous Assessment	**55%**					
1. Assignments	55%	✓	✓	✓		
2. Project/Lab Exercises		✓	✓	✓	✓	✓
Examination	**45%**	✓	✓	✓		
Total	100%					

The assignment weights will be effectively distributed amongst the intended subject learning outcomes to nurture creative thinking, independence, teamwork, technical skills and a global perspective towards the technological base of this subject. Specifically, the assignments and the project/lab exercises are selected to develop the technical skills and knowledge to solve problems in computing and software development as well as to realise effective solutions, understand, evaluate and develop a critical perspective in the development of both small and large systems and integration of systems. Critical thinking, effective communication and a demonstrable global outlook will be incorporated at every level of exercises and examination. The final examination accounts for a global and comprehensive understanding of the entire subject material and serves as the final checkpoint for the learning outcomes against technical skills and critical problem solving with respect to all components of computer graphics and 3D modelling.

Student Study Effort Expected

Class contact:	
▪ Lecture/Tutorial/Laboratory	39 Hrs.
Other student study effort:	
▪ Assignments	24 Hrs.
▪ Course Work: Reading, Discussions	42 Hrs.
Total student study effort	105 Hrs.

Reading List and References

1. S. Marschner and P. Shirley, *Fundamentals of Computer Graphics*, 4th Edition, Boca Raton: CRC Press, Taylor & Francis Group, 2016.
2. T. Akenine-Möller, E. Haines, and N. Hoffman, *Real-Time Rendering*, 4th Edition, Boca Raton, F.L.: A K Peters/CRC Press, 2018.
3. D. Cantor and B. Jones, *WebGL Beginner's Guide*, 1st Edition, Birmingham: Packt Pub, 2012.
4. *Blender Reference Manual*, https://docs.blender.org/manual/en/latest/index.html
5. D. Hearn, M. Baker, and W. Carithers, *Computer Graphics with OpenGL*, 4th Edition, Boston: Prentice Hall, 2011.

	6. F. S. Hill Jr. and S. Kelley, *Computer Graphics Using OpenGL*, 3rd Edition, Upper Saddle River, N.J.: Pearson Prentice Hall, 2007. 7. ACM Transactions on Graphics 8. IEEE Transactions on Visualization and Computer Graphics 9. ACM SIGGRAPH 10. IEEE Virtual Reality 11. Computer Aided Geometric Design 12. Computer Graphics Forum 13. Computers & Graphics 14. Graphical Models 15. Computer Animation and Virtual Worlds 16. The Visual Computer