Subject Description Form

Subject Code	COMP350 (for 42075)
Subject Title	Computer Graphics
Credit Value	3
Level	3
Pre-requisite	Computer Programming (EIE264)
Co-requisite/ Exclusion	Nil
Objectives	**This subject allows students to:** 1. understand the concept and practice of computer graphics; 2. appreciate the role of graphics as foundations to user interfaces, visualization and digital design; 3. learn the fundamental techniques, data structures and algorithms used in standard graphics API's; 4. learn about the common API's, for example, Java 3D, OpenGL, DirectX.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. identify and integrate digital hardware components required for high-performance computer graphics; 2. develop programs using Java 3D, OpenGL and/or DirectX APIs; 3. understand the problems and apply the techniques in image synthesis; 4. effectively construct data structures and develop algorithms for handling 3D modelling and animation; 5. develop simple graphics software systems. Category B: Attribute for all-roundedness 6. understand, appreciate and follow the development and advancement of computer graphics technologies, including advanced technologies for 3D modelling, high performance rendering.
Contribution of the Subject to the Attainment of the Programme Outcomes	**Programme Outcomes:** Category A Professional/academic knowledge and skills • Programme Outcomes 6 and 8: This subject contributes to the programme outcomes through graphics program development with careful design and implementation via programming exercises and laboratories. Category B Attributes for all-roundedness • Programme Outcomes 6 and 8: This subject contributes to the programme outcomes through graphics program development with careful design and implementation via programming exercises and laboratories. • Programme Outcomes 7 and 10: This subject contributes to the programme outcomes with group project development and associated report writing.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Hardware components (3 hours) Basic hardware modules necessary for a functional graphics workstation, such as display devices, colour formation, frame buffers and image representation in hardware. 2. Rasterization and scan conversion (4 hours)

	Algorithms for digitizing basic 2D shapes, such as lines, curves, circles, polygons. 3. 2D transformations(3 hours) Transforming points, lines, and vectors in 2D; introduction to homogeneous transformations. 4. 3D modelling and projective spaces (4 hours) 3D modelling: rotations, translations, scaling, shearing, and projective geometry. 5. Camera model (3 hours) Constructing the 3D viewing frustrum; modelling a pin-hole camera for digital image synthesis. 6. Basic 3D object modelling (4 hours) Object hierarchies; planes; polygon meshes; spline curves and surfaces. 7. 3D Visibility (4 hours) Visibility problems and solutions; the Z-Buffer algorithm. 8. Rendering (3 hours) Light, colour, illumination models; shading; ray-tracing; radiosity. **Laboratory Experiment:** Appropriate laboratory exercises will be conducted using the currently available computer graphics API such as OpenGL and DirectX. **Case Study:** If applicable, case studies may be conducted on modelling and design systems that are used in commercial applications.
Teaching/ Learning Methodology	Lectures will provide the basic concepts, theories and models of computer graphics. Laboratory will provide the training in using the programming tools, such as Java 3D, OpenGL and/or DirectX APIs to understand, realize and implement the concepts, theories and models learnt in the lectures. Case studies will be given and discussed in tutorials wherever it is appropriate. Assessments including assignments and project are given to students for reinforcing, practising and applying the basic concepts, theories and models of computer graphics. Project is required to work in groups, which also helps students to develop team work in solving problems. Quiz is given to evaluate students' individual understanding of the subject.

Alignment of Assessment and Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)					
		1	2	3	4	5	6
Continuous Assessment							
• Assignments	40%	✓	✓	✓	✓		✓
• Quiz(zes)	20%	✓		✓	✓		✓
• Project	40%	✓	✓	✓	✓	✓	✓
Total	100%						

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

This subject is assessed through continuous assessment: assignments, quiz(zes) and project.

The assignments will assess the understanding and use of proper hardware and software (data structures and algorithms) for computer graphics design and applications.

The project will assess in more depth to those assessed in the assignments and, in addition, those components in computer graphics system development have been evaluated. Team work in achieving the project goals is also evaluated.

The Quiz(zes) will assess the individuals' understanding of the subject.

Student Study Effort Expected

Class contact (time-tabled):	
• Lecture	28 Hours
• Tutorial/Laboratory	14 Hours
Other student study effort:	
• Self-study	20 Hours
• Assignments	10 Hours
• Project	30 Hours
Total student study effort:	**102 Hours**

Reading List and References

Textbook:

1. D. Hearn and P.M. Baker, *Computer Graphics with OpenGL*, 3rd ed., Prentice-Hall, 2004.

Reference Books:

1. E.S. Angel, Interactive Computer Graphics, *A top-down approach with OpenGL*, 5th ed., Addison-Wesley, 2009.
2. F.S. Hill, Jr. and Stephen M. Kelley, Jr., *Computer Graphics: using OpenGL*, 3rd ed., Prentice-Hall, 2007.
3. D. Shreiner and The Khronos OpenGL ARB Working Group, *OpenGL programming guide: the official guide to learning OpenGL*, versions 3.0 and 3.1, Addison-Wesley, 2010.
4. D. Shreiner et. al., *OpenGL programming guide: the official guide to learning OpenGL*, versions 2.1, Addison-Wesley, 2008.