英文課名: Introduction to Graphics Programming and its Applications
中文課名: 繪圖程式設計與應用

一、課程說明(Course Description)

This course will introduce the fundamental of computer graphics and how to develop 3D applications using a powerful graphics APIs, named OpenGL. OpenGL has been designed to be a cross-platform Graphics API running on PCs and mobile devices. Although OpenGL ES (OpenGL for Embedded System) is widely adopted as the standard Graphics API for mobile devices, it is actually consisting of well-defined subsets of desktop version. In this course, we will lead you to go through the whole rendering pipeline, particularly focus on those programmable stages (or Shaders). Detailed APIs specification will be elaborated with the sample applications to help understand the physical meaning behind the functions.

二、指定用書(Text Books)

NA

三、參考書籍(References)

1. *OpenGL Programming Guide: The Official Guide to Learning OpenGL*, Version 3.0 and 3.1, 7th Edition, by Dave Shreiner and the Khronos OpenGL ARB Working Group, 2009.

2. *OpenGL Super Bible: Comprehensive Tutorial and Reference*, 5th Edition, by Richard S. Wright, Nicholas Haemel, Graham Sellers, and Benjamin Lipchak, 2010.

3. *OpenGL ES 2.0 Programming Guide*, by Aaftab Munshi, Dan Ginsburg, and Dave Shreiner, 2009.

4. *OpenGL Shading Language*, 3rd Edition, by Randi J. Rost and Bill Licea-Kane, 2009.

5. *Beginning OpenGL Game Programming*, 2nd Edition, by Luke Benstead, 2009.

6. *Fundamentals of Computer Graphics*, 3rd Edition, by Peter Shirley and Steve Marschnes, 2009.

7. *Real-Time Rendering*, 3rd Edition, by Tomas Akenine-Möller, Eric Haines, and Naty Hoffman, 2008.

8. *Interactive Computer Graphics: A Top-Down Approach Using OpenGL*, 5th Edition, by Edward Angel, 2009

9. OpenGL official website. http://www.opengl.org/

10. OpenGL ES official website. http://www.khronos.org/opengles/

11. NVIDIA Developer's Websites. http://developer.nvidia.com/page/home.html

12. AMD Developer's Websites. http://developer.amd.com/Pages/default.aspx

四、教學方式(Teaching Method)
Lectures.

五、教學進度(Syllabus)
- Transformations (1 week)
  - 3D Space, Math, Projection
- OpenGL Overview (3 weeks)
  - Rendering Pipeline
  - OpenGL Object (Buffer, Texture, Uniform)
- Vertex Shader Stage (2 weeks)
  - Basic Concept
  - Drawing Commands
- Fragment Shader Stage (1 week)
  - Basic Concept
  - Frame Buffers
- Mesh Rendering (1 week)
  - Vertex Skinning
- Fundamental of Shading (1 week)
  - Basic Concept
  - Shading Models (Blinn-Phong, Normal Mapping, Environment Mapping, Cell Shading)
- Tessellation Shader Stage + Geometry Shader Stage (1 week)
- Rendering Techniques (1 week)
  - Shadow, SSAO
- WebGL (2 weeks)

六、成績考核(Evaluation)
Assignments: 30%
In-Class Quiz: 25%
Final Project: 45%

七、AI 使用規則
有條件開放，請註明如何使用生成式 AI 於課程產出。