11B1WCI671: Computer Graphics Lab

Course Credit: 1
Semester: VI

Objective:

This is an introductory course on principles of computer graphics. We will consider both 2D and 3D graphics. Broadly speaking, we will look at raster scan graphics including line and circle drawing, polygon filling, anti-aliasing algorithms, clipping, hidden-line and hidden surface algorithms including ray tracing and, of course, rendering - the art of making photo realistic pictures with local and global illumination models.
Lab course of two hours per week will supplement the theory. Implementation of basic and advanced algorithms will be done in OpenGL and C++. Basic knowledge of C/C++ programming is mandatory.
The course will involve four hours of contact including lectures, tutorials and lab classes. Students are strongly encouraged to participate actively in class discussions.

Learning Outcomes:

1. Using OpenGL for Graphics
2. Programming User-interface issues
3. Concepts of 2D & 3D object representation
4. Implementation of various scan & clipping algorithms
5. 2D modeling
6. Implementation of illumination model for rendering 3D objects
7. Visibility detection & 3D viewing
8. Implementation of a project based on learned concepts.

List of Experiments

S NO	Topics
1	**Introduction: Graphics Programming using OPENGL** Please read this document before attempting the first lab. The first lab sections will be held 9/11 and 9/12 at the times listed above.
2	**Lab 1: OpenGL 2D** In this lab, you will take your first step into the world of OpenGL. After this lab you will know the basics of creating and moving 2D objects in order to create a game of Pong.
3	**Lab 2: OpenGL 3D** In this lab, you'll learn about 3D tesselation and transformations to create a target practice game.
4	**Lab 3: Animation** In this lab, you will learn how to take 3D objects and use them to create interesting scenes. In particular, you will learn how to use lighting, shading, and animation to enhance your scenes.

5	**Lab 4: Terrain** Procedural shape generation is an important tool in computer graphics. You will use a simple algorithm to generate a terrain/mountain range to witness the power of procedural shape generation first hand.
6	**Lab 5: Particles** Particle effects in OpenGL are relatively simple to implement and look cool. In this lab you will implement a simple, but highly customizable particle emitter.
7	**Lab 6: Camtrans** In this lab, you will create your own virtual camera. This camera will use various viewing properties to produce a transformation matrix to display 3D graphics on our 2D output devices. The code written in this lab will be used in future assignments.
8	**Lab 7: Shaders Part I** In this lab, we enter the realm of shaders and GLSL (Open GL Shading Language). You will learn what shaders are and implement some shaders of your own using a procedurally generated terrain as your scene.
9	**Lab 8: Shaders Part II** In this lab, you will implement the Phong illumination model in a shader and learn about linking shaders. You will also do some post process effects using framebuffer objects.
10	**Lab 9: Shaders Part III** In this lab, you will implement two different shaders which implement the Cook-Torrance lighting model using Fresnel's equations for reflection and refraction. You will write a glass shader and a metal shader.
11	**Lab 10: Modeler** In this lab, you will implement several 3D interaction controls for a simple 3D modeling program. These controls will allow users to modify a 3D scene in real time.

References

1. Donald Hearn and M. Pauline Baker. “Computer Graphics with OPENGL” 3rd Edition Pearson Publishers, 2011.
2. James D. Foley, Van Adams, K.Fenier and F. Hughes, “Computer Graphics-Principle and Practices”, 3rd Edition Pearson Publishers, 2002.
3. Harrington, S. “Computer Graphics: A Programming Approach” Mc-Graw Hill Book Co.

Evaluation Scheme:

1.	Mid Term Exam (Viva and Written Exam)	20
2.	End term Exam (Viva and Written Exam)	30
3.	Lab Records	5
4.	Regular Assessment (Quality and quantity of experiment performed, Learning laboratory skills, Attendance etc.)	30
5.	Project	15
	Total	**100**