

2/4 B.Tech SECOND SEMESTER

IT4T5

**COMPUTER GRAPHICS
(Common to CSE/IT)**

Credits: 4

Lecture: 4 periods/week

Internal assessment: 30 marks

Tutorial: 1 period /week

Semester end examination: 70 marks

Objectives:

- To explain the basics of application programming interface (API) implementation based on graphics pipeline approach.
- To introduce the basic graphics through OpenGL.
- To explain the basic input devices and interaction of computer graphics.
- To explain the basic fundamentals of 2D and 3D computer graphics.
- To explain the modern graphical hardware and rendering pipeline.
- To explain the mathematical transformations and vector techniques in the production of computer graphics.
- To demonstrate the clipping algorithms, rasterization techniques.

Outcomes:

Students will be able to

- Develop and build an interactive graphics program using the OpenGL application programming interface.
- Gain proficiency with OpenGL to produce 2D and 3D computer graphics.
- Develop a facility with the relevant mathematics of computer graphics.
- Write basic graphics application programs including animation.
- Develop the application of mathematical transformations and vector techniques in producing graphics requiring rotation, translation, scaling, and 3D projection.
- Develop a polygonal mesh representing the boundary surface of a three dimensional object.
- Understand of the clipping algorithms commonly used in computer graphics.

Syllabus:

UNIT-I

INTRODUCTION:

Applications of computer graphics; A graphics system; Images Physical and synthetic; Imaging systems; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable pipelines; Performance characteristics.

GRAPHICS PROGRAMMING:

The Sierpinski gasket; Programming two- dimensional applications.

UNIT-II

The OpenGL:

The OpenGL API; Primitives and attributes; Color; Viewing; Control functions; The Gasket program; Polygons and recursion; The three-dimensional gasket; Plotting implicit functions.

UNIT-III

INPUT AND INTERACTION:

Interaction; Input devices; Clients and servers; Display lists; Display lists and modeling; Programming event-driven input; Menus; Picking; A simple CAD program; Building interactive models; Animating interactive programs; Design of interactive programs; Logic operations.

UNIT-IV

GEOMETRIC OBJECTS AND TRANSFORMATIONS-1:

Scalars, points, and vectors; Three-dimensional primitives; Coordinate systems and frames; Modeling a colored cube; Affine transformations; Rotation, translation and scaling.

UNIT-V

GEOMETRIC OBJECTS AND TRANSFORMATIONS-2:

Transformations in homogeneous coordinates; Concatenation of transformations; OpenGL transformation matrices; Interfaces to three-dimensional applications; Quaternions.

UNIT-VI

VIEWING:

Classical and computer viewing; Viewing with a computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden-surface removal; Interactive mesh displays; Parallel-projection matrices; Perspective-projection matrices; Projections and shadows.

UNIT-VII

LIGHTING AND SHADING:

Light and matter; Light sources; The Phong lighting model; Computation of vectors; Polygonal shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global illumination.

UNIT-VIII

IMPLEMENTATION :

Basic implementation strategies; The major tasks; Clipping; Line-segment clipping; Polygon clipping; Clipping of other primitives; Clipping in three dimensions; Rasterization; Bresenham's algorithm; Polygon rasterization; Hidden-surface removal; Antialiasing; Display considerations.

Text Books :

1. Edward Angel, "Interactive Computer Graphics A Top-Down Approach with OpenGL", Addison-Wesley, 5th Edition, 2008. (Chapters 1, 2, 3, 4, 5, 6, 7)
2. "Computer Graphics through OpenGL", Sumantha Guha, Chapman and Hall/CRC 2011.

Reference Books:

1. F.S. Hill,Jr, and M. Kelley, Jr. "Computer Graphics Using OpenGL", Pearson/PHI, 3rd Edition, 2009.
2. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, "Computer Graphics", Addison-wesley 1997.