

# **GUJARAT TECHNOLOGICAL UNIVERSITY**

## **MASTER OF COMPUTER APPLICATIONS (MCA)**

### **Semester: IV**

Subject Name: **Elective I – Computer Graphics (CG)**

Subject Code: **2640008**

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#### **Learning Objectives:**

The objective of the course is to enable the students to:

- ✓ Gain basic understanding of the underlying theory of graphics display.
- ✓ Develop basic algorithms for the applications of Computer Graphics.
- ✓ Explore and apply graphics algorithms and primitives using the OpenGL language.

#### **Prerequisites:**

- ✓ Fundamentals of Programming.
- ✓ Knowledge of Coordinate Geometry and Matrix Algebra.
- ✓ Knowledge of Numerical Methods.

#### **Contents:**

##### **1. A Survey of Computer Graphics (2 Lect.)**

Graphs and Charts, Computer-Aided Design, Virtual Relative Environments, Data Visualizations, Education and Training, Computer Art, Entertainment, Image Processing, Graphical User Interfaces

##### **2. Overview of Graphics Systems (2 Lect.)**

Video-Display Devices, Raster Scan Systems, Graphics Workstations And Viewing Systems, Input Devices, Hard Copy Devices, Graphics Networks, Graphics On The Internet, Graphics Software, Introduction To OpenGL.

##### **3. Graphics Output Primitives (10 Lect.)**

Co-Ordinate Reference Frames, Specifying 2-D World Co-Ordinate Reference Frame In OpenGL, OpenGL Point Functions, OpenGL Line Functions, Line Drawing Algorithms, Parallel Line Algorithms, Setting Frame buffer Values, OpenGL Curve Functions, Circle Generating Algorithms, Ellipse Generating algorithm, Other Curves, Parallel Curve Algorithm, Pixel Addressing, Fill Area Primitives, Polygon Fill Areas, OpenGL Polygon Fill Area Functions, OpenGL Vertex Arrays.

##### **4. Attributes of Graphics Primitives (8 Lect.)**

OpenGL State Variables, Color and Gray Scale, Point Attributes, Line Attributes, Curve Attributes, OpenGL Point Attribute Functions, OpenGL Line Attribute Functions, General Scan line Polygon Fill Algorithm, Scan Fill of Convex Polygons and Regions with Curved Boundaries, Fill Methods for Areas with Irregular Boundaries, OpenGL Area With Fill Attribute Functions, Anti aliasing.

## **5. Geometric Transformations (10 Lect.)**

Basic 2-D Geometric Transformation, Matrix Representations And Homogeneous Co-Ordinates, Inverse Transformations, 2-D Composite Transformation, Other 2-D Transformation, Geometric Transformation In 3-D Space, 3-D Translation, Rotation And Scaling, Composite 3-D Transformations And Other (Reflection And Shear) 3-D Transformation.

## **6. 2-D Viewing (10 Lect.)**

The 2-D Viewing Pipeline, The Clipping Window, Normalization And View Port Transformation, OpenGL 2D viewing functions, Clipping Algorithm, 2-D Point Clipping, Line Clipping And Polygon Fill Area Clipping.

## **7. 3-D Viewing (8 Lect.)**

Overview Of 3-D Viewing Concepts, The 3-D Viewing Pipeline, 3- Viewing Co-Ordinate Parameters, Transformation For World To Viewing Co-Ordinates, Projections Transformations, Orthogonal Projections, Oblique Parallel Projections, Perspective Projections, Viewport Transformation, 3D clipping algorithms.

### **Text Book:**

- ✓ Donald Hearn and M. Pauline Baker, “Computer Graphics with OpenGL”, Third Edition, Pearson Education.

### **Other Reference Books:**

1. F. S. Hill, “Computer Graphics Using OpenGL”, Third Edition PHI.
2. Dave Shreiner, Woo, Neider and Tom Davis: “OpenGL Programming Guide – The Official Guide to Learning OpenGL, Version 2.1,” Sixth Edition, Pearson Education.
3. Dave Shreiner, Woo, Neider and Tom Davis: “OpenGL Programming Guide – The Official Guide to Learning OpenGL, Version 3.0 and 3.1, Seventh Edition, Pearson Education (to be announced).
4. Amarendra N Sinha, Arun D Udai, “Computer Graphics”, TMH.
5. ISRD Group, “Computer Graphics”, TMH.

### **Chapter wise Coverage from the Text Book:**

Chapters	Articles
1	Complete
2	Complete
3	3-1 to 3-17
4	4-1 to 4-8, 4-10 to 4-14, 4-17,4-18
5	5-1 to 5-14
6	6-1 to 6-8
7	7-1 to 7-11

### **Accomplishments of the student after completing the course:**

At the end of the course the student will be able to

- ✓ Describe and explain different algorithms for Line Drawing, Circle Drawing, Line Clipping, Polygon Clipping and Polygon Filling.
- ✓ Use Matrices and Homogeneous Coordinates to represent and perform 2D and 3D transformations Understand and use 3D To 2D Projection
- ✓ Implement algorithms using OpenGL.