

**UNIT I****Chapter 1 : Basics of Computer Graphics 1-1 to 1-33****Syllabus :**

Image and Objects, pixels and resolution, Text mode, Graphics Mode. Basic Graphics pipeline, Bitmap and Vector based graphics, Applications of Computer Graphics,

Display Devices : Raster Scan Display, Random Scan Display, Flat Panel Display, LED-LCD Display, Plasma, Touch Screen,

Output Primitives : line, polygon, marker, text, Graphics functions and standards, Latest trends in Computer Graphics : Virtual reality, Augmented reality

1.1	Introduction to Computer Graphics.....	1-1
1.2	Image and Object	1-2
1.3	Pixels, Resolution and Frame Buffer	1-2
1.3.1	Pixel	1-2
1.3.2	Resolution	1-3
1.3.3	Frame Buffer	1-3
1.4	Display Adapters.....	1-4
1.4.1	Video Adapters	1-4
1.4.2	Display Modes	1-8
1.4.2.1	Text Mode	1-8
1.4.2.2	Graphics Mode	1-9
1.5	Basic Graphics Pipeline.....	1-9
1.5.1	Application Stage.....	1-9
1.5.2	Geometry Stage.....	1-9
1.5.3	Rasterization.....	1-10
1.6	Types of Graphics.....	1-10
1.6.1	Bitmap based Graphics	1-10
1.6.2	Vector based Graphics	1-10
1.6.3	Bitmap vs. Vector Graphics	1-11
1.7	Applications of Computer Graphics	1-11
1.8	Display Devices	1-14
1.8.1	Cathode Ray Tube (CRT).....	1-14
1.8.2	Raster Scan Display	1-16
1.8.3	Random Scan Display	1-17
1.8.4	Raster scan vs. Random Scan Display	1-18
1.8.5	Interlaced Display System	1-18
1.8.6	Flat Panel Display.....	1-19
1.8.6.1	LED Display	1-20
1.8.6.2	LCD Display.....	1-20
1.8.6.3	Plasma Panel.....	1-21

1.8.6.4	Touch Screen	1-21
1.9	Output Primitives	1-21
1.9.1	Point.....	1-22
1.9.2	Line	1-22
1.9.3	Polygon.....	1-22
1.9.4	Marker.....	1-23
1.9.5	Text.....	1-23
1.10	Graphics Functions and Standards	1-24
1.10.1	Coordinate Representation.....	1-24
1.10.1.1	Cartesian Coordinate System.....	1-25
1.10.1.2	Polar Coordinate System.....	1-25
1.10.1.3	Spherical Coordinate System	1-26
1.10.1.4	Cylindrical Coordinate System.....	1-26
1.10.2	Graphics Functions.....	1-26
1.10.3	Software Standards	1-27
1.11	Latest trends in Computer Graphics.....	1-27
1.11.1	Virtual Reality.....	1-27
1.11.1.1	Introduction to Virtual Reality.....	1-27
1.11.1.2	Components of Virtual Reality	1-28
1.11.1.3	Types of VR Systems	1-28
1.11.1.4	Input / Output Devices	1-30
1.11.1.5	Applications of VR	1-30
1.11.2	Augmented Reality	1-31
1.11.2.1	Introduction to Augmented Reality.....	1-31
1.11.2.2	Types of Augmented Reality.....	1-31

UNIT II**Chapter 2 : Raster Scan Graphics 2-1 to 2-53****Syllabus :**

Basic Concepts in Line Drawing : Line drawing algorithms, Digital Differential Analyzer (DDA) algorithm, Bresenham's algorithm, Circle Generating Algorithms: Symmetry of circle, Bresenham's Circle Drawing Algorithm, Polygons, Types of Polygons, Inside Outside Test, Polygon Filling : Seed fill algorithms : Flood Fill, Boundary Fill, Scan Line Algorithm, Scan Conversion, Frame Buffers, Character Generation Methods : Stroke, Starburst, Bitmap

2.1	Basic Concepts in Line Drawing	2-1
2.1.1	Point	2-1
2.1.2	Basics of Line	2-1
2.1.2.1	Characteristics of Ideal Line	2-2
2.1.2.2	Line Representation	2-3



2.2	Line Drawing Algorithms	2-3	3.1.2	Coordinate Transformation	3-2
2.2.1	Digital Differential Analyzer (DDA) Algorithm	2-3	3.2	Matrix Operations	3-2
2.2.2	Bresenham's Line Drawing Algorithm	2-12	3.2.1	Representation of Matrix	3-2
2.2.3	DDA vs. Bresenham's Line Drawing Algorithm	2-18	3.2.1.1	Column Measure Representation	3-2
2.3	Circle Generation Algorithms	2-18	3.2.1.2	Row Measure Representation	3-3
2.3.1	Symmetry of Circle	2-19	3.2.2	Matrix Properties	3-3
2.3.2	Polar Circle Drawing Algorithm	2-20	3.2.3	Determinant of Matrix	3-3
2.3.3	Bresenham's Circle Drawing Algorithms	2-21	3.2.4	Multiplying Two Matrices	3-4
2.4	Polygons	2-26	3.3	Translation	3-4
2.4.1	Types of Polygons	2-26	3.4	Scaling	3-6
2.4.1.1	Convex Polygon	2-27	3.4.1	Scaling with respect to Origin	3-6
2.4.1.2	Concave Polygon	2-27	3.4.2	Scaling with respect to Reference Point	3-7
2.4.1.3	Complex Polygons	2-27	3.4.3	Uniform vs. Non Uniform Scaling	3-8
2.4.2	Inside-Outside Test	2-27	3.5	Rotation	3-10
2.4.2.1	Even-Odd Method	2-28	3.5.1	Rotation with respect to Origin	3-11
2.4.2.2	Winding Number Method	2-29	3.5.2	Rotation with Respect to Reference Point	3-12
2.5	Polygon Filling	2-29	3.6	Matrix Representation and Homogeneous Coordinates	3-14
2.5.1	Pixel Connectivity	2-30	3.6.1	Translation	3-15
2.5.2	Seed Fill Algorithms	2-30	3.6.2	Scaling	3-15
2.5.2.1	Boundary Fill Algorithm	2-30	3.6.3	Rotation	3-16
2.5.2.2	Flood Fill Algorithm	2-32	3.7	Composite Transformation	3-16
2.5.3	Scan Line Polygon Filling Algorithms	2-34	3.7.1	Successive Transformations	3-16
2.5.4	Seed Fill vs. Scan Line Algorithm	2-35	3.7.2	General Pivot Point Rotation	3-17
2.6	Scan Conversion	2-38	3.7.3	General Pivot Point Scaling	3-23
2.7	Frame Buffer	2-39	3.8	Reflection	3-24
2.8	Character Generation Methods	2-40	3.8.1	Reflection about X-Axis (Y = 0 Line)	3-24
2.8.1	Stroke Method	2-40	3.8.2	Reflection About Y Axis (X = 0 Line)	3-25
2.8.2	Starburst Method	2-41	3.8.3	Reflection about X = Y Axis	3-26
2.8.3	Bitmap Method	2-41	3.8.4	Reflection about X = - Y Axis	3-26
2.9	Lab Programs	2-42	3.8.5	Reflection about Origin	3-26
			3.8.6	Reflection about Any Line $y = mx + c$	3-27
			3.8.7	Reflection about a Line Parallel to X Axis	3-27
			3.8.8	Reflection about a Line Parallel to Y Axis	3-28
			3.9	Shearing	3-33
			3.9.1	X-direction Shearing	3-33
			3.9.2	Y direction Shearing	3-36
			3.10	Solved Examples	3-39
			3.11	Lab Programs	3-51

UNIT III

Chapter 3 : 2D Transformation
3-1 to 3-60
Syllabus :

Two Dimensional Transformations : Translation, Scaling, Rotation, Reflection, Shearing,

Matrix Representations and Homogeneous Coordinates : Translation, Scaling, Rotation, Reflection, Shearing, Composite Transformations : Rotation About and Arbitrary Point

3.1	Introduction	3-1
3.1.1	Geometric Transformation	3-1

UNIT III

Chapter 4 : 3D Transformation and Projection

4-1 to 4-41

Syllabus :

Three Dimensional Transformations : Translation, Scaling, Rotation,

Types of Projections : Perspective and Parallel Projection

4.1	Three Dimensional Transformations.....	4-1
4.1.1	Translation	4-1
4.1.2	Scaling	4-2
4.1.2.1	Scaling with respect to Origin	4-2
4.1.2.2	Scaling with respect to Reference Point	4-3
4.1.3	Rotation	4-4
4.1.3.1	Rotation about a Principal Axis	4-4
4.1.3.2	Rotation about a Line Parallel to Principal Axis	4-6
4.1.3.3	Rotation about an Arbitrary Line	4-7
4.1.4	Solved Examples	4-11
4.2	Types of Projection	4-20
4.2.1	Introduction to Projection	4-20
4.2.2	Parallel Projection	4-21
4.2.2.1	Orthographic Parallel Projection	4-22
4.2.2.2	Oblique Parallel Projection	4-24
4.2.3	Perspective Projection	4-29
4.2.3.1	One-point Perspective Projection	4-31
4.2.3.2	Two-point Perspective Projection	4-33
4.2.3.3	Three-point Perspective Projection.....	4-33
4.2.4	Parallel Vs. Perspective Projection.....	4-37
4.3	Lab Programs	4-37

UNIT IV

Chapter 5 : Windowing and Clipping

5-1 to 5-49

Syllabus :

Windowing and Clipping Concepts : Window-to-Viewport Transformation,

Line Clipping : Cohen Sutherland Clipping Algorithm, Cyrus beck, Liang Barsky, Midpoint Subdivision, Polygon Clipping Sutherland-Hodgeman, Text Clipping

5.1	Windowing and Clipping Concepts.....	5-1
5.1.1	Introduction	5-1
5.1.2	Viewing Pipeline	5-1

5.1.3	Window-to-viewport Transformation.....	5-3
5.2	Point Clipping	5-5
5.3	Line Clipping	5-6
5.3.1	Introduction	5-6
5.3.2	Line Clipping Algorithm.....	5-6
5.3.2.1	Cohen Sutherland Line Clipping Algorithm.....	5-7
5.3.2.2	Midpoint Subdivision Line Clipping Algorithm.....	5-17
5.3.2.3	Cyrus-Beck Line Clipping Algorithm	5-19
5.3.2.4	Liang Barsky Line Clipping Algorithm	5-22
5.4	Polygon Clipping.....	5-30
5.4.1	Introduction to Polygon Clipping	5-30
5.4.2	Sutherland-Hodgeman Algorithm	5-30
5.5	Text Clipping.....	5-33
5.5.1	All or None String Clipping	5-33
5.5.2	All or none Character Clipping.....	5-33
5.5.3	Individual Character Clipping.....	5-34
5.6	Lab Programs	5-34

UNIT V

Chapter 6 : Introduction to Curves

6-1 to 6-30

Syllabus :

Curve Generation : Arc Generation Using DDA Algorithm, Interpolation,

Types of Curves : Hilbert's Curve, Koch Curve, B-Spline, Bezier Curves

6.1	Introduction to Curve Generation.....	6-1
6.1.1	Arc Generation using DDA Algorithm	6-1
6.1.2	Interpolation	6-3
6.1.2.1	Lagrange Interpolation.....	6-3
6.2	Types of Curve	6-5
6.2.1	Spline Curve Representation.....	6-5
6.2.1.1	Bezier Curve	6-6
6.2.1.2	B-Spline Curve	6-14
6.2.1.3	Bezier vs. B-Spline	6-18
6.2.2	Fractal Representation	6-18
6.2.2.1	Hilbert's Curve	6-21
6.2.2.2	Koch Curve.....	6-22
6.3	Lab Programs	6-23

