

CLASS: B. Sc (Information technology)		Semester – III	
COURSE: Computer Graphics			
Periods per week 1 Period is 50 minutes	Lecture	5	
	TW/Tutorial/Practical	3	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	TW/Tutorial/Practical	--	50

Unit-I	<p>Introduction Computer Graphics and Primitive Algorithms: Introduction to Image and Objects, Image Representation, Basic Graphics Pipeline, Bitmap and Vector-Based Graphics, Applications of Computer Graphics, Display Devices, Cathode Ray Tubes, Raster-Scan Display, Random-Scan Display, Flat Panel Display, Input Technology, Coordinate System Overview,</p> <p>Scan-Conversion of graphics primitives: Scan-Conversion of a Lines (Digital Differential Analyzer Algorithm, Bresenham's Line-Drawing Algorithm, Scan-Conversion of Circle and Ellipse (Bresenham's Method of Circle Drawing, Midpoint Circle Algorithm), Drawing Ellipses and Other Conics.</p>
Unit-II	<p>Two Dimensional Transformation: Introduction to transformations, Transformation Matrix, Types of Transformations in Two-Dimensional Graphics: Identity Transformation, Scaling, Reflection, Shear Transformations, Rotation, Translation, Rotation about an Arbitrary Point, Combined Transformation, Homogeneous Coordinates, 2D Transformations using Homogeneous Coordinates</p>
Unit-III	<p>Three-dimensional transformations, Objects in Homogeneous Coordinates, Three-Dimensional Transformations: Scaling, Translation, Rotation, Shear Transformations, Reflection, World Coordinates and Viewing Coordinates, Projection, Parallel Projection, Perspective Projection.</p>
Unit-IV	<p>Viewing and Solid Area Scan-Conversion: Introduction to viewing and clipping, Viewing Transformation in Two Dimensions, Introduction to Clipping, Two-Dimensional Clipping, Point Clipping, Line Clipping, Introduction to a Polygon Clipping, Viewing and Clipping in Three Dimensions, Three-Dimensional Viewing Transformations, Text Clipping</p> <p>Introduction to Solid Area Scan-Conversion, Inside–Outside Test, Winding Number Method and Coherence Property, Polygon Filling, Seed Fill Algorithm, Scan-</p>

	Line Algorithm, Priority Algorithm, Scan Conversion of Character, Aliasing, Anti-Aliasing, Halftoning, Thresholding and Dithering
Unit-V	<p>Introduction to curves, Curve Continuity, Conic Curves, Piecewise Curve Design, Parametric Curve Design, Spline Curve Representation, Bezier Curves, B-Spline Curves, Fractals and its applications.</p> <p>Surface Design: Bilinear Surfaces, Ruled Surfaces, Developable Surfaces, Coons Patch, Sweep Surfaces, Surface of Revolution, Quadric Surfaces, Constructive Solid Geometry, Bezier Surfaces, B-Spline Surfaces, Subdivision Surfaces</p> <p>Visible Surfaces: Introduction to visible and hidden surfaces, Coherence for visibility, Extents and Bounding Volumes, Back Face Culling, Painter's Algorithm, Z-Buffer Algorithm, Floating Horizon Algorithm, Roberts Algorithm.</p>
Unit-VI	<p>Object Rendering: Introduction Object-Rendering, Light Modeling Techniques, Illumination Model, Shading, Flat Shading, Polygon Mesh Shading, Gourand Shading Model, Phong Shading, Transparency Effect, Shadows, Texture and Object Representation, Ray Tracing, Ray Casting, Radiosity, Color Models.</p> <p>Introduction to animation, Key-Frame Animation, Construction of an Animation Sequence, Motion Control Methods, Procedural Animation, Key-Frame Animation vs. Procedural Animation, Introduction to Morphing, Three-Dimensional Morphing</p>

Books:

Computer Graphics, R. K. Maurya, John Wiley.

Mathematical elements of Computer Graphics, David F. Rogers, J. Alan Adams, Tata McGraw-Hill.

Procedural elements of Computer Graphics, David F. Rogers, Tata McGraw-Hill.

Reference:

Computer Graphics, Donald Hearn and M. Pauline Baker, Prentice Hall of India.

Computer Graphics, Steven Harrington, McGraw-Hill.

Computer Graphics Principles and Practice, J.D. Foley, A. Van Dam, S.K. Feiner and R.L. Phillips, Addison Wesley.

Principles of Interactive Computer Graphics, Willaim M. Newman, Robert F. Sproull, Tata McGraw-Hill.

Introduction to Computer Graphics, J.D. Foley, A. Van Dam, S.K. Feiner, J.F. Hughes and R.L. Phillips, Addison Wesley.

Term Work:

Assignments: **Should contain at least 6 assignments (one per unit) covering the syllabus.**

Practical(Suggested):

Should contain at least 10 programs developed using C++. Some Sample practical are listed below.

1. Write a program with menu option to input the line coordinates from the user to generate a line using Bresenham's method and DDA algorithm. Compare the lines for their values on the line.
2. Develop a program to generate a complete circle based on
 - a. Bresenham's circle algorithm
 - b. Midpoint Circle Algorithm
3. Implement the Bresenham's/DDA algorithm for drawing line (programmer is expected to shift the origin to the center of the screen and divide the screen into required quadrants).
4. Write a program to implement a stretch band effect. (A user will click on the screen and drag the mouse/arrow keys over the screen coordinates. The line should be updated like rubber-band and on the right-click gets fixed).
5. Write program to perform the following 2D and 3D transformations on the given input figure
 - a. Rotate through θ .
 - b. Reflection
 - c. Scaling
 - d. Translation.
6. Write a program to demonstrate shear transformation in different directions on a unit square situated at the origin.
7. Develop a program to clip a line using Cohen-Sutherland line clipping algorithm between $(x_1, y_1)(x_2, y_2)$ against a window $(x_{min}, y_{min})(x_{max}, y_{max})$.
8. Write a program to implement polygon filling.
9. Write a program to generate a 2D/3D fractal figures (Sierpinski triangle, Cantor set, tree etc).
10. Write a program to draw Bezier and B-Spline Curves with interactive user inputs for control polygon defining the shape of the curve.
11. Write a program to demonstrate 2D animation such as clock simulation or rising sun
12. Write a program to implement the bouncing ball inside a defined rectangular window.

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