

B.E. INFORMATION TECHNOLOGY 2ND YEAR-2ND SEMESTER EXAMINATION- 2022**Subject: Graphics and Geometric Modeling****Time: 3 hrs.****Full Marks: 100***(Note: Answers of all parts/subparts of a question should be written together)*

| | |
|-------------|---|
| CO1 (15) | <p>Q.1 Answer any <i>one</i>:</p> <p>a.</p> <ol style="list-style-type: none"> Given the centre point coordinates (10, 10) and radius as 15 unit, generate all the points (in the 1st octant) to form a circle using Bresenham circle drawing algorithm. Consider two different raster systems with resolutions of 640×480 and 1280×1024. What is the size of frame buffer (in bytes) for each of these systems to store 12 bits per pixel? Explain with suitable example: why 8-connected boundary fill algorithm is efficient than 4-connected. <p style="text-align: right;">7+4+4</p> <p>b.</p> <ol style="list-style-type: none"> Given the centre point coordinate (15, 15) and radius as 20, generate all the points (in the 1st octant) to form a circle using midpoint circle drawing algorithm. How much time is spent scanning across each row of pixels during screen refresh on a raster system with resolution of 1280×1024 and a refresh rate of 60 frames per second? How does aspect ratio affect the performance of CRT? Differentiate between raster scan display and random scan display. <p style="text-align: right;">7+3+(2+3)</p> |
| CO2 (25) | <p>Q.2 Answer any <i>one</i>:</p> <p>a.</p> <ol style="list-style-type: none"> Design a Bezier curve controlled by four control points (2, 2), (3, 4), (5, 4), and (7, 5). Determine the cubic Bezier blending functions for four control points. Plot each function and label the maximum and minimum values Suppose the knot vector of a B-spline is {0, 0, 0, 1, 2, 3, 3, 3}. Find the possible values of number of control points and degree of the polynomial. How do B-Spline curves allow local control over the shape? <p style="text-align: right;">10+8+4+3</p> <p>b.</p> <ol style="list-style-type: none"> A cubic splined curve has start and end point at (20, 0) and (7, 2) respectively. The tangent vectors at start and end points meet at (18, 9). Determine the Hermit cubic spline curve and hence find out its mid-point. Determine the Bezier blending functions for five control points. Plot each function and label the maximum and minimum values. Define knot vector of B-Spline curves. What are the practical applications and disadvantages of B-spline curve? <p style="text-align: right;">10+9+3+3</p> |
| CO3 (25) | <p>Q.3 Answer any <i>one</i>:</p> <p>a.</p> <ol style="list-style-type: none"> A triangle having vertices (2, 2, 2), (4, 4, 4), and (4, 2, 2), is rotated 45° about Y-axis. Find the new coordinates of the rotated triangle after reflection on XY plane. The lower left-hand corner and upper right-hand corner of a rectangular window are at (-3, 1) and (2, 6) respectively. Using Sutherland-Cohen algorithm, check and find the visibility portion of the line segments AB, BC and CD for A(-4, 2), B(-1, 7), C(-1, 5), and D(-2, 3) in the clipping window. What is multi-point perspective and when it is used? Reflection is a special case of rotation- justify your answer. <p style="text-align: right;">9+10+(4+2)</p> <p>b.</p> <ol style="list-style-type: none"> A triangle having vertices (2, 2, 2), (4, 4, 4), and (4, 2, 2), is rotated 45° about Z-axis. Find the new coordinates of the reflected rotated triangle on YZ plane. A polygon formed by the vertices A(-4, 2), B(-1, 7), C(-1, 5), D(1, 2), and E(1, -2) is clipped by the clipping window with lower left-hand corner and upper right-hand corner at (-3, 1) and (2, 6) respectively. Find the clipped polygon using a suitable polygon clipping algorithm. What is vanishing point and why it is so important? How does translation affect the rotation of an object about a point? <p style="text-align: right;">9+10+(3+3)</p> |

| | |
|-------------|--|
| CO4 (15) | <p>Q.4 Answer any <i>one</i>:</p> <p>a.</p> <ol style="list-style-type: none"> What is chromaticity? Find out CMY and YIQ color vectors whose equivalent RGB vector is (60, 120, 180). Differentiate (with examples) among flat, gouraud and phong shadings. Describe Rediosity as a technique of rendering. <p style="text-align: right;">(2+4)+5+4</p> <p>b.</p> <ol style="list-style-type: none"> What is half toning and how dithering technique is related with it? Find the YIQ vector of white, black and perfect grey colors. Compare ambient light, diffusion reflection, and specular reflection types of illumination models. Describe Ray-tracing as a technique of rendering. <p style="text-align: right;">(3+3)+5+4</p> |
| CO5 (13) | <p>Q.5 Answer any <i>one</i>:</p> <p>a.</p> <ol style="list-style-type: none"> Explain with examples of various feasible set operations in CSG modeling. How is polygon mesh useful in modeling solids? How is scene graph used in 3D modeling? Find the total length after 5th order of Koch Curve fractal where number of segments and scaling factor are 5 and 1/4 respectively. <p style="text-align: right;">(3+3)+(3+4)</p> <p>b.</p> <ol style="list-style-type: none"> What is octree mesh and how do we use (i.e., implement) octrees in 3D modeling? Differentiate octree from quadtree. Write the disadvantages of wireframe model. Find the fractal dimension of the above problem (in Q.5 a-ii). <p style="text-align: right;">(3+2)+(3+3)</p> |
| CO6 (7) | <p>Q.6 Answer any <i>one</i>:</p> <p>a. Is VR and 3D the same? What are the various types of VR and how it is distinguished from AR? Write the disadvantages of VR.</p> <p style="text-align: right;">1+2x3</p> <p>b. What is morphing? Write the generic steps of morphing. What is the role of 3D Visualizer? Name some generalized authoring metaphors.</p> <p style="text-align: right;">1+2x3</p> |

-: Course Outcomes :-

CO1: Describe fundamental terms of computer graphics and input-output devices of Computer Graphics and Explain the algorithms for Raster scan Graphics.

CO2: Illustrate curve and surface representation and drawing algorithms.

CO3: Compute 2D and 3D Geometric transformations and apply viewing algorithms in typical cases.

CO4: Describe color representation and rendering mechanisms of images.

CO5: Describe Object representation and Illustrate Geometric Modeling.

CO6: Discuss various topics of advanced computer graphics such as fractals, animations, morphing etc.