

B.E. INFORMATION TECHNOLOGY 2ND YEAR-2ND SEMESTER EXAMINATION– 2023**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 (a) and any one from (b) and (c):</p> <p>a. Given the center point coordinate (20, 20) and radius as 25 unit, generate all the points (in the 1st octant) to form a circle using Bresenham circle drawing algorithm. 7</p> <p>b.</p> <p>i. How long would it take to load a 640 x 480 frame buffer with 12 bits per pixel, if 105 bits can be transferred per second? How long would it take to load a 24-bit per pixel frame buffer with a resolution of 1280 x 1024 using this same transfer rate?</p> <p>ii. Explain with example: efficiency of 8-connected boundary fill algorithm over 4-connected. 4+4</p> <p>c.</p> <p>i. Suppose you have a system with a 12 inch by 14 inch video monitor that can display 120 pixels per inch. If memory is organized in one byte words, the starting frame buffer address is 0, and each pixel is assigned 4 bits of storage, what is the frame buffer address of the pixel with screen coordinates (x, y)?</p> <p>ii. How does aspect ratio affect the performance of CRT? Differentiate between raster scan display and random scan display. 4+(2+2)</p>
CO2 (25)	<p>Q.2 Answer (a) and any one from (b) and (c):</p> <p>a.</p> <p>i. Design a Bezier curve controlled by four control points (3, 4), (4, 5), (5, 6), and (7, 4).</p> <p>ii. A cubic splined curve has start and end point at (15, 0) and (8, 3) respectively. The tangent vectors at start and end points meet at (16, 8). Determine the Hermit cubic spline curve and hence find out its mid-point. 10+8</p> <p>b.</p> <p>i. 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.</p> <p>ii. What are the practical applications and disadvantages of B-spline curve? 4+3</p> <p>c.</p> <p>i. Define knot vector of B-Spline curves. How do B-Spline curves allow local control over the shape?</p> <p>ii. Define C^0, C^1, and C^2 continuity used in splines. (2+2)+3</p>
CO3 (25)	<p>Q.3 Answer any one:</p> <p>a.</p> <p>i. A triangle having vertices (2, 4, 4), (1, 4, 2), and (4, 4, 2), is rotated 45° around a point $(7/3, 4, 8/3)$. Find the new coordinates of the rectangle.</p> <p>ii. 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.</p> <p>iii. Show that the composition of two rotations is additive by concatenating the matrix representations for $R(\theta_1)$ and $R(\theta_2)$ to obtain $R(\theta_1) \cdot R(\theta_2) = R(\theta_1 + \theta_2)$. What is vanishing point and why it is so important? 8+10+(4+3)</p> <p>b.</p> <p>i. Vertices of a triangle are (2, 4, 4), (1, 4, 2), and (4, 4, 2). Find the new coordinates of the triangle when it is rotated 45° about X, Y and Z-axis (separately).</p> <p>ii. Prove that the multiplication of transformation matrices for each of the following sequences is commutative: i) Two successive rotations, ii) Two successive translations, iii) Two successive scalings.</p> <p>iii. What is multi-point perspective and when it is used? Reflection is a special case of rotation- justify your answer. How does translation affect the rotation of an object about a point? 8+(3x3)+(4+2+2)</p>

<p>CO4 (15)</p>	<p>Q.4 Answer (a) and any one from (b) and (c):</p> <p>a.</p> <p>i. Write short notes on any two rendering techniques: Rediosity, Ray-casting and Ray-tracing. ii. Find out RGB and CMY color vectors whose equivalent YIQ vector is (50, 60, 70) (3+3)+3</p> <p>b.</p> <p>i. Differentiate (with examples) among flat, gouraud and phong shadings. ii. How many intensity levels can be displayed with halftone approximations using $n \times n$ pixel grids, where each pixel can be displayed with m different intensities? 4+2</p> <p>c.</p> <p>i. Define depth peeling. How to determine it? Write some issues of depth peeling. ii. Discuss the differences you might expect to see in the appearance of specular reflections modeled with (N.H)^{ns} compared to specular reflections modeled with (V.R)^{ns}. 4+2</p>
<p>CO5 (13)</p>	<p>Q.5 Answer any one:</p> <p>a.</p> <p>i. How is scene graph used in 3D modeling? What is the fastest way to insert and move a rectangle object into a linear octree? ii. Differentiate between Euclidean dimensions and Fractal dimensions? How to use Ray-casting typically to implement CSG operators? iii. Differentiate octree from quadtree. Write the disadvantages of wireframe model. 4+5+4</p> <p>b.</p> <p>i. Find the total length after 5th order of Koch Curve fractal where number of segments and scaling factor are 5 and 1/4 respectively. Also find the fractal dimension. ii. Explain with examples of various feasible set operations in CSG modeling. How is polygon mesh useful in modeling solids? iii. What is content modeling? How to use wireframes in content modeling? 5+4+4</p>
<p>CO6 (7)</p>	<p>Q.6 Answer any one:</p> <p>a. What can we do to reduce people's resistance towards a VR or AR or MR product? What are the alternatives for VR/AR/MR? Why AR is better than VR for artists and creatives? 3+2+2</p> <p>b. Define morphing and its generic steps? Write the features of authoring tools. Define snowflake fractals. 3+2+2</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.