[This question paper contains 7 printed pages]

Your Roll No.	:	.....
Sl. No. of Q. Paper	:	**8074 I**
Unique Paper Code	:	2343010016
Name of the Paper	:	Computer Graphics (DSE)
Name of the Course	:	**B.Sc. (Hons.) Computer Science**
Semester	:	VI

Time : 3 Hours ***Maximum Marks : 90***

Instructions for Candidates :

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Question **No. 1 (Section - A)** is compulsory.

(c) Attempt any **4 (four)** questions from **Section-B**.

(d) Parts of a question should be attempted together.

Section - A

1. (a) An RGB raster system is to be designed using an 8 × 10 inches screen with a resolution of 100 pixels per inch in each direction. If 6

P.T.O.

bits per pixel required to be stored in the frame buffer, how much storage in bytes is required for the frame buffer ? Also find the aspect ratio of the raster system. 3

(b) What is antialiasing ? Name any **one** antialiasing technique ? 3

(c) Show that 2 × 2 matrix [T] given below is a pure rotation matrix. 3

$$[T] = \begin{bmatrix} \frac{1-b^2}{1+b^2} & \frac{2b}{1+b^2} \\ \frac{-2b}{1+b^2} & \frac{1-b^2}{1+b^2} \end{bmatrix}$$

(d) Scan convert a line from screen coordinate (1, 1) to (3, 2), using Bresenham's line drawing algorithm. 3

(e) How can you compute the depth value z of a pixel at (x, y) in Z buffer algorithm. Using incremental calculations find out the depth value Z (x + 1, y) and Z (x, y + 1). 3

(f) What is a gradient vector ? Why is it necessary while scan converting the Ellipse ? 3

(g) Consider a Bezier curve with end points, P1 and P4 in x – direction as 4 and 8 respectively. The two intermediate control points P1 being 6 and P3 being 7 in x – direction. What will be the magnitude of tangent vector R1 at P1 and magnitude of tangent vector R4 at P4 in x – direction. 3

(h) Explain frequency, brightness and purity of light. 3

(i) What is diffuse reflection ? However is it different form specular reflection ? 3

(j) Define projection. Give any **two** differences between parallel and perspective projections. 3

Section - B

2. (a) Consider a line PQ with position vectors of the end points as P [0 2] and Q [4 6] and transformation matrix [T] = $\begin{bmatrix} 2 & 4 \\ 6 & 2 \end{bmatrix}$.

Find transformed line P* Q*. Also prove that the mid point of the transformed line corresponds to the mid point of the untransformed line after transformation. 7

(b) Using Sutherland Hodgeman polygon clipping algorithm, clip the triangle ABC with the vertices as P (10, 17) ; Q (13. 12) ; R (3, 8) ; against a rectangular window A (5, 5) ; B (15, 5) ; C (15, 5) ; and D (5, 15).Give the coordinates of the clipped polygon. 8

3. (a) Differentiate between trimetric and isometric axonometric projections. Consider a triangle ABC with A (0, 0); B (10, 0); and (0, 10). Apply single point perspective projection onto y = 0 plane from the centre of projection at $y_c = -2$, Also state the coordinates of vanishing points. 7

(b) What is morphing ? What are the two rules to equalize the key frames 'K' and 'K + 1' in an animation scene. Using any one of the these rules transform may triangle into a pentagon. 8

4. (a) What is a Hermite curve ? Derive the basis matrix for parametric cubic Hermite curve. Also obtain its blending function. 7

(b) List the data structures used in scan line polygon filling algorithm. Showing all steps, apply the algorithm to a polygon with the vertex list in given order : 8

$V_1(1,1)$; $V_2(1, 5)$; $V_3(2, 5)$; $V_4(2, 7)$; $V_5(5,7)$; $V_6(5,5)$; $V_7(7, 5)$; $V_8(7, 1)$; $V_9(5, 1)$; $V_{10}(5, 2)$; $V_{11}(3, 2)$; $V_{12}(3,1)$; $V_{13}(1,1)$

5. (a) What is old parity rule for filling a polygon ? Consider a rectangle ABCD A (5, 5); B (10, 5); C (10, 10); and D (5, 10). Using. odd parity rule, discuss whether the following horizontal lines of the rectangle will be drawn or not ? 7

(i) AB

(ii) CD

(b) Consider two Bezier curve segments defined by control points P_1 (20, 20); P_2 (40, 50); P_3 (60, 20); and P_4 (80, 20). Another curve segment is defined by Q_1(a, b); Q_2(c, d); Q_3 and Q_4. Find point Q_1 and Q_2 such that two curves join smoothly and C^1 continuity exist them. 8

6. (a) Explain Specular Reflection and Phong model. 7

(b) Use the Cohen Sutherland algorithm to clip line A (70, 20) and B (100, 10) against a window lower left hand corner (50, 10) and upper right hand corner (80, 40). 8

7. (a) Find the transformation matrix that reduces the square ABCD whose centre is at (2, 2) to half of its size, with centre still remaining at (2, 2). The coordinates of the square ABCD are A (0, 0); B (0, 4); C (4, 4) and D (4, 0). Find the coordinates of new square. 7

(b) Explain the Warnock's area sub – division algorithm for visible surface determination. Does it uses image space or objects space method ? 8

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