

This question paper contains 4 printed pages]

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S. No. of Question Paper : 9941

Unique Paper Code : 2343010016

Name of the Paper : Computer Graphics

Name of the Course : B.Sc. (H) Computer Science

Semester : VII

Duration : 3 Hours

Maximum Marks : 90

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

The paper has two sections A and B. Section A is compulsory.

Attempt any four questions from Section B. Each question is of 15 marks.

Answer all parts of a question together.

### Section-A

1. (a) Write steps to design an animation sequence. 3
- (b) Two-dimensional rotations are commutative. State whether true or false.  
Justify your answer. 3
- (c) Differentiate between diffuse reflection and specular reflection. 3
- (d) Scan convert first three points of a line segment from (3, 4) to (13, 9)  
using DDA line drawing algorithm. 3
- (e) Briefly explain persistence, bitmap and refresh rate. 3

P.T.O.

- (f) Specify the steps to equalize the set of edges in key frame  $K$  having 4 edges and key frame  $K + 1$  having 10 edges. 3
- (g) In a chromaticity diagram of a RGB color model, define complementary colors and pure colors. 3
- (h) What is the vanishing point in perspective projection? Illustrate with an example. 3
- (i) Prove that parallel lines remain parallel after generalized 2D transformation. 3
- (j) Explain beam penetration method of random scan using appropriate diagram. 3

### Section-B

2. (a) A cubic Bezier curve is defined by control points  $P_0 (3, 3)$ ,  $P_1 (5, 9)$ ,  $P_2 (9, 9)$  and  $P_3 (10, 6)$ . Another curve segment is defined by  $Q_0 (a, b)$ ,  $Q_1 (c, 3)$ ,  $Q_2 (16, 3)$ ,  $Q_3 (19, 3)$ . Find the values of  $a$ ,  $b$  and  $c$  such that the curve segments join smoothly with  $C_1$  continuity between them. 7
- (b) Use the Sutherland-Hodgman polygon clipping algorithm to clip a polygon with vertices  $A (1, 1)$ ,  $B (10, 4)$ ,  $C (7, 12)$  and  $D (3, 8)$  against a clipping window defined by vertices  $(2, 2)$ ,  $(8, 2)$ ,  $(8, 8)$  and  $(2, 8)$ . 8

3. (a) Consider a polygon with vertices PQRS with coordinates P (2, 2), Q (6, 5), R (8, 3), and S (4, 7). Using the scan line fill algorithm, show the global edge table and active edge table till scan line  $y = 5$ . 7

- (b) The triangle ABC with position vectors  $[1 \ 0]$ ,  $[0 \ 1]$  and  $[-1 \ 0]$ , is transformed by transformation matrix,  $T = \begin{bmatrix} 3 & 2 \\ -1 & 2 \end{bmatrix}$  to create a second triangle  $A^*B^*C^*$ . Compute the area of new triangle by using area of the original triangle and transformation matrix. 8

4. (a) Given an ellipse with major axis of 16 units and minor axis of 12 units. Determine the first 6 raster positions along the ellipse path, considering the first raster position at (0, 6). 7

- (b) Consider the position vector :

$$[X] = \begin{bmatrix} 3 & 2 & 5 & 1 \end{bmatrix} \quad 8$$

Find the resultant position vector after applying the given sequence of 3D transformations in order.

- (i) Rotate  $90^\circ$  counter clockwise about the z-axis
- (ii) Reflect about xy-plane
- (iii) Two-point perspective projection on  $z = 0$  plane with centre of projection on z-axis as 2.0 and along y-axis as -1.0.

P.T.O.

5. (a) Explain Gouraud shading method. Write *two* merits and *two* demerits of this method. 7
- (b) Explain the basic working principle of the Z-buffer algorithm for hidden surface determination. How does it ensure that only the visible surfaces are displayed? Give *one* advantage and *one* disadvantage of the algorithm. 8
6. (a) Briefly explain the significance of illumination models in realistic rendering. Explain ambient, diffuse, and specular reflections. 7
- (b) Derive the basis matrix for parametric cubic Hermite curve. Also, obtain its blending functions. Write *two* characteristics of Hermite curves. 8
7. (a) What is anti-aliasing and explain *three* anti-aliasing techniques in detail. 7
- (b) Compute the composite 2D transformation matrix when the following transformations are applied in order : 8
- (i) Rotation about origin by  $90^\circ$
  - (ii) Translation in  $x$ -direction by 20 units
  - (iii) Uniform scaling by a factor of 3
  - (iv) Reflection about line  $y = -x$
- [Use homogenous co-ordinates]