[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4786 **E**

Unique Paper Code : 32341602

Name of the Paper : Computer Graphics

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

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Attempt any **four** questions from **Section B**.
4. Parts of a question must be answered together.

SECTION A

1. (a) What is a polygon Mesh? List any one polygon mesh representation. (2)

P.T.O.

(b) Consider a polygon with vertices ABCD with co-ordinates A(1,2), B(6,6), C(8,3) and D(5,10). Trace the contents of Active Edge Table according to scan line fill algorithm. (3)

2. (a) Define horizontal and vertical retracing. (2)

(b) What are the properties of unweighted area sampling technique of anti-aliasing? (3)

3. (a) Why is depth-sort algorithm for visible surface determination called painter's algorithm? (2)

(b) Prove that parallel lines remain parallel under 2-D Transformations. (3)

4. (a) Differentiate between orthographic and oblique projections. (2)

(b) Rotate a triangle with coordinates A(0,0), B(1,1), C(5, 2) by 45° about coordinate C in clockwise direction. (3)

5. (a) How to convert RGB color model to CMY color model? (2)

(b) Draw a 3 X 3 pixel grid pattern to display 10 intensities on a bi-level system display. Show patterns for all the intensity values. (3)

6. (a) What is the condition to switch from region 1 to region 2 of the first quadrant of an ellipse in mid-point ellipse drawing algorithm? (2)

(b) What is diffuse reflection? How is it different from specular reflection? (3)

7. (a) Differentiate between cabinet and cavalier parallel projections. (2)

(b) Write the 4X4 3-D transformation matrices for each of the following transformations respectively :

(i) Uniform scaling to double the size of an object.

(ii) Translate an object 2 units in x direction and 3 units in y direction. (3)

SECTION B

8. (a) Explain briefly raster scan display architecture. (4)

P.T.O.

(b) Give the steps to clip the lines PQ and RS (having co-ordinates P(5,12), Q(20,25), R(11,8) and S(25,16)) against the clip rectangle ABCD (having co-ordinates A(10,20), B(20,20), C(10,10), D(20,10)) using Cohen Sutherland line clipping Algorithm. (6)

9. (a) Consider a 3D object with coordinate points P(0,3,3), Q(3,3,6), R(3,0,1) and S(0,0,0). Perform a local scaling on the object with scaling factors of 2, 3 and 3 along X, Y and Z axes respectively, to obtain the new coordinates of the transformed object. (4)

(b) A cubic Bezier curve segment is described by control points $P_0(2,2)$, $P_1(4,8)$, $P_2(8,8)$ and $P_3(9,5)$. Another curve segment is described by $Q_0(a,b)$, $Q_1(c,2)$, $Q_2(15,2)$ and $Q_3(18,2)$. Find the values of a, b, c, such that the curve segments join smoothly and C^1 continuity exist between them. (6)

10. (a) Write steps to shade an object using Phong shading method of polygon rendering? How does it overcome the drawback of Gouraud shading method? (5)

(b) Consider a line from (0,0) to (5,5). Rasterize the line using Bresenham line drawing algorithm. (5)

11. (a) Reflect the polygon whose vertices are A(−1, 0), B(0, −2), C(1,0) and D(0,2) about the line x = 2 using homogeneous co-ordinates. (4)

(b) Clip the polygon ABCD with the vertices A(0,7), B(5,12), C(7,7) and D(6,2) against the window P (2,0), Q(10,0), R(10,10) and S(2,10) using the Sutherland-Hodgeman Polygon Clipping algorithm. Also show out vertex array at each step. (6)

12. (a) Explain Hue, Saturation and Value in HSV color model. (3)

(b) Consider a line segment AB parallel to the Z axis with end points A[3 2 2 1] and A[3 2 4 1], Overall scale to double the size of line AB followed by 2-point perspective projection with COP along x-axis and Y-axis as Xc=10 and Yc=20 respectively. Also, write the corresponding vanishing points. (7)

13. (a) Explain depth sort algorithm for visible surface determination. (5)

P.T.O.

(b) A rectangular parallelopiped is given. Its length on x-axis, y-axis and z-axis is 3, 2 and 1 respectively. Perform a rotation by an angle 90° about x-axis followed by a rotation by an angle 90° about y-axis. (5)

14. (a) Consider a rectangular parallelepiped with coordinates :

$$\begin{bmatrix} 0 & 0 & 1 & 1 \\ 3 & 0 & 1 & 1 \\ 3 & 2 & 1 & 1 \\ 0 & 2 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 3 & 0 & 0 & 1 \\ 3 & 2 & 0 & 1 \\ 0 & 2 & 0 & 1 \end{bmatrix}$$

Apply a trimetric projection on the given position vectors by performing rotation by an angle $\phi = 30^0$ about the y-axis, followed by a rotation by an angle $\theta = 45^0$ about the x-axis, followed by orthographic parallel projection onto the $z = 0$ plane. Also, find the three foreshortening ratios. (6)

(b) Given two keyframes for an object transformation, first keyframe contains a triangle and the second keyframe contains a quadrilateral. Convert the triangle into the quadrilateral by equalizing vertex counts. (4)