BACHELOR OF COMPUTER SCIENCE & ENGG. EXAMINATION, 2019
(3rd YEAR , 1st SEMESTER)

COMPUTER GRAPHICS

Time: Three Hours   **Full Marks: 100**

Answer ONE question from EACH group

Group-1 (25 Marks)

1. a) Consider the line from (0, 0) to (-8,-4), use general Bresenham's line algorithm to rasterize this line. Evaluate and tabulate all the steps involved.   **10**

    b) Derive decision parameters for the midpoint circle algorithm assuming the start position as $(r_x, 0)$ and points are to be generated along the "counter clockwise" order.   **10**

    c) Check if point (3, 4) is inside concave polygon defined by vertices (1, 1), (6, 3), (4, 6), (1, 5), (2, 3), (1,1).   **5**

OR

2. a) Given input ellipse parameters $r_x = 8\ and\ r_y = 6$, centred at origin, illustrate the steps in the midpoint ellipse algorithm by determining raster positions along the ellipse path in the first quadrant.   **15**

    b) Write a boundary-fill procedure to fill an 8-connected region   **5**

    c) Write a short note on Flat-Panel Displays   **5**

Group-2 (25 Marks)

3. a) Prove that two successive 2D rotations are additive: $R(\theta_1) \cdot R(\theta_2) = R(\theta_1 + \theta_2)$ **10**

    b) Set up a detailed algorithm for Cohen-Sutherland Line clipping   **15**

OR

4. a) Prove that the transformation matrix for reflection about the line $y = -x$, is equivalent to a reflection relative to the $y - axis$, followed by a counter-clockwise rotation of 90°.   **10**

    b) Set up a detailed algorithm for Sutherland-Hodgeman polygon clipping   **15**

Group-3 (25 Marks)

5. a) Given a unit cube with one corner at (0,0,0) and the opposite corner at (1,1,1). 12
Derive the transformations necessary to rotate the cube by θ degrees about the main
diagonal from (0,0,0) to (1,1,1) in the counter clockwise direction, when looking
along the diagonal toward the origin.

   b) What are Polygon Tables? Give a suitable example. 8

   c) Discuss the basic characteristics of a Fractal object. 5

OR

6. a) Prove that the multiplication of three-dimensional transformation matrices for each of 12
the following sequence of operations is commutative (i.e., $A \times B = B \times A$)

       i) any two successive translations

       ii) any two successive scaling operations

       iii) any two successive rotations in "any one" of the coordinate axes

   b) What are the different types of projections? Derive the matrix equation for 13
perspective projection.

Group-4 (25 Marks)

7. a) What is a Convex Hull? Discuss the basic characteristics of Bézier Spline Curves. 10

   b) What is the Phong model for Specular Reflection? Derive the formulation for diffuse 10
and specular reflections from multiple light sources.

   c) Briefly discuss the A-Buffer algorithm for hidden surface removal 5

OR

8. a) What are the advantages and disadvantages between the Phong and Gouraud surface 12
rendering models?

   b) What is Ray-Tracing? Discuss the Tay-Tracing Tree with an example. 8

   c) Briefly discuss the Painter's algorithm for hidden surface removal 5