BACHELOR OF COMPUTER SCIENCE & ENGG. EXAMINATION, 2024
(3rd YEAR , 1st SEMESTER)

COMPUTER GRAPHICS

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

Read the Following Instructions Carefully:

Let R be the last two digits of your Exam Roll No. and let R_1 and R_2 be the two digits in your Roll No. For example, If your Roll No. is 23, then, $R = 23$, $R_1 = 2$ and $R_2 = 3$; $R_1 + R_2 = 5$. If your Roll No. is 05, then, $R = 5$, $R_1 = 0$ and $R_2 = 5$; $R_1 + R_2 = 5$.

Answer ONE question from EACH group

Group-1 (25 Marks)

1. a) What is DDA Line drawing algorithm? What are the disadvantages of DDA algorithm? **5**
   b) Digitize a line from (R_1,12) to (15, R_2) on a raster screen using Bresenham's straight-line Algorithm (compute upto 10 points) **15**
   c) What is an inside-outside test? Briefly discuss two algorithms with suitable examples. **5**

OR

2 a) Calculate the pixel locations approximating the first octant of a circle having a centre at (4,5) and a radius $R_1 + R_2$ units using Bresenham's algorithm. What is 8-point symmetry? **15**
   b) What is the scan-line polygon fill algorithm? How is it different from seed-fill algorithms? Explain it with a concave polygon example. **10**

Group-2 (25 Marks)

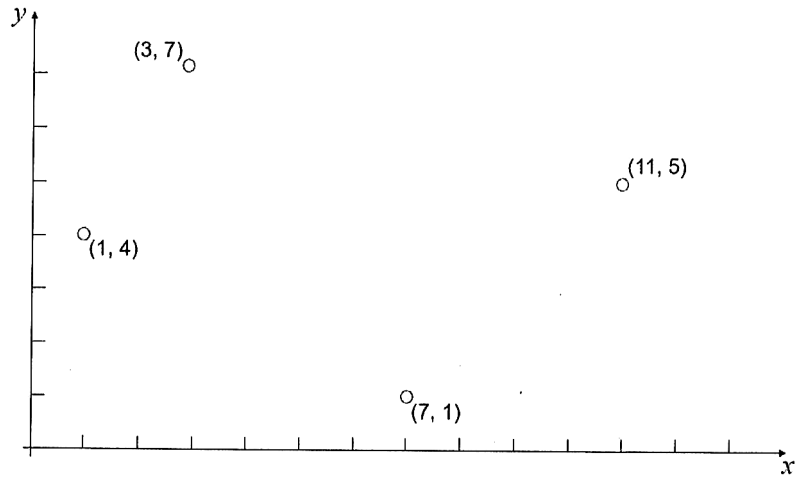
3. a) What is Affine transformation? Write the homogeneous coordinate matrix representation for 2D translation and rotation. **5**
   b) Generate the transformation matrix for scaling an object with respect to an arbitrary position (x, y) not at the origin. **5**
   c) Explain the Weiler-Atherton Polygon Clipping algorithm, step-by-step, with a concave polygon example. **15**

OR

4. a) Let ABCD be the rectangular window with A(0,0), B(10,0), C(10,10), D(0,10). Use Nicholl–Lee–Nicholl Algorithm to clip a line XY, such that X(-5,R_1) and Y(15,R_2). **10**
   b) Explain Sutherland-Hodgeman Polygon Clipping algorithm, step-by-step, with a concave polygon example. **15**

Group-3 (25 Marks)

5. What are interpolation and approximation splines? What is a convex hull? What is a control graph? Derive the equation of a cubic Bezier curve and generate the intermediate points on the curve for the following control points ($\Delta u = 0.20$). **25**



OR

6. **a)** Derive the formulation for a Uniform B-Spline curve. **10**
   b) What is a Fractal? Briefly explain the Koch Snowflake **5**
   c) How to model objects in 3-D? Briefly discuss the following: **10**
      a) Sweep representations
      b) Octrees

Group-4 (25 Marks)

7. **a)** What are Diffuse and Specular Reflections? Derive the formulation for diffuse and specular reflections from multiple light sources, with RGB color considerations. **15**
   b) Briefly discuss the Depth buffer and Z-Buffer algorithms for hidden surface removal, with suitable examples. **10**

OR

8. **a)** Discuss Gouraud surface rendering model in detail. What are its limitations? How it could be improved to achieve better rendition effects? **15**
   b) Briefly discuss the Scanline algorithm for hidden surface removal **5**
   c) What is a Ray-Tracing tree? **5**