

- (b) A Bezier curve is to be drawn given the control points P_0 (30, 20), P_1 (10, 15), P_2 (20, 40) and P_3 (50, 30). Calculate the co-ordinates of the points corresponding to the parameter $t=0.2, 0.4$.
- (c) What is the Convex Hull property of Bezier curves? How is it satisfied?

4 + 4 + 4 = 12

Group - E

8. (a) Compare and contrast between Constant Shading and Interpolated shading.
- (b) "Cyclic Overlapping hinder Painter's algorithm" - Explain the statement with suitable diagram.
9. (a) Explain the intensity calculation according to Phong Shading with respect to a suitable diagram.
- (b) What factors make ray-tracing computationally expensive? Explain the algorithm for two pass ray tracing.

6 + 6 = 12

6 + 6 = 12

**COMPUTER GRAPHICS
(MCAP 2203)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

**Group - A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Consider a raster system with resolution 1280 by 1024. What size frame buffer (in KB) is needed for this system to store 12 bits per pixel?
 (a) 106 (b) 15360
 (c) 1920 (d) 848.
- (ii) Line clipping algorithm that follows 'Divide and Conquer' strategy is
 (a) sutherland hodgman (b) cohen sutherland
 (c) midpoint subdivision (d) cyrus beck.
- (iii) Dragging is achieved through which of the following transformations?
 (a) Translation (b) Rotation
 (c) Scaling (d) Shearing.
- (iv) Consider a raster system with a resolution of 640 by 480. If the display controller refreshes the screen at a rate of 60 frames per second, what is the access time per pixel?
 (a) 54.25 ns (b) 64.25 ns
 (c) 50.45 ns (d) 48.55 ns.
- (v) An accurate and efficient raster line generating algorithm is
 (a) Bresenham's line algorithm (b) Mid-point algorithm
 (c) Parallel line algorithm (d) DDA algorithm.

- (vi) Which of the following algorithms to fill polygons was the one used by real rasterizers?
 (a) Flood-Fill Polygons (b) Scan-Line Polygon
 (c) Boundary Fill Polygons (d) None.
- (vii) The Cohen-Sutherland algorithm divides the surface region into _____ number of regions.
 (a) 8 (b) 6
 (c) 7 (d) 9.
- (viii) Which of the following techniques is used in midpoint subdivision for line clipping?
 (a) Linear Search (b) Binary Search
 (c) Bubble Sort (d) Selection Sort.
- (ix) The CMY coordinates of a colour that is at (0.2, 1, 0.4) in the RGB space is
 (a) (0.8, 1, 0.4) (b) (0.8, 0, 0.4)
 (c) (0.2, 0, 0.6) (d) (0.8, 0, 0.6).
- (x) If we want to cut a 512×512 sub-image out from the center of an 800×600 image, what are the coordinates of the of the pixel in the large image that is at the lower left corner of the small image?
 (a) (144, 144) (b) (150, 150)
 (c) (800, 512) (d) (512, 600).

Group - B

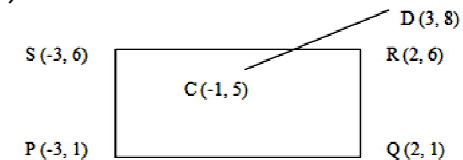
2. (a) Suppose RGB raster system is to be designed using on 8 inch×10 inch screen with a resolution of 100 pixels per inch in each direction.
 (i) If we want to store 6 bits per pixel in the frame buffer, how much storage (in bytes) do we need for frame buffer?
 (ii) Suppose it has a non-interlaced 72 Hz refresh with 8% of the scan time is required for horizontal retrace and that 7% of the frame time is required for vertical retrace. What is the time required for a single scan line, including one horizontal retrace?
- (b) What are the various input devices used for computer graphics? Describe any two briefly.
- (2 + 4) + 6 = 12**
3. (a) Explain three major adverse side effects of scan conversion? Describe line drawing with DDA algorithm. Briefly describe the drawbacks of this algorithm?

- (b) For a straight line, two end points are (2, -3) and (14, -7). Using DDA algorithm if the line is processed from left end point, what is the third calculated pixel?

$$9 + 3 = 12$$

Group - C

4. (a) Show that transformation matrix for a reflection about the line $y = -x$ is equivalent to a reflection relative to the y -axis followed by a counter-clockwise rotation of 90° .
- (b) Reflect the diamond-shaped polygon whose vertices are A(-1, 0), B(0, -2), C(1, 0) and D(0, 2) about
 (i) the horizontal line $y = 2$
 (ii) about the vertical line $x = 2$ and
 (iii) the line $y = x + 2$.
- 4 + (2 + 2 + 4) = 12**
5. (a) Clip the line CD using midpoint subdivision algorithm (use tolerance level 0.1).



- (b) What is a viewport? Find a normalization transformation from the window whose lower left corner is at (0,0) and upper right corner is at (4,3) onto the normalized device screen so that aspect ratios are preserved.

$$6 + (2 + 4) = 12$$

Group - D

6. (a) Derive the 3D transformation matrix to rotate an object within YZ plane.
 (b) What is projection? Compare between Perspective and Parallel projections with reference to practical applications.
- 6 + 6 = 12**
7. (a) State different degrees of continuity at the connection points of piecewise curves and their significance.