

Register No.: ..... Name: .....

## SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**SIXTH SEMESTER B.TECH DEGREE EXAMINATION (R,S), MAY 2024**

**COMPUTER SCIENCE AND ENGINEERING**

**(2020 SCHEME)**

**Course Code : 20CST304**

**Course Name: Computer Graphics and Image Processing**

**Max. Marks : 100**

**Duration: 3 Hours**

### PART A

*(Answer all questions. Each question carries 3 marks)*

- Differentiate between raster scan display and random scan display systems.
- Suppose you have a raster system designed using an 8 inches  $\times$  10 inches screen with a resolution of 100 pixels per inch in each direction. What frame buffer size is required if 6 bits are stored per pixel in the buffer?
- Write the flood fill algorithm for filling a polygon.
- Show that the composition of two successive rotations are additive:  
 $R(\theta_1).R(\theta_2) = R(\theta_1 + \theta_2)$ .
- Define the terms window, viewport and windowing transformation in the context of 2D viewing with suitable diagrams.
- How does Cohen Sutherland algorithm determine whether a line is visible, invisible or a candidate for clipping based on the region codes assigned to the end points of the line?
- Consider the image segment shown. Let  $V$  be the set of intensity values used to define adjacency and  $V = \{0,1\}$ . Compute the lengths of the shortest 4-, 8- and  $m$ - path between  $p$  and  $q$ . if a particular path does not exist between these two points, explain why?  

3	1	2	1	(q)
2	2	0	2	
1	2	1	1	
(p)1	0	1	2	
- What is spatial and gray level resolution?

9. CRT devices would produce images that are darker than intended. How it is rectified? Explain.
10. What is edge detection? Explain any one edge detection technique in digital image processing.

**PART B**

**(Answer one full question from each module, each question carries 14 marks)**

**MODULE I**

11. a) Generate the points between the end points of a line viz.(9,18) and (14,22) by using Bresenham's line drawing algorithm. (7)
- b) Explain the basic concept of Midpoint circle algorithm. Calculate the pixel positions to draw a circle having center as (0,0) and radius as 10 units. (7)

**OR**

12. a) Explain the working of a random scan display system with suitable diagram. (5)
- b) Explain DDA algorithm. Scan convert the line segment with end points (20,10) and (30,18) using DDA line drawing algorithm. (9)

**MODULE II**

13. a) Give the 3-D Transformation matrix for a) Translation b) Rotation c) scaling (6)
- b) Write a short note on a) Reflection b) shearing transformation. (8)  
Given a square object with coordinate points A(0,3), B(3,3), C(3,0), D(0,0). Apply the scaling parameter 2 towards X axis and 3 towards Y axis and obtain the new coordinates of the object.

**OR**

14. a) Give the 2-D Transformation matrix for a) Translation b) Rotation c) scaling (6)
- b) Write the scan line algorithm for filling a polygon. (8)

**MODULE III**

15. a) Distinguish between parallel and perspective projections. (4)
- b) Explain Cohen-Sutherland line clipping algorithm. Use Cohen-Sutherland algorithm to clip two lines P1 (40,15) — P2 (75,45) and P3 (70, 20) — P4 (100,10) against a window A (50,10), B (80,10), C(80,40) & D(50,40) (10)

**OR**

16. a) Describe Sutherland Hodgeman polygon clipping algorithm. What are its limitations? (7)

- b) Describe in detail the depth buffer visible surface detection technique. Derive the equation to find the depth values for a surface position (x, y). (7)

**MODULE IV**

17. a) Assume you have to process a digital image. List the stepwise process to do the processing. Explain with the help of a diagram. (7)  
b) Illustrate how the image is digitized by sampling & quantization. (7)

**OR**

18. a) Define 4-adjacency and 8-adjacency. Explain with necessary examples (7)  
b) Explain the components of an image processing system with suitable diagram. (7)

**MODULE V**

19. a) Define histogram equalization. Explain the procedure for histogram equalization (7)  
b) Define Resolution of an image. Explain the spatial and gray level resolution of an image with an example. (7)

**OR**

20. a) Explain about smoothing frequency domain filters and sharpening frequency domain filters. (7)  
b) With necessary graphs explain the log and power law transformation used for spatial image enhancement. (7)

\*\*\*\*\*