Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (R,S) (FT/WP/S4PT) Examinations April 2026 (2019 Scheme)

Course Code: CST304
Course Name: COMPUTER GRAPHICS AND IMAGE PROCESSING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1	Illustrate and describe the key components and working principles of a raster scan display system.	(3)
2	List the different focusing methods used in CRT monitors.	(3)
3	A square with vertices at points A(2,2), B(6,2), C(6,6), and D(2,6) is scaled by a factor of 1.5 in the x-direction and 0.75 in the y-direction. Determine the final coordinates of the transformed square.	(3)
4	A point P(4, 5) is rotated counter clockwise by 45° about origin. Explain the steps involved in determining the new coordinates of the point after rotation.	(3)
5	Explain the concept of Window to Viewport Transformation in computer graphics.	(3)
6	Outline the types of parallel projection with examples.	(3)
7	Differentiate between Grayscale, Binary, and Colour Images in computer graphics	(3)
8	Explain the concepts of connectivity and adjacency in image processing with examples.	(3)
9	List and explain any three basic gray level transformation functions in image processing with examples.	(3)
10	Differentiate between Smoothing and Sharpening in image processing. Explain their significance with examples.	(3)

PART B

Answer one full question from each module, each carries 14 marks.

Module I

11	a)	Apply the Digital Differential Analyzer (DDA) algorithm to draw a line between the points (1,7) and (11,17). Show step-by-step calculations and plot the intermediate points.	(6)

b) Explain the working principle of a random scan display system. How does it differ from a raster scan display in terms of image rendering? (8)

OR

12 a) Explain the colour CRT monitor display technique. How does it generate different colours using methods like the beam-penetration and shadow-mask techniques? (8)

b) Apply Bresenham's Circle Drawing Algorithm to plot a circle with centre (6,6) and radius 6. Show all necessary calculations and determine the pixel positions plotted in the first quadrant. (6)

Module II

13 a) Explain scan-line polygon filling algorithm. Discuss the data structures employed in the scan-line polygon filling algorithm and explain how the algorithm handles cases where a scan line intersects exactly at a polygon's vertex. (8)

b) Explain the concept of composite 2D translations and derive the final transformation matrix resulting from two successive translations. (6)

OR

14 a) Explain the flood fill algorithm used for polygon filling in computer graphics, detailing the steps involved in both 4-connected and 8-connected approaches. (8)

b) Consider a triangle with vertices at points A(1, 1), B(4, 1), and C(2, 3). Apply the following transformations in sequence and find the resultant vertices: (6)

i. Translate the triangle by 3 units in the x-direction and 2 units in the y-direction.

ii. Scale the translated triangle by a factor of 2 in the x-direction and 0.5 in the y-direction.

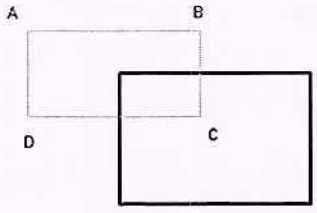
Module III

15 a) Describe the Depth Buffer Algorithm in computer graphics. Explain its working principle and advantages. Provide a suitable example to illustrate how it is used in 3D rendering. (8)

b) Consider a clipping window with the boundaries (xmin, ymin)=(3,3) and (xmax, ymax)=(9,7). A line segment is given with endpoints P1(1,4) and P2(11,6). Using the Cohen-Sutherland Line Clipping Algorithm, determine whether the line is completely inside, outside, or partially inside the window. If it is partially inside, compute the clipped coordinates of the line segment. (6)

OR

16 a) Apply the Sutherland-Hodgeman Algorithm to clip a polygon ABCD with respect to a clipping rectangle. Explain the step-by-step process of the algorithm to illustrate how polygon clipping is performed. (6)



b) Explain the Scan Line Visible Surface Detection Algorithm in computer graphics. Describe its working principle. Provide a suitable example to illustrate its application in visible surface detection. (8)

Module IV

17 a) Explain the fundamental steps in image processing with a detailed description of each step. Illustrate the process with a block diagram. (8)

b) Given a 1D image data f(x) and a mask (filter) weight w(x). Compute the correlation operation and determine the resulting output image. (6)

- Image Data: f(x)=[0 0 0 1 0 0 0 0]
- Mask (Filter) Data: w(x)=[1,1,2,2,0]

OR

18 a) Explain about D_4 distance, D_8 distance, and D_m-distance in pixel measurement? Explain with suitable examples. (7)

b) Explain the concepts of Sampling and Quantization in image processing. How do they affect image quality? (7)

Module V

19 a) Explain the concept of Image Segmentation in image processing. Discuss different segmentation techniques such as intensity thresholding, global thresholding, and region-based segmentation methods. (7)

b) Explain the concept of Edge Detection in image processing. Discuss different edge detection techniques such as Sobel, Prewitt edge detectors. (7)

OR

20 a) Explain Histogram Equalization. Perform Histogram Equalization for the given image. (8)

4	1	3	2
3	1	1	1
0	1	5	2
1	1	2	2

b) Explain the concept of Smoothing Spatial Filters in image processing. Discuss about Linear and nonlinear filters (6)

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