

TE sem VI ETC c-scheme May 12026

Date: 15/05/2026

Max Marks: 80

Duration: 3hrs

- N.B. : (1) Question No 1 is Compulsory.
 (2) Attempt any three questions out of the remaining five.
 (3) All questions carry equal marks.
 (4) Assume suitable data, if required and state it clearly.

1 Attempt any **FOUR**

[20]

- a A high pass filter is a sharpening filter. Justify your answer.
 b Justify using a 3X3 image how median filter is superior to smoothing filters when dealing with salt-and-pepper noise.
 c Explain why the Ideal low pass filter produces significant ringing artifacts in the spatial domain.
 d Explain the role of first order derivatives in edge detection.
 e Describe the significance of support vectors in defining the decision boundary.

- 2 a Perform region splitting on the following 4X 4 image segment with a threshold (T = 3). Using the results from splitting, check if any adjacent regions can be merged using the same threshold.

[10]

10	10	20	22
11	12	21	23
5	6	15	16
5	7	14	15

- b Explain the effects of image rotation and scaling in the spatial domain on its 2D DFT spectrum. How can these properties be used for invariant pattern recognition?

[10]

- 3 a Given a 3-bit grayscale image of size 4x5 pixels, perform histogram equalization to enhance the image contrast. Find the output image after histogram equalization.

[10]

0	1	1	3	4
7	2	5	5	7
6	3	2	1	1
1	4	4	2	1

- b Perform a morphological erosion and dilation on the binary image (A) using the 3x3 cross-shaped structuring element (B). Assume the origin of (B) is at its center. Show the resulting output images and explain why certain pixels were removed or added.

[10]

Input Image (A):

0	0	0	0	0
0	1	1	1	0
0	1	0	1	0
0	1	1	1	0
0	0	0	1	0

Structuring Element (B): (Origin at center)

0	1	0
1	1	1
0	1	0

- 4 a Calculate the contrast stretching transformation function for the following 3-bit image (I) to maximize its dynamic range and find the output image (R). [10]

2	3	5
4	2	3
5	4	2

- b Explain the principle of Global Thresholding and describe the conditions under which it is most effective for image segmentation [10]
- 5 a What is a Chain Code? Discuss the limitations of standard chain codes regarding translation and rotation, and explain how normalization techniques address these issues. [10]
- b Explain how k-means clustering algorithm with suitable example. [10]
- 6 a Explain canny edge detection algorithm [10]
- b Define a 2 X 2 confusion matrix. How does the classifier give errors, and how does the matrix help us pinpoint visual confusion between two different classes? [10]

0	1	2	3	4
1	2	3	4	5
2	3	4	5	6
3	4	5	6	7
4	5	6	7	8

0	1	2	3	4
1	2	3	4	5
2	3	4	5	6
3	4	5	6	7
4	5	6	7	8

0	1	2	3	4
1	2	3	4	5
2	3	4	5	6
3	4	5	6	7
4	5	6	7	8