

DEPARTMENT OF COMPUTER SCIENCE AND ENGG.

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI- 620 015.

CYCLE TEST I

CSPE 74 – IMAGE PROCESSING AND ITS APPLICATIONS

Date: 21/08/25

TIME: 60 Mins

Max: 20 marks

ANSWER ALL THE QUESTIONS

1. An image is originally represented using 24-bit colour (8 bits for each RGB channel). Calculate the reduction in storage size if the image is converted to a 16-bit colour format where 5 bits are used for R, 6 bits for G, and 5 bits for B. Assume the image is 1920×1080 pixels. (1)

2. Explain sampling and quantization using a neat sketch. (2)

3. Consider the image segment shown below. Let the intensities in the domain be $V = \{1, 2\}$. Compute the lengths of the shortest 4-path and 8-path between p and q. If a particular path does not exist between these two points, explain why.

5	1	2	1 (q)
2	1	0	2
1	2	1	1
(p)	1	0	1 4

(2)

4. A line PQ with endpoints P (2,3) and Q (7,8) is to be rotated about the origin by 30° in clockwise direction. Determine the coordinates of the endpoints for the rotated line. (2)

5. Write a short note on Discrete Cosine Transform (DCT) in image processing. (1)

6. Compute the Hadamard transform of an image

$$\begin{array}{cccc} 2 & 1 & 2 & 1 \\ 1 & 2 & 3 & 2 \\ 2 & 3 & 4 & 3 \\ f(x,y) = & 1 & 2 & 3 & 2 \end{array} \quad (3)$$

7. Show that image averaging can be done recursively. That is, if $a(k)$ is the average of k images, then the average of $k + 1$ images can be obtained from the already-computed average, $a(k)$, and the new image, f_{k+1} . (2)

8. Draw the histograms for the input image(a) and for the target image(b). Modify the histogram for 'a' as given by histogram 'b'.

6	6	7	7	6
5	3	4	2	3
4	4	5	5	6
5	7	6	3	5
7	6	5	4	3

(a) Input Image

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

(b) Target Image

(4)

9. Derive the Laplacian mask using the second-order derivative for image sharpening. (1)

10. Explain the Butterworth Lowpass Filter with sketches. (2)