Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

SEVENTH SEMESTER B.TECH. (E & C) DEGREE END SEMESTER EXAMINATION DECEMBER 2018/JANUARY 2019 SUBJECT: DIGITAL IMAGE PROCESSING (ECE -4006)

TIME: 3 HOURS

MAX. MARKS: 50

Instructions to candidates

- Answer **ALL five** full questions.
- Missing data may be suitably assumed.
- 1A Illustrate the concept of histogram specification for the following sub-image with 4X4 matrix of a 3-bit image and the specified histogram as shown below.



- 1B. Describe the basic relationship between the pixels in terms of adjacency
- 1C. Obtain the analytical expression for T by assuming p1(z) and p2(z) as Gaussian distribution function. If $\mu 1 = 110 \sigma 1 = 15$ and $\mu 2 = 200$, $\sigma 2 = 40$, Propose a thresholding solution for segmenting the objects out of the image.(Background pixel is more compared to object pixel).

(4+3+3)

- 2A. Let A denote the set shown shaded in the following figure. Refer to the structuring element shown. Sketch the result of the following morphological operation.
 - a. A eroded B4 dilated with B2
 - b. A eroded B1 dilated with B3



a. Contrast Stretching b. Gray–level slicing c. Image subtraction

- 3A. With a neat block diagram describe the applications of image processing in real time problems.
- 3B. Explain the Marr-Hilderth edge detector.
- 3C. Estimate the Haar transform coefficient for the given 2X2 sub_image

234	231
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4A. Show that the Laplacian operator defined below is isotropic.

$$\nabla^2 f = \frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2}$$

 $x = x'\cos\theta - y'\sin\theta$ and $y = x'\sin\theta + y'\cos\theta$

(x, y) are unrotated and (x', y') are rotated coordinates.

- 4B. Write the fundamental steps involved in digital image processing. Describe the basic relationship between the steps.
- 4C. Illustrate the morphological method to extract the extract the boundary of the following object. (A;Object B: Structuring element).

	Origin

(4+3+3)

5A. Calculate the 4-point 2D DCT for the following sub-image.

1	2	2	0
0	1	3	1
0	1	2	1
1	2	2	-1

5B. Find the frequency response of the following averaging filter

$$h(m,n) = \frac{1}{9} \begin{pmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

5C. Show that subtracting the laplacian from an image is proportional to unsharp masking.

(4+3+3)