Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
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SEVENTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION
NOV/DEC 2015
SUBJECT: DIGITAL IMAGE PROCESSING (ECE -437)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates
- Answer **ANY FIVE** full questions.
- Missing data may be suitably assumed.

1A. Determine the Fourier transform, $H(u,v)$ of the mask.

$$h = \begin{bmatrix} 0 & 0 & -1 & 0 & 0 \\ 0 & -1 & -2 & -1 & 0 \\ -1 & -2 & 16 & -2 & -1 \\ 0 & -1 & -2 & -1 & 0 \\ 0 & 0 & -1 & 0 & 0 \end{bmatrix}$$

1B. Mention the steps involved in frequency domain filtering. Give the transform function for Butterworth Low Pass Filter and compare it with Gaussian filter

1C. Give the formula for calculating D4 and D8 distance.

(5+3+2)

2A. With a neat diagram explain motion compensated inter frame coding system.

2B. Consider the following table and generate the lookup table using Huffman method. Code the symbols a1, a1, a2, a3, a4, a3, a5 using Huffman coding.

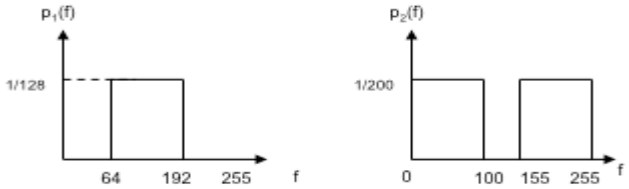
Symbol	Probability
a1	0.20
a2	0.15
a3	0.20
a4	0.15
a5	0.30

2C. Compare effect of first and second order derivatives in case of spatial image enhancement with a suitable example.

(5+3+2)

3A. i) With conversion formula for the color models RGB to HSI and HSI to RGB
ii) Explain Hough space and image space in Hough transform

3B. The histograms of two images are illustrated below. Sketch a transformation function for each image that will make the image has a better contrast. Use the axis provided below to sketch your transformation functions.



3C. Define Gradient Operator.

(5+3+2)

4A. Explain region growing and region splitting segmentation algorithm. Discuss region growing (active contour model) with its energy minimization function.

4B. Find the 2D convolution between h(x,y) and f(x,y)

$$f(x,y) = \begin{matrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{matrix} \qquad h(x,y) = \begin{matrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{matrix}$$

4C. Write the result of median filter of 3 X 3 mask for thegiven sub image.

1	4	5	8
0	1	14	11
0	8	7	9
1	2	0	3

(5+3+2)

5A. Consider an image with 8 gray levels with number of pixels in each gray level (700, 1100, 750, 656, 229, 345, 222 and 81). Find the equalized histogram for this image.

5B. Find F(u,v) for the following sub image f(m,n).

$$f(m,n) = \begin{matrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{matrix}$$

5C. What is the use of DCT for image compression? Why DCT cannott be applied to the whole image like wavelet transformation.

(5+3+2)

6A. A certain X- ray imaging geometry produces a blurring degradation that can be modeled as a convolution of the sensed image with the spatial, circularly symmetric function.

$$h(x,y) = \frac{x^2 + y^2 - 2\sigma^2}{\sigma^4} e^{-\frac{x^2+y^2}{2\sigma^2}}$$

Assuming continuous variables, show that the degradation in the frequency domain is given by the following expression.

$$H(u,v) = -8\pi^2\sigma^2(u^2 + v^2)e^{-2\pi^2\sigma^2(u^2+v^2)}$$

6B. Suppose an image has a probability density function as shown in Fig 6(B)(i). We would like to modify it so that it has a probability density function given in Fig. 6(B) (ii). Derive the transformation function g(f) that will accomplish this. For simplicity, assume both the original image and the modified image can take on gray levels in the continuous range of (0,255).

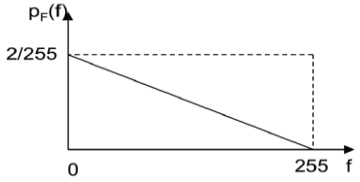


Fig 6 (B) (i)

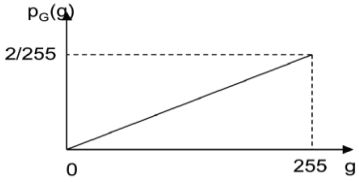


Fig. 6 (B) (ii)

6C. What is the need for Compression?

(5+3+2)