AQ–2794

Faculty of Engineering & Technology

M.E. (Digital Electronics) (Part Time/Full Time) Semester-II (C.G.S.-New) Examination

DIGITAL IMAGE PROCESSING

Paper—2 UMEF 1

Time—Three Hours]   [Maximum Marks—80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Due credit will be given to neatness and adequate dimensions.

(3) Assume suitable data wherever necessary.

(4) Illustrate your answers wherever necessary with the help of neat sketches.

(5) Use pen of Blue/Black ink/refill only for writing the answer book.

1. (a) Explain the Receptors of Human visual system in detail along with distribution and brightness adaptation.   7

   (b) Explain image sampling and quantization in detail.   6

OR

2. (a) Develop an algorithm for converting a one-pixel-thick 8-connected path to 4-connected path.   6

   (b) Draw and explain the functional block diagram of fundamental image processing in detail.   7

3. (a) For the images A and B shown below, perform the following arithmetic and logical operation :

   (i) A · B;

   (ii) A + B;

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(iii) $A \oplus B$;

(iv) $\overline{A}$;

(v) $\overline{A} \cdot B$;
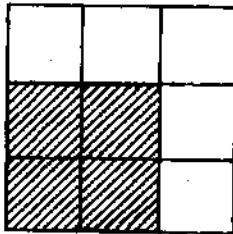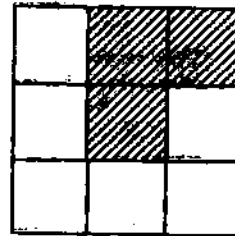
(vi) $\overline{A \cdot B}$.

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Fig. A   Fig. B

(b) Discuss the fundamentals of color image representation and discuss any one color space in detail.   5

OR

4. (a) Compute the median value of the marked pixels shown using a 3 × 3 mask :

$$\begin{bmatrix} 18 & 22 & 33 & 25 & 32 & 24 \\ 34 & (128) & (24) & (172) & (26) & 23 \\ 22 & 19 & 32 & 31 & 28 & 26 \end{bmatrix}$$

10.

(b) Explain the processing of Histogram equalization in detail.   4

5. (a) Find the 1-D Walsh basis for the fourth-order system i.e. N = 4.   6

(b) Explain 2D Discrete Fourier Transform in detail. Also, explain properties of 2D-DFT in brief.   7

OR

6. (a) Obtain the slant transform for N = 4.   7

(b) What do you mean by image transform ? Explain its significance in image processing.

6

7. (a) A blur filter is given by h(m, n) :

$$h(m,n) = \begin{bmatrix} 0 & 0.05 & 0.05 & 0 \\ 0.15 & 0.1 & 0.1 & 0.15 \\ 0 & 0.1 & 0.1 & 0 \\ 0 & 0.1 & 0.1 & 0 \end{bmatrix}$$

Find the deblur filter using Weiner filter approach with $\sigma_x^2 = 200, \sigma_w^2 = 100$. 7

(b) Explain non-linear image restoration techniques in detail. 7

OR

8. (a) Explain various types of noise. Also discuss image denoising algorithm. 7

(b) Draw and explain image restoration model. 7

9. (a) Explain Edge linking and Boundary detection using Hough transform. 6

(b) Explain in detail image segmentation using watershed transformation. 7

OR

10. Obtain the thresholded image for the 3BPP image shown below. Choose appropriate threshold value i.e. T.

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

Also, explain thresholding of images. 13

11. (a) Obtain the binary Huffman code for the image :

$$\begin{bmatrix} 1 & 2 & 5 & 7 \\ 2 & 3 & 7 & 5 \\ 7 & 2 & 1 & 3 \\ 6 & 4 & 7 & 1 \end{bmatrix}$$

  Also, find average length, entropy and efficiency of Huffman code.   7

(b) Explain lossy block truncation and vector quantization in detail.   6

OR

12. (a) Compare lossy and lossless image compression techniques in detail.   6

(b) Explain the transform selection for image compression using transform coding approach.

    7