B.E. Electronics & Communication/Telecommunication Engineering (Model Curriculum)
Semester-VIII

# ET802M - Digital Image & Video Processing

P. Pages : 3 **GUG/S/25/14355**

Time : Three Hours * 2 6 1 1 * Max. Marks : 80

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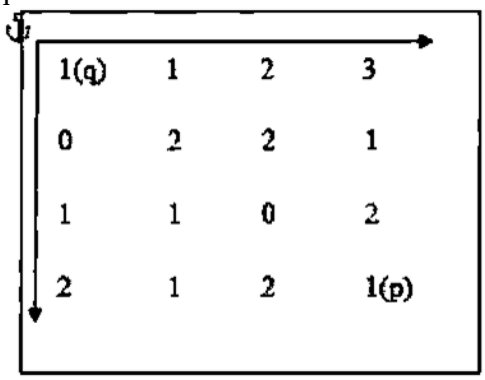
Notes : 1. All questions carry marks as indicated.
2. Assume suitable data wherever necessary.
3. Illustrate your answers wherever necessary with the help of neat sketches.

**1.** a) Define 4-connectivity, 8-connectivity and m-connectivity with examples. What is the advantages of m-connectivity over 4-connectivity relationship? **8**

b) A 4 x 4 sub image is shown in figure. Let V = {0, 1}, compute Euclidean $D_4$, and $D_8$ Distances between p and q. **4**




c) Explain the TIFF file format. **4**

**OR**

**2.** a) Explain in detail the effect of varying the **8**
i) Number of gray levels used
ii) Number of pixels in the given image with suitable examples.

b) What is meant by resolution? Distinguish between spatial and gray level resolution. **8**

**3.** a) **8**

An image matrix is given by $f(m, n) = \begin{bmatrix} 1 & 1 & 2 & 1 \\ 2 & 1 & 1 & 2 \\ 1 & 3 & 2 & 1 \\ 2 & 1 & 2 & 1 \end{bmatrix}$. Find the 2DHadamard transform for this image matrix.

b) Explain any two of the following Non-linear gray level transformation techniques. **8**
i) Thresholding
ii) Logarithmic transformation
iii) Power law Transformation

**OR**

**4.** a) Given an image of size 3 x 3 as $f(m,n) = \begin{bmatrix} 128 & 212 & 255 \\ 54 & 62 & 124 \\ 140 & 152 & 156 \end{bmatrix}$. Determine the output image g(m, n) using a logarithmic transformation g(m, n) = $[c \log_{10}(1+f(m,n))]$ by choosing c as (i) c = 1 and (ii) $c = \frac{L}{\log_{10}(1+L)}$ where L = 255. **8**

b) Given two image segments $f_1(m,n)$ and $f_2(m,n)$. **8**

$$f_1(m,n) = \begin{bmatrix} 2 & 2 & 2 & 2 \\ 2 & 2 & 2 & 2 \\ 2 & 2 & 2 & 2 \\ 2 & 2 & 2 & 2 \end{bmatrix} \text{ and } f_2(m,n) = \begin{bmatrix} 4 & 4 & 4 & 4 \\ 4 & 4 & 4 & 4 \\ 4 & 4 & 4 & 4 \\ 4 & 4 & 4 & 4 \end{bmatrix}$$

Prove the additivity property of Fourier transform i.e.

$$DFT\{f_1(m,n)\} + DFT\{f_2(m,n)\} = DFT\{f_1(m,n) + f_2(m,n)\}$$

**5.** a) Explain **any two** colour segmentation methods of the following. **8**

i) Thresholding.

ii) K-means clustering technique

iii) RGB colour space segmentation

b) Explain the following: **8**

i) RGB colour model.

ii) HIS colour model

**OR**

**6.** a) Explain HSV colour model. Write the algorithm to convert the HSV model to RGB model. **8**

b) Explain **any two** Non uniform quantization algorithms: **8**

i) Popularity algorithm
ii) Median cut algorithm
iii) Octree algorithm

**7.** a) Define the following metrics which are used to quantify compression measures. **8**

i) Compression ratio.

ii) Saving percentage

iii) Bit rate

iv) Relative redundancy

b) How gradient is used to detect the edges of an image? Consider a one dimensional image f(x) = 60 60 60 100 100 100. What are first and second derivatives? Explain their significance. **8**

**OR**

**8.** a) What is the difference between lossy and lossless compression? **4**

b) Calculate the entropy for the symbols shown in table below. **4**

| Symbol | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Probability | 0.4 | 0.2 | 0.2 | 0.1 | 0.05 | 0.05 |

c) Explain the following second order derivative method for edge detection: **8**

i) Laplacian of Gaussian (LOG)

ii) Difference of Gaussian filter (DOG)

**9.** a) Explain **any two** of the following Motion Estimation algorithms **8**

i) Gradient techniques

ii) Pel-recursive techniques

iii) Block matching techniques.

b) Explain the steps involved in MPEG video compression standard. **8**

**OR**

**10.** a) An image scan center needs to store medical images whose resolution is 1024 x 1024 x 24 bits. A total of 10,000 images are present. How much storage (in KB) and transmission time (in hours) will they require at 64 kbps? **4**

b) Distinguish between interframe and intraframe coding. **4**

c) What are the different motion estimation criteria for video signal? Explain phase correlation method for motion estimation. **8**

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