USN | | | | | | | | | | | 21EC732

Seventh Semester B.E./B.Tech. Degree Examination, June/July 2025
Digital Image Processing

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. Explain fundamental steps in digital image processing with block diagram.   (10 Marks)
    b. Explain the image acquisition using sensor strips and sensor arrays.   (10 Marks)

OR

2   a. Explain the process of image sampling and quantization.   (07 Marks)
    b. How image is formed in eye? Explain visual perception of eye.   (06 Marks)
    c. For V = {0, 1}, compute the length of the shortest 4, 8 and m paths between p and q in the following image. If a particular path does not exist between these two points, explain why? Repeat for V = {1, 2}.

$$\begin{array}{cccc}
3 & 1 & 2 & 1 \ \text{(q)} \\
2 & 2 & 0 & 2 \\
1 & 2 & 1 & 1 \\
\text{(p)} \ 1 & 0 & 1 & 2
\end{array}$$

   (07 Marks)

Module-2

3   a. Explain the two-dimensional discrete Fourier transform (2D-DFT) and also state the properties of 2D-DFT.   (10 Marks)
    b. Explain the following properties of unitary transforms.
       i)   Energy Conservation and Rotation
       ii) Energy Compaction and Variances
       iii) Transform coefficients
       iv) Decorrelation.   (10 Marks)

OR

4   a. Define discrete cosine transformation and its inverse transformation. Also state the properties of cosine transform.   (10 Marks)
    b. For the 2 × 2 transform A and the image U

$$A = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}, \ U = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$

       Calculate the transformed image V and the basis images.   (06 Marks)
    c. Briefly explain separable Unitary Transforms.   (04 Marks)

Module-3

5   a. Explain the following intensity transformation functions
       i)   Image Negative
       ii) Log – transformation
       iii) Power law transformation   (12 Marks)

b. Write the original histogram, transformation function and equalized histogram for the 3 bit, 64 × 64 size image whose information is given in below table

r_k	0	1	2	3	4	5	6	7
n_k	790	1023	850	656	329	245	122	81

(08 Marks)

OR

6 a. What do you mean by histogram processing? Explain histogram equalization. **(10 Marks)**

b. Explain image sharpening in spatial domain using second order Laplacian derivative.

(06 Marks)

c. Explain the concept of Bit plane slicing. **(04 Marks)**

Module-4

7 a. Explain Smoothing of image in frequency domain using
  i) Ideal low pass filter
  ii) Butterworth low pass filter
  iii) Gaussian low pass filter **(10 Marks)**

b. Explain Homomorphic filters for image enhancement with necessary equations block diagram and transfer function. **(10 Marks)**

OR

8 a. Explain the following color models :
  i) RGB color model
  ii) HSI model **(10 Marks)**

b. What is pseudo color image processing? Explain intensity slicing as applied to pseudo color image processing. **(10 Marks)**

Module-5

9 a. Explain adaptive local noise reduction filter and adaptive median filter with the algorithm.

(08 Marks)

b. Explain Weiner filtering with necessary mathematical equations. **(06 Marks)**

c. Explain the following mean filters used for image restoration
  i) Arithmetic mean
  ii) Geometric mean
  iii) Harmonic mean **(06 Marks)**

OR

10 a. With necessary diagram and relevant equations, explain any four noise probability density functions. **(10 Marks)**

b. Explain with necessary expression the periodic noise reduction by frequency domain filtering. **(10 Marks)**

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