

**MASTER OF COMPUTER
APPLICATIONS (MCA-NEW)**

Term-End Examination

December, 2023

**MCS-230 : DIGITAL IMAGE PROCESSING AND
COMPUTER VISION**

Time : 3 Hours

Maximum Marks : 100

***Note :** Question No. 1 is compulsory. Attempt any
three questions from the rest. Use of
scientific calculator is allowed.*

1. (a) What is an imaging system ? Compare direct imaging system with the indirect imaging system. Also, explain the term 'image digitization'. 8
- (b) Compare orthogonal transform and unitary transform. Also, discuss the properties of both the transforms. 8
- (c) Explain the term 'Wavelet' with suitable example. Give properties of wavelets. Differentiate between continuous wavelet transform and discrete wavelet transform.

8

- (d) Why do we need to transform an image from spatial domain to frequency domain ? Discuss the various categories of frequency domain filters. Also, list the filters under each category. 8
- (e) Compare unsupervised learning techniques with supervised learning techniques. Explain the different categories of supervised machine learning algorithms. Also draw block diagram for classical taxonomy of clustering methods. 8
2. (a) What is sampling ? Explain the role of sampling in image digitization, with suitable example. 7
- (b) Given a gray scale image with aspect ratio of 6 : 2 and pixel resolution of 480000 pixels. Calculate the following : 5
- (i) Dimensions of image
- (ii) Size of image
- (c) Write expression for forward and inverse orthogonal transform of an $(N \times N)$ image $f(x, y)$. Given orthogonal matrix
- $$(A) = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix} \quad \text{and image matrix}$$
- $$f = \begin{bmatrix} 1 & 3 \\ 5 & 7 \end{bmatrix}, \quad \text{determine orthogonal}$$
- transform and its inverse. 8

3. (a) Explain Discrete Fourier Transform (DFT). Discuss the properties of DFT. Compute the 2-D DFD of the 2×2 image

$$f(x, y) = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}. \quad 8$$

- (b) What do you understand by shifting the centre of the spectrum ? Why is it required ? Write the steps to carry out filtering in frequency domain. 7
- (c) Explain CMY and CMYK colour models. 5
4. (a) Draw a block diagram to show the learning phases of a supervised learning algorithm. Also, write steps to explain the process of applying supervised machine learning to a real world problem. 7
- (b) Explain Agglomerative Hierarchical Clustering. Write steps of general agglomerative clustering algorithm. Also discuss single-link and complete link type of agglomerative clustering. 8
- (c) Describe the following quantities, used to represent any colour : 5
- (i) Brightness
- (ii) Contrast

5. Write short notes on any *five* of the following : 4×5=20

- (a) Classification of images on the basis of attributes
- (b) Pseudo colour images
- (c) Pixel resolution
- (d) Gaussian low pass filter
- (e) Rayleigh noise
- (f) Median filters