Course Code	**:**	**MCS-230**
Course Title	**:**	**Digital Image Processing and Computer Vision**
Assignment Number	**:**	**MCA_NEW/MCAOL(IV)/230/Assign/2026-27**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last Dates for Submission	**:**	**31st October, 2026 (For July, 2026 Session)** **15th April, 2027 (For January, 2027 Session)**

This assignment has sixteen questions of 5 Marks each; answer all questions. The remaining 20 marks are for viva voce. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1: Given an image is a gray-scale image with an aspect ratio of 8:2 and pixel resolution of 1280000 pixels, calculate the following:

a) Resolve pixel resolution to calculate the dimensions of the image
b) Calculate the size of the image

Q2: Solve the following problems:

a) What is the storage requirement for a 1024 x 1024, 24-bit colour image?
b) Calculate pixel resolution of a camera in megapixels, capturing an image of dimensions: 2000 X 3000

Q3: Explain how image enhancement is better in the frequency domain as compared to the spatial domain.

Q4: For the given 4x4 image having grey scales between [0, 9], carry out histogram equalization. Also, draw the histogram of the image before and after equalization.

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

Q5: What do you mean by Camera Calibration? Explain how intrinsic and extrinsic parameters of a camera are estimated.

Q6: Explain the following Smoothing Filter(s):

(i) Ideal Low Pass Filters (ILPF) **(ii)** Butterworth Low Pass Filters (BLPF) **(iii)** Gaussian Low Pass filters (GLPF)

Q7: Explain the following Image Sharpening Filter(s):

(i) Ideal High Pass Filters (ILPF) **(ii)** Butterworth High Pass Filters (BLPF) **(iii)** Gaussian High Pass filters (GLPF)

Q8: Perform partitional clustering using Frogy's method for the data given in the table below with k-2 (two clusters). Use the first two sample points (3,3) and (6,8) as seed points.

S. No.	X	Y
1	4	4
2	5	7
3	11	11
4	5	5
5	2	2
6	13	11
7	18	16
8	20	18

Q9: Explain Bayesian Classification with the help of a suitable example. Also discuss its properties.

Q10: Explain Optical flow in the context of motion perception in computer vision.

Q11: What are the different distance measures used for clustering? Explain each with the help of a suitable example.

Q12: Describe the Discrete Cosine Transform (DCT) and compare it with the Discrete Fourier Transform (DFT)

Q13: Describe the following with respect to Haar:

(i) Haar basis functions,
(ii) Haar transform matrix,
(iii) Its mathematical formulation and orthogonality property,
(iv) Computation of Haar transform,
(v) Advantages and applications of Haar in image processing with suitable illustrations.

Q14: Explain the role of camera models in three-dimensional scene reconstruction with suitable diagrams and examples

Q15: Explain Linear Discriminant Function (LDF), Piecewise Linear Discriminant Function, and Quadratic Discriminant Function with their mathematical formulations, properties, decision boundaries, advantages, limitations, and applications in pattern recognition.

Q16: Explain different image representation models (pixel model and vector model) and classify digital images based on attributes, colour, dimensions, and data types with suitable examples.

Q1: Given an image is a gray-scale image with an aspect ratio of 8:2 and pixel resolution of 1280000 pixels, calculate the following:

a) Resolve pixel resolution to calculate the dimensions of the image

b) Calculate the size of the image

Answer

Let the image width and height be in the ratio 8:2. This is the same as 4:1. If the height is h pixels, then the width is 4h pixels. The total number of pixels is therefore $4h^2$.

$$4h^2 = 1{,}280{,}000 \Rightarrow h^2 = 320{,}000 \Rightarrow h \approx 565.69 \text{ pixels}$$

$$\text{Width} = 4h \approx 2{,}262.74 \text{ pixels}$$

Hence, the mathematical dimensions are approximately 2263 × 566 pixels. Since pixel dimensions must be integers, a real stored image can only approximate both the stated pixel count and the exact 4:1 ratio unless an exact integer pair is supplied.

For a normal gray-scale image, one pixel is commonly stored with 8 bits = 1 byte. Therefore:

$$\text{Image size} = 1{,}280{,}000 \times 1 \text{ byte} = 1{,}280{,}000 \text{ bytes}$$

This is about 1.28 MB in decimal units, or about 1.22 MiB when 1 MiB = 1,048,576 bytes. Thus, assuming 8-bit gray scale, the uncompressed image requires approximately 1.28 MB of storage.

Q2: Solve the following problems:

a) What is the storage requirement for a 1024 x 1024, 24-bit colour image?

b) Calculate pixel resolution of a camera in megapixels, capturing an image of dimensions: 2000 X 3000

Answer

(a) Storage requirement

$$\text{Number of pixels} = 1024 \times 1024 = 1{,}048{,}576 \text{ pixels}$$

$$\text{Storage} = 1{,}048{,}576 \times 24 \text{ bits} = 25{,}165{,}824 \text{ bits}$$

$$= 25{,}165{,}824 / 8 = 3{,}145{,}728 \text{ bytes} = 3 \text{ MiB}$$