

**MCA/M.Sc. II Semester Practical Examination 2023-24**  
**Computer Science, CS341P: Image Processing**

**Note: Answer any two of the following questions:**

1. Take an image as input data and perform the following steps:
  - I. Resize your image (gray scale) into a square matrix (if no. of rows and columns are unequal)
  - II. Divide the image into 4 blocks. Show each block into a subplot.
  - III. Apply Median, Average, Laplacian and Sobel filters on each block respectively.
  - IV. Display all the processed blocks in a subplot.
  
2. Take an image, divide it into  $16 \times 16$  blocks, apply Discrete Cosine Transformation (DCT), quantize data and apply Huffman coding. Apply Huffman decoding and inverse DCT to obtain a reconstructed image. Calculate CR and PSNR.
  
3. Perform image sharpening on an image in frequency domain using
  - I. Butterworth High pass filter of order 2 and order 4 (Use different cut off frequency  $D_0 = 15, 30, 80$ )
  - II. Gaussian High pass filter (same cut-off frequency)
  - III. Obtain a sharpened image.

Answer all questions

Max. Marks: 20; Time allotted: 1:00 hr

1. (a) Dark characteristics in an image are better solved using \_\_\_\_\_. [1\*4=4]
- Image Negative
  - Power-law Transformation
  - Averaging
  - None of the above
- (b) What are the two types of photoreceptor cells found in the retina?
- Rods and cones
  - Bipolar cells and ganglion cells
  - Cornea and lens
  - Sclera and choroid
- (c) In binary image processing, which logic operation is used to combine two binary images to produce an output image where a pixel is set to 1 if either of the corresponding pixels in the input images is 1?
- AND
  - OR
  - NOT
  - XOR
- (d) A grayscale image with dimensions  $1024 \times 1024$  pixels is quantized with a bit depth of 5 bits per pixel. Calculate the total size of the image file in kilobytes (KB), assuming no compression is applied. How many different gray levels can be represented in this image?
2. Explain the significance of image sampling and quantization with suitable example. [4]
3. Define spatial resolution in the context of digital images. How does it differ from gray-level resolution? [4]
4. Explain the following terms: [4]
- (i) Connectivity (ii) City-Block distance (iii) Chess Board distance.
5. (a) Discuss the basic intensity transformation functions. Explain the effect of choosing  $\gamma < 1$ ,  $\gamma > 1$  and  $\gamma = 1$  in power law transformation. [2+2=4]
- (b) Perform image negative on the 3-bit image segment  $\begin{bmatrix} 4 & 2 & 3 \\ 2 & 1 & 1 \\ 1 & 3 & 5 \end{bmatrix}$ .