

Roll No



**PRESIDENCY UNIVERSITY
BENGALURU**

**SCHOOL OF ENGINEERING
MID TERM EXAMINATION - APR 2023**

Semester : Semester IV&VI

Course Code : ECE3029

Course Name : Sem IV&VI - ECE3029 - Digital Image Processing

Program : ECE

Date : 15-APR-2023

Time : 9.30AM - 11.00AM

Max Marks : 60

Weightage : 30%

Instructions:

- (i) Read all questions carefully and answer accordingly.
 - (ii) Question paper consists of 3 parts.
 - (iii) Scientific and non-programmable calculator are permitted.
 - (iv) Do not write any information on the question paper other than Roll Number.
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PART A

ANSWER ALL THE QUESTIONS

(5 X 2 = 10M)

1. If $r(x,y)$ is the amount of illumination reflected by the object in scene, what are the range of values it can take.
(CO1) [Knowledge]
2. Digitization involves sampling and quantization. Which sampling category does Zooming and Shrinking comes under.
(CO1) [Knowledge]
3. The distance between pixels p and q is less than or equal to some value of radius r and it forms a diamond centred at (x,y) . What distance measure is this.
(CO1) [Knowledge]
4. Image Transformation represents a given image as a series summation of a set of Unitary Matrix. Under what condition, matrix A is a Unitary Matrix.
(CO2) [Knowledge]
5. Most graphic displays are based on the cathode ray tube (**CRT**). A **CRT** contains an electron beam which is focused onto a phosphor-coated glass screen when light is emitted to form an image. In cathode ray tube (CRT) devices, if γ (gamma) = 2.5, what will be the effect on the appearance of the images produced.
(CO2) [Knowledge]

PART B

ANSWER ALL THE QUESTIONS

(2 X 15 = 30M)

6. If H is a general operator, that operates on a input image $f(x,y)$ to produce an output image $g(x,y)$, then H is said to be a Linear Operator if it satisfies Additive property and Homogeneity Property, where $H[f(x,y)]=g(x,y)$.
- a) Describe additive and homogeneity if $f_1(x,y)$ and $f_2(x,y)$ are the sub images of $f(x,y)$ [3M]
 - b) Considering $F_1=[0 \ 2 \ 7; 2 \ 3 \ 9]$, $F_2=[6 \ 5 \ 0; 4 \ 7 \ 2]$ with $a_1=1$ and $a_2= -1$ for the Operator $H=MEDIAN$, Verify whether the operator is Linearity/Non-Linearity of the Operator. [4M]
 - c) Repeat the above problem for the operator $H=\Sigma$ (summation) [4M]
 - d) Consider an image of size 256 x 256. Compute the number of bits required if it is a Binary image, Gray scale image, Colour image. [4M]

(CO1) [Comprehension]

7. The purpose of image enhancement is to or to provide 'better' input for other system to improve the interpretability or perception of information in images for human viewing automated image processing techniques. Say a 3 bit 5x5 size digital image is obtained of a TAJ MAHAL (foreground) with tourists (background) using camera perform intensity level slicing where input intensity $r_1=3$ and $r_2=5$.
- a) Intensity level slicing with background [3M]
 - b) Intensity level slicing without background [3M]
 - c) Image negative. [3M]
 - d) Perform Translation by a Translation vector (2,2) and then scale the image by a factor 2 for the image formed by the coordinates (0,0), (0,4), (3,0) and (3,4) [6M]

5	1	3	2	7
0	3	1	1	6
0	1	4	4	2
1	6	3	2	5
3	3	4	7	5

(CO2) [Comprehension]

PART C

ANSWER THE FOLLOWING QUESTION

(1 X 20 = 20M)

8. a) An image histogram is a type of histogram that acts as a graphical representation of the tonal distribution in a digital image. It plots the number of pixels for each tonal value. By looking at the histogram for a specific image a viewer will be able to judge the entire tonal distribution at a glance. How does Histogram useful in analyzing the contrast of an image. Draw the Histograms to illustrate the images with varying contrasts. [5M]
- b) Histogram equalization often produces unrealistic effects in photographs; however it is very useful for scientific images like thermal, satellite or X-ray images, often the same class of images to which one would apply false colour. Also histogram equalization can produce undesirable effects when applied to images with low colour depth. For example, if applied to 8-bit image displayed with 8-bit gray scale palette, it will further reduce colour depth.(number of unique shades of gray) of the image. Histogram equalization will work the best when applied to images with much higher colour depth than palette size, like continuous data or 16-bit gray-scale images. Apply the concept to achieve the Histogram equalization for the image given below. [15M]

35	25	45	55
75	75	85	25
35	15	25	35
55	45	65	75

(CO2) [Application]

