Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

MAKE-UP EXAMINATION – JAN 2023

Course Code: ECE 307
Course Name: Digital Image Processing
Program : B. Tech

Date: 27-JAN-2023
Time: 9.30 AM to 12.30 PM
Max Marks: 100
Weightage: 50%

Instructions:

(i) Read all the questions carefully and answer accordingly.
(ii) Non-Programmable Scientific Calculators permitted

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries TWO marks. (10Qx 2M= 20M)

1. After digitization process a digital image with M rows and N columns have to be positive and for the number, intensity "L". Then, number of bits required to store the image is B=MXNXK Determine the of "K" value for gray image _____ and color image _____ respectively. (C.O.NO.1) [Knowledge Level]
2. Digital image processing deals with manipulation of digital images through a digital compute. So _____ is the term most widely used to denote the smallest elements of a digital image and name the third step in digital image processing____. (C.O.NO.1) [Knowledge Level]
3. Histogram is graphical representation of a digital image. The discrete function given as h(rk)=nk, here "rk" is _____ and "nk" is_____. (C.O.No.2) [Knowledge Level]
4. An image transform can be applied to an image to convert it from one domain to another. So, log transformation can be represented by ____ formula and power law transformation by _____ formula. (C.O.No.2) [Knowledge Level]
5. Segmentation subdivides an image into its constituent regions or objects. So name any 2 _____ and ____ out of 3 basic types of discontinuities. (C.O.No.3) [Knowledge Level]
6. Image compression refers to the process of reduction of image data achieved by the removal of redundant data. So how many types of data redundancy are there in image compression_____ and the redundancy of the data can be found using formula_____. (C.O.No.3) [Knowledge Level]
7. A color image is a digital image that includes color information for each pixel. Name the three secondary colors _____. (C.O.NO.4) [Knowledge Level]
8. A color image has three channels per pixel and they measure the intensity and chrominance of light. Name the color attribute _____that describes the pure color. And also name the color attribute _____ that gives the measure of the degree to which a pure color is diluted by white light. (C.O.NO.4) [Knowledge Level]
9. Light is a form of electromagnetic energy that can be completely specified at a point in the image plane by its wavelength distribution. The visible spectrum ranges from_____ to ___. (C.O.NO.4) [Knowledge Level]
10. Radiance is the total amount of energy that flows from the light source and luminance is the measure of amount of energy an observer perceives from a light source. So radiance is measured in_____ units and Luminance is measured in_____ units. (C.O.NO.4) [Knowledge Level]

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries TWELVE marks. (4Qx12M=48M)

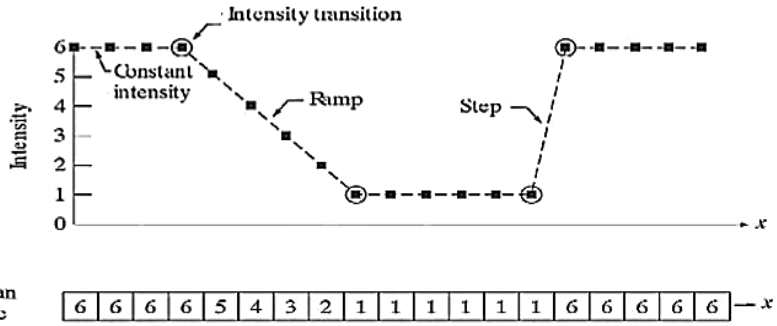
11. A computer graphics system requires the user to construct everything directly into a single scene. Say for a Pizza hut advertisement, a pizza slice image is being built in a convenient place and to a convenient size which are as follows (0,3) (3,3) (3,0). Because of the requirements of a scene, it is first moved to a desired position by (1, 2) and then scaled to be bigger by a factor 3. Draw the new transformed figure with its new coordinates values. (C.O.No.2) [Comprehension level]
12. Huffman Coding is a lossless data compression algorithm, where variable-length code is assigned to different source input characters. Most frequent characters have the smallest codes and longer codes for least frequent characters. Suppose that we want to encode a message constructed from symbol "A to F" where respective probabilities are given which is shown in the table below. How many bits are required to encode each symbol and also mention the average length of the code.

(C.O.No.3) [Comprehensive Level]

Symbol	A	B	C	D	E	F
Probabilities	0.2	0.03	0.23	0.12	0.16	0.26

13. Segmentation subdivides an image into its constituent regions or objects and is for non-trivial images and one of the most difficult tasks in image processing. Its accuracy determines the eventual success of failure of the computerized analysis. To extract basic features such as points, edges and lines by abrupt changes in intensity can be detected using derivatives. An image strip 'x' a section of horizontal intensity profile given below taken from a glass building of a mall, identify the cracks by using 1st and 2nd derivative method.

(C.O.No.3) [Comprehension level]



14.

(a) In Digital Image Processing, there are various Set and Logical Operations. While dealing with Binary Images the Foreground (1-Valued) and Background(0-Valued) sets of Pixels, we refer Union, Intersection and Compliment (Set Operations) as the OR, AND and NOT Logical Operations respectively. Considering the two Regions (Sets) A and B as shown in figure.1, perform any two logical operations which use both sets as arguments

figure.1

(b) A common measure of transmission for digital data is the baud rate, defined as the number of bits transmitted per second. Generally, transmission is accomplished in packets consisting of start bit, a byte (8 bits) of information, and a stop bit. Using these facts, answer the following:

(i) How many minutes would it take to transmit a 1024 X 1024 image with 256 gray levels using a 56K baud modem?

(ii) What would the time be at 750K baud, a representative speed of a phone DSL (digital subscriber line) connection?

(C.O.No.4) [Comprehension Level]

Part C [Problem Solving Questions]

Answer all the Questions. Each question carries SIXTEEN marks. (2Qx16M=32M)

15. In digital x-rays in which colors achieved are a palette of whites and blacks, different types of colors give the physician an idea of the type of density that he/she is observing. For example, in the case of the chest the heart, lungs, and blood vessels are so close together that contrast is critical for achieving an accurate diagnosis. Hence histogram equalization is a straightforward image-processing technique often used to achieve better quality images in black and white color scales in medical applications. Considering above problem statement, suppose a 3-bit image of size 5x5 having intensity distribution as shown in figure below, where intensity levels are in the range 0-7, perform histogram equalization transformation by scaling the intensity to 0-15. Note: Approximate the result obtained during simplification to only 2 decimal places. (C.O.No.2) [Comprehensive Level]

F(x,y)

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

16. Given an Image **"A"** and its structuring element **"B"**. Compute the Output Image. (C.O.No.4) [Comprehensive Level]

Input Image (A)	Structuring Element Origin (B)	Morphological Operation	Output
A 0 0 0 0 0 0 0 0 1 1 0 0 0 1 1 1 1 0 0 0 1 1 0 0 0 0 0 0 0 0	B 1 1 . 1	(i) A Dilated by B ($A \oplus B$) (ii) A^c Dilated by B ($A^c \oplus B$)	
0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0	1 1 . 1	(i) A Erosion by B ($A \ominus B$) (ii) A^c Erosion by B ($A^c \ominus B$)	