## **Question Paper**

Exam Date & Time: 25-Jun-2024 (02:30 PM - 05:30 PM)



## MANIPAL ACADEMY OF HIGHER EDUCATION

SIXTH SEMESTER B.TECH MAKE UP EXAMINATIONS, JUNE 2024

Ε

DIGITAL IMAGE PROCESSING [CSE 4052]

Marks: 50

Duration: 180 mins.

## Answer all the questions.

image?

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) Estimate the equalized values (transformed values) for the following tabulated input image (5) intensities

A)

$r_k$	$n_k$	$p_r(r_k) = n_k/MN$
$r_0 = 0$	790	0.19
$r_1 = 1$	1023	0.25
$r_2 = 2$	850	0.21
$r_3 = 3$	656	0.16
$r_4 = 4$	329	0.08
$r_5 = 5$	245	0.06
$r_6 = 6$	122	0.03
$r_7 = 7$	81	0.02

- Along with an example, explain the two ways of obtaining a digital image from the objects. In which (3) case the clarity of pixels is good and why?
- C) If a digital image consists of 10 squares of an inch size in x direction and 10 squares in y direction (2) with a spatial resolution of 300dpi (or also called as 300 PPI pixels per inch). Estimate the pixel resolution of the image?
- With a neat diagram of filter kernel and the equation, discuss the image smoothing using (6) Butterworth Lowpass filter (BLPF)
   A)
- B) Represent the low pass filter in terms of high pass filter in frequency domain (2)
  C) With a diagram and mathematically, relate illumination, reflectance, and luminance (2)
  3) Along with the equation, explain how the salt and pepper noise is computed and added to the (5)

- A)
- B) Which filter plays the dual role based on the order of the filter? and choose three values and explain (3) the filter behaviour?
- C) List the three approximations to compute the rate of change of intensity (during edge detection) (2) either in case of first order derivative or second order derivative
- 4) Propose the equations for forward difference, backward difference and the central difference (4) calculations using first order derivatives in 1D. Extend the same equation for central difference using second order derivative
  - B) Discuss three types of edges with a neat diagram. What is the practical application of such intensity (4) profiles?
  - C) Defend why Canny operator is superior compared to other methods (2)
- 5) Compile the possible properties that can be extracted using morphological image processing for the (3) following segmented region?
  - A)
  - B) Explain the mathematical expression for opening and closing an object using a structuring element



C)

For the following 3x3 image, represent it using graph, solve the problem of segmentation using (3) graph cut method and the final result image

(4)

-----End-----