

- (c) Consider any three valid colours and with coordinates and in the chromaticity diagram. Derive the necessary general expressions for computing the relative percentages of , and composing a given colour that is known to lie within the triangle whose vertices are the co-ordinates of , and .

Roll No.

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**B.C.A.****FIFTH SEMESTER EXAMINATION, 2018-19****IMAGE PROCESSING**Time : **3 Hours**Max. Marks : **60**

- Note :** (i) Attempt **ALL** questions.  
(ii) Choices are given in each question set.

1. Attempt any **Four** of the following questions: **3 x 4 =**

**12**

- (a) Write short note on neighbors of a pixel with suitable example.

- (b) Consider the following image segment.

$$\begin{matrix} 3 & 1 & 2 & 1 & (q) \\ 2 & 2 & 0 & 2 \\ 1 & 2 & 1 & 1 \end{matrix}$$

$$\begin{matrix} (p) & 1 & 0 & 1 & 2 \end{matrix}$$

Let  $V = \{1, 2\}$  and compute the lengths of the shortest 4-, 8- and m-path between p and q.

- (c) Explain the concept of brightness adaptation in image processing with necessary graph.
- (d) Define city block distance with an example.
- (e) Find the number of bits required to store a 256 x 256 image with 32 gray levels.
- (f) Discuss the role of sampling and quantization in image processing.

2. Attempt any **Four** of the following questions: **3 x 4 =**

12

- (a) Apply Sobel operator for the following 4 x 4 image with replication on boundary pixels.

2 2 4 7  
7 4 3 2  
1 1 1 2  
1 3 4 7

4

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- (b) Smooth the given image using the following 3 x 3 mask by apply mirror (reflection) in the boundary pixels.

2 2 1  
1 2 1  
1 2 2

mask / filter

5 10 15 25

20 10 30 40

1

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- (b) Laplacian operator uses the 2<sup>nd</sup> order derivative, to estimate the magnitude of the spatial variation at a point. A popular method based on Laplacian for enhancing the image quality can be modeled by the following equation.

$$\text{If } G(u) = H(u) F(u).$$

Find the filter  $H(u)$  in the frequency domain. Then draw the graph of the filter and classify whether this filter is high pass or low pass?

50 40 35 20

10 30 40 50

Image

- (c) Explain bit plane slicing. What would be the effect on histogram if we set to zero the higher order but planes?
- (d) Explain the process of unsharp masking and high boost filtering.
- (e) What is Gamma Correction? In power Law equation discuss the role of with the practical examples in the context of images.
- (f) Consider an image below: mortar

1 1 1

1 8 1

1 1 1

Apply a 3x3 median filter to above image to produce 3 x 3 output images by zero padding the image.

3. Attempt any **Two** of the following questions: **6 x 2 = 12**

- (a) Find the Fourier Transform (continuous) of 2-D sine function

- (c) Explain and compare ideal high pass and Butterworth filter for image sharpening.

4. Attempt any **Two** of the following questions: **6 x 2 = 12**

- (a) Consider the problem of image blurring caused by uniform acceleration in the x-direction. If the image is at rest at time  $t=0$  and accelerates with a uniform acceleration for a time  $T$ , find the blurring function. You may assume that shutter opening and closing times are negligible.
- (b) Explain inverse filtering approach with necessary mathematical expressions. List its limitation in image restoration.
- (c) Discuss various mean filters used in image restoration.

5. Attempt any **Two** of the following questions: **6 x 2 = 12**

- (a) Sketch the schematic diagram of the RGB colour cube and write expressions to convert HIS to RGB image.
- (b) Explain the concept of opening and closing. Discuss their use in morphological image processing.