

Date: 17/11/2016.

Student Exam No. \_\_\_\_\_

GANPAT UNIVERSITY

B. Tech. Semester: VII (Mechatronics) Engineering

Regular Examination Nov-Dec 2016

2MC705: Digital Image Processing & Machine Vision

Time: 3 Hours

Total Marks: 70

Instructions:

1. Start new question from new page only.
2. Number to the right indicates full marks of question/sub-question.
3. Draw figure neat and clean wherever desired.

Section - I

Que. - 1 Attempt ALL.

[12]

- (A) Find edges in an image 'a' using canny edge detection method.

[06]

$$a = \begin{bmatrix} 194 & 180 & 132 & 85 \\ 150 & 44 & 16 & 16 \\ 27 & 13 & 12 & 12 \end{bmatrix}$$

- (B) Determine global threshold value using iterative method.

[03]

$$f = \begin{bmatrix} 70 & 23 & 14 & 12 & 41 & 26 \\ 6 & 58 & 6 & 12 & 9 & 46 \\ 23 & 61 & 26 & 23 & 9 & 61 \\ 162 & 185 & 200 & 52 & 0 & 52 \\ 238 & 229 & 255 & 107 & 26 & 49 \end{bmatrix}$$

- (C) Show result of region growing algorithm for following image. Assume that difference between neighbor pixels is not greater than 4. The seeds are indicated by underlines.

[03]

$$a = \begin{bmatrix} 1 & 0 & 7 & 8 & 7 \\ 0 & 1 & 8 & \underline{9} & 8 \\ 0 & 0 & 7 & 9 & 8 \\ 0 & \underline{1} & 8 & 8 & 9 \\ 1 & 2 & 8 & 8 & 9 \end{bmatrix}$$

OR

Que. - 1 Attempt ALL.

[12]

- (A) Determine global threshold value using Otsu's method for following 3 bit image.

[06]

$$f = \begin{bmatrix} 0 & 2 & 5 & 3 \\ 1 & 4 & 5 & 6 \\ 5 & 6 & 1 & 2 \\ 2 & 2 & 7 & 5 \end{bmatrix}$$



- (B) What is redundancy? Name different types of redundancy in an image and Explain in detail "How do redundant data result due to coding process?" [03]
- (C) Use region splitting and merging operation for segmenting following 4X4 image. Assume maximum change in intensity is not more than 2 for splitting the region and difference in average intensities is less than and equal to 2 for merging two regions. [03]

$$a = \begin{bmatrix} 8 & 6 & 3 & 4 \\ 6 & 7 & 2 & 2 \\ 8 & 7 & 9 & 5 \\ 8 & 6 & 5 & 6 \end{bmatrix}$$

Que. - 2 Attempt ALL.

[11]

- (A) Find line parameters for following image using Hough transform. Assume parameter space sampling as  $45^\circ$  along slope and 1 row/column along distance axis. [05]

$$f = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

- (B) For 2-bit image, encode the image  $a = [0 \ 1 \ 2 \ 2 \ 3]$  using arithmetic coding process if probability of each intensity is as given below. [03]

Gray level, $i$	0	1	2	3
Probability, $P_i$	0.2	0.2	0.4	0.2

- (C) Design filter using Laplacian operator to detect discontinuities in an image. [03]

OR

Que. - 2 Attempt ALL.

[11]

- (A) Find prewitt response for following image [05]

$$f = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 12 & 1 \\ 1 & 15 & 2 & 1 \\ 1 & 3 & 13 & 1 \end{bmatrix}$$

- (B) Discuss lossy predictive coding with necessary block diagram of encoder and decoder. Explain each block briefly. [03]
- (C) For 3-bit image, probability of each gray level value of occurrence is as under. [03]

Gray level, $i$	0	1	2	3	4	5	6	7
Probability, $P_i$	0.3	0.4	0.1	0.06	0.1	0	0	0.04

Determine Huffman code for the image.

Que. - 3 Attempt ALL.

[12]

- (A) Explain how gray code can be used to obtain better reduction in data for image compression using bit plane decomposition?
- (B) Why are channel encoder and decoder needed? Explain how channel encoding and decoding process can be implemented.
- (C) Draw a block diagram of image compression model and explain each term briefly.



## Section – II

- Que. – 4 Attempt ALL [12]**
- (A) Illustrate with an example: 1. Zooming by replication, [04]  
2. Zooming by linear interpolation.
- (B) Explain imaging geometry with two coordinate systems concept with a neat sketch. [04]
- (C) Illustrate the process of thresholding and grey level slicing with an example. [04]

OR

- Que. – 4 Attempt ALL [12]**
- (A) Compare the basic frequency domain filters: Ideal low pass filter, [04]  
Butterworth low pass filter and Gaussian low pass filter.
- (B) Equalize the given histogram. [04]
- | Gray level | 0   | 1   | 2 | 3   | 4 | 5  | 6 | 7 |
|------------|-----|-----|---|-----|---|----|---|---|
| $n_k$      | 120 | 110 | 0 | 100 | 0 | 50 | 0 | 0 |
- (C) Discuss the concept of image negative and bit plane slicing with an example. [04]

- Que. – 5 Attempt ALL [11]**
- (A) A camera on gimbal system is enabled to pan and tilt. The gimbal center is at (1, 2, 5). The camera center is displaced from gimbal center by (0.5, 0.6, 0.7) in XYZ. If pan angle is 60 degree & tilt angle is 30 degree, find out image coordinates (Cartesian form) of a world point (1, 1, 5). Assume focal length to be 3 mm. [04]
- (B) Describe the construction and working of vidicon tube with a neat sketch. [04]
- (C) Exemplify the concept of machine vision with diagram. [03]

OR

- Que. – 5 Attempt ALL [11]**
- (A) Exemplify the process of digital image processing with necessary steps. [04]
- (B) Explain: 1. Simple image formation model, [04]  
2. Filters used in spatial domain image enhancement
- (C) Write in brief about camera calibration procedure. [03]

- Que. – 6 Attempt ALL [12]**
- (A) What will happen to the dynamic range of an image if all the slopes in the contrast stretched algorithm are more than one? Explain with an illustration.
- (B) Explain the concept of imaging transformation and inverse imaging transformation.
- (C) Discuss about following: 1. Neighbors of pixels, 2. Regions, [04]  
3. Adjacency, 4. Connectivity between pixels

\*\*\*\*\*END OF PAPER \*\*\*\*\*