

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institution of Manipal University

VI SEMESTER B.TECH. (MECHATRONICS ENGINEERING) END SEMESTER EXAMINATIONS, JUN 2017

SUBJECT: MACHINE VISION AND IMAGE PROCESSING [MTE 4006]

REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitable assumed.
- 1A. An astronomer working with a large-scale telescope observes that his images are (3) degraded. The manufacturer tells the astronomer that the unit is operating within specifications. The telescope lenses focus images onto a high resolution, CCD imaging array, and the images are then converted by the telescope electronics into digital images. Trying to improve the situation by conducting controlled lab experiments with the lenses and imaging sensors is not possible due to size and weight of the telescope components. The astronomer, having heard about you as an image processing expert, calls you for help to formulate a digital image processing solution for sharpening the images a little more. How would you go about solving this problem, given that the only images you can obtain are images of stellar bodies using the same setup?
- 1B. An image consists of two different shape of objects which has to be clustered to (3) two different groups. For this the processor decides to use k-means clustering. Describe the steps involved in k-means clustering.
- 1C. Describe bit plane slicing. For a 3 bit image given below reconstruct the image (4) using only 6^{th} and 7^{th} plane.

148	154	135
133	112	140
165	167	142

- 2A. Illustrate the image formation technique in camera plane and also describe the (5) procedure for finding the 3D points from image points.
- **2B.** Identify and describe the morphological operations to be performed for the (3) following scenario:

(a) A paragraph given in Fig.Q2B (a) has to be processed by a digital computer. But due to bridging gaps computer is unable to consider each letter as a whole character. Observe the highlighted part for bridging gaps.

(b) Due to improper camera setting the two objects (square and circle) appear to

be a single object as shown in Fig.Q2B (b) But for further processing it is necessary to separate these two objects as in Fig. Q2B(c)

2C.	Differentiate Image Enhancemen	nt and Image Restoration	
	U	0	

Historically, certain computer programs were written using only two digits rather than four to define the applicable year, Accordingly, the company's software may recognize a date using "00" as 1900 rather than the year

k

0

1

2000.

Fig.Q2B (a)

Describe various frequency domain image sharpening techniques. (4) 3A.

Fig.Q2B (b)

Fig. Q2B(c)

3B. Suppose there is a 3 bit image of size MxN=8200. The intensity distribution (4) shown in table. Plot the histogram of the image. Perform histogram equalization on this image and find the pixels in equalized image and then plot histogram of the equalized image.

3

		n_k	30	50	100	1500	2300	4000	200	20		
3C.	C. Consider the image segment shown below. Let $V = \{1,2\}$ and compute the lengths								(2)			
	of the shortest 4,8,m path between p and q. If a particular path does not exist											
	between these two points explain the reason behind it											

4

5

1500 0000 4000 000 00

2

1

6

between these two points explain the reason behind it. 3 $1 \ 2 \ 1(q)$

> 2 0

2 1

 $(p)1 \quad 0 \quad 1$ 2 4A. Describe three principal sensor arrangements used to transform illumination (4) energy into digital images.

2

1

4B. Describe the circular Hough transform for identifying the wheels shown in the (3) image given in Fig.Q4B. The radius of the circular component is known to you.

4C. Elucidate working of kalman filter for object tracking.

- 5A. Discuss intrinsic and extrinsic parameters of camera. A point in world plane is (5) captured by two identical cameras placed on right and left side. Derive the expression for relating fundamental matrix with corresponding two views.
- **5B.** Assume that you are watching football match on a system. You would wish to (3) track the motion of players. Identify which kind of object tracking technique you should apply and describe the same.
- 5C. Describe the goal of stereo vision.

(2)



(3)

(2)