Enrolment No.____

GUJARAT TECHNOLOGICAL UNIVERSITY ME - SEMESTER-III • EXAMINATION – WINTER 2015

Subject Code :2730303 Subject Name: Image Processing for Instrumentation Time:2:30 PM to 5:00 PM Marks: 70

Date:04/12/2015

Total

Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary and mention it clearly in your solution.
- 3. Figures to the right indicate full marks.
- 4. All symbols carry their usual meaning unless otherwise stated.
- Q.1 (a) An automobile manufacturer is automating the placement of certain 07 components on the bumpers of a limited-edition line of sports cars. The components are color coordinated, so the robots need to know the color of each car in order to select the appropriate bumper component. Models come in only four colors: blue, green, red, and white. Propose a solution based on imaging.

How would you solve the problem of automatically determining the color of each car, keeping in mind that cost is the most important consideration in your choice of components?

(b) In the Hough Transform, a point (x0, y0) in the xy-plane is mapped into a curve in the (,) parameter space. Write down the equation of the curve. If we apply the Hough transform on the image below, what would be the maximum value for the accumulator cell in the (,) space? What is the corresponding (,) value? Give justification of your answer. Each black square denotes a point and the numbers are the coordinates, in figure.



Q.2 (a) Images X and Y are shown below with the crossing in the left bottom showing 07 their correspondence. Design an appropriate structure element such that Y can be obtained after dilating X. Mark the center of the structure element clearly. (black for 1 and white for 0)



(b) Develop a MATLAB function named MEDIANFN for computing the median 07 of an n x n neighborhood. Using this function write a program to apply 3x3 median filter to the image I of size 100 x 100. Consider zero extended image. Appropriate comment lines are must.

OR

(b) Two images f(x, y) and g(x, y) have histograms h_f and h_g . Give the conditions 07 under which you can determine the histograms of

(i) f(x, y) + g(x, y) (ii) f(x, y) - g(x, y) (iii) f(x, y) x g(x, y)in terms of h_f and h_g . Explain how to obtain histogram in each case.

Q.3 (a) The histogram of two images are shown below. Sketch a transformation 07 function for each image that will make the image has a better contrast.



(b) The following figure shows an 8-bit image of size 5×5 , with x and y 07 coordinates specified.

x \ y->	0	1	2	3	4
0	210	150	54	95	62
1	120	211	65	65	56
2	220	255	87	87	42
3	235	184	84	56	85
4	181	211	87	50	74

write the kernel in all solutions and compute the following

- (i) The output of a 3×3 max filter at (1,1).
- (ii) The output of a 3×3 median filter at (2,1).
- (iii) The output of a 3×3 Laplacian filter at (3,2).

Q.3 (a) What is the need of histogram equalization? Obtain Histogram equalization for 07 the following image segment of size 5×5 ? Write the inference on image segment before and after equalization

unu	uncer e	quanza	acion	
20	20	20	18	16
15	15	16	18	15
15	15	19	15	17
16	17	19	18	16
20	18	17	20	15

(b) Find 2D correlation between x and h shown below.

x =

0	0	0	0	0
0	1	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	2	0

h=

1	2	3
4	5	6
7	8	9

- Q.4 (a) Discuss the periodicity and conjugate symmetry properties for 1-D and 2-D 07 Fourier spectrum with the help of figures. How do we centralize the Fourier spectrum?
 - (b) Consider 4x4, 8-bit image shown below. Construct the dictionary for LZW 07 coding.

30	30	212	212
30	30	212	212
30	30	212	212
30	30	212	212
30	30	212	212

OR

- Q.4 (a) With the help of necessary derivations discuss Laplacian in the frequency 07 domain.
 - (b) The probabilities of the symbols a_1 to a_6 are 0.1, 0.4, 0.06, 0.1, 0.04, and 0.3, **07** respectively. Assign Huffman code to each symbol and find the average length of this code.
- Q.5 (a) With the help of figures and equations discuss the role of illumination in 07 histogram distortion.
 - (b) Define grayscale dilation. For the image segment of size 4x4 and operator of 07 size 3x3 shown below, find grayscale dilation output.

6	7	3	4
5	6	6	8
6	4	5	2
6	4	2	3

1
1
1

OR

- Q.5 (a) Discuss region filling algorithm of morphology with the help of necessary 07 figures.
 - (b) Define grayscale erosion. For the image segment of size 4x4 and operator of 07 size 3x3 shown in Q-5(b), find grayscale erosion output.

07