GUJARAT TECHNOLOGICAL UNIVERSITY B.E. - SEMESTER – VIII EXAMINATION – OCTOBER 2012

Subject Code: 181102 Subject Name: Fundamental of Image Processing Time: 02.30pm - 05.00pm

Date: 25/10/2012

Total Marks: 70

Instructions:

- 1. Attempt any five questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 (a) Explain sampling, quantization and bit-planes of gray scale 07 images with examples.
 - (b) Sketch a piece-wise linear input-output characteristic with 07 the corner points (0, 0), (100, 30), (200, 230), and (255, 255). Determine the output for the following input.

20	40	60			
80	100	120			
140	160	200			
Image I: Q.1 (b).					

- Q.2 (a) Explain implementation of Laplacian operator in 2D space 07 and in 2D spectrum. State an application of Laplacian.
 - (b) Segment the following image into two regions, clearly 07 depicting the boundary based on the histogram.

3	2	0	8	7		
2	3	1	8	7		
2	2	1	8	7		
7	7	7	8	8		
6	6	6	6	5		
Image II: Q.2 (b)						
OR						

- (b) Explain motivation and implementation of homomorphic 07 filter approach for image enhancement.
- Q.3 (a) Explain extension of 1D DFT to 2D DFT. Sketch a typical 07 MxN point DFT to depict low and high frequencies.
 - (b) Explain Butterworth low-pass and high-pass frequency 07 responses and their implementation in 2D spectral domain.

OR

Q.3 (a) Explain 2D wavelet analysis structure. Derive 2-level 07 wavelet analysis of the following image with the subband filters $h_0[n] = \{1,1\}$ and $h_1[n] = \{1,-1\}$.

$u_{11}[1] - \{1, -1\}.$						
4	5	3	2			
5	6	4	1			
3	2	4	2			
2	3	2	3			
	4 5 3 2	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			

Image III: Q.3 (a) and Q.3 (b).

(b) Derive Huffman code for encoding the gray-levels in 07

Image III given above and the compression ratio for the same.

- Q.4 (a) Explain each of the three characteristics of AWGN 07 (Additive White Gaussian Noise) model.
 - (b) Explain RGB and CMY color models. Derive a CMY **07** equivalent of a 24-bits RGB vector (55, 100, 165).

OR

- Q.4 (a) Derive the relation between the reduction in noise and the 07 number of observations K in an averaging method where K degraded image observations due to an additive noise with zero mean and a constant variance are averaged.
- Q.4 (b) Explain color complements in RGB and HSI color spaces. 07 Derive the color complement of RGB vector (0.5, 0.1, 0.2) on the elementary color scales of [0, 1].
- Q.5 (a) Explain Erosion, Dilation, Opening and Closing. Give 07 appropriate morphological operations on a 2-pixel thick 'H', depicted in the following image for (i) removing the horizontal segment of 'H', (ii) removing the vertical segments of '<u>H'</u>, and (iii) thinning of '<u>H'</u> to 1-pixel.

1	1					1	1	
1	1					1	1	
1	1					1	1	
1	1	1	1	1	1	1	1	
1	1	1	1	1	1	1	1	
1	1					1	1	
1	1					1	1	
1	1					1	1	

Image IV: Q.5 (a).

(b) Segment the following image into two regions based on the **07** edge-orientations derived through a gradient operator clearly depicting the boundary.

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27	27	27	27	27		
25	25	25	25	25		
23	23	30	33	36		
21	21	33	36	39		
19	19	36	39	42		
Image V: Q.5 (b).						
OR						

- Q.5 (a) Explain a linear image-degradation model, an inverse 07 restoration filter and its limitations.
 - (b) Give a morphological approach to detect 3x3 size patches 07 of white color in a color image in RGB space.
