Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VII• EXAMINATION–SUMMER 2015

Subject Code:170307 **Date:06/05/2015**

Subject Name: Image Processing

Time:2.30pm-5.00pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Explain the main features of human eye and their functions relevant to image formation in the eye.	**07**
	(b)	Explain the transformation $t=s^2$, where "s" is intensity of a pixel of the input image f(x, y) and "t" is the intensity of the corresponding pixel in the output image g(x,y). Also give an example of a 3x3 input f(x, y) and the corresponding output g(x, y) for the given transformation.	**07**
Q.2	**(a)**	Consider a sequence of intensity values of pixels in a 3x3 image {2.2, 4.7, 1.0, 7.4, 0.2, 3.4, 6.6, 5.8, 4.1}. Give a 3-bit per pixel representation of the given sequence. Also calculate the mean squared quantization error due to this representation of the given sequence.	**07**
	(b)	Plot the histogram of the following sequence of intensity values of pixels in a 3x3 image, {3, 2, 3, 7, 6, 6, 7, 2, 2}, considering the integer values from 0 to 7. Give a boundary (threshold) condition for classification of the pixels into two different classes based on their values.	**07**
		OR	
	(b)	Explain the relation of the illumination i(x, y), the radiance of surface r(x, y), and the corresponding pixel intensity f(x, y), in an image. Explain the implementation of homo-morphic filters based on the relation.	**07**
Q.3	**(a)**	Explain various Neighborhood processing methods for edge detection in images.	**07**
	(b)	In a 16x16 binary image, f(x, y) = 1, for (x, y) equal to (0, 0), (2, 1), (4, 2), (6, 3), (8, 4), (10, 5), (12, 6), (14, 7); and f(x, y) = 0, otherwise. Link the pixels with value '1' to a particular geometrical shape. Also give steps of the algorithm for the same.	**07**
		OR	
Q.3	**(a)**	Explain region growing for image segmentation with an example.	**07**
	(b)	Give equations for DFT of MxN image and its inverse. Explain any two properties of DFT.	**07**
Q.4	**(a)**	Explain the procedure to derive the KL transform of a set of images of size NxN. Also explain the orthogonal relations of its basis functions.	**07**
	(b)	Consider a 3 pixel thick "L" shape in a binary image represented by pixel values '1' and all other pixel value are '0'. Give a method based on morphological operations to convert all '1' from the horizontal section of the "L" shape to '0', and preserving all '1' in the vertical section.	**07**
		OR	
Q.4	**(a)**	Explain the hit-or-miss transform and its applications in image processing.	**07**
	(b)	Explain LZW coding and its applications in image processing.	**07**
Q.5	**(a)**	Explain various steps of JPEG encoding giving a functional block diagram.	**07**

	(b)	There are four intensity values in an image namely {a, b, c, d} and their corresponding probabilities are {0.5, 0.2, 0.2, 0.1}, respectively. Derive an arithmetic code for a length-four sequence "a b c a". State whether the arithmetic coding is uniquely decodable or not and why?	**07**

OR

Q.5	**(a)**	Define the nth moment of a sequence of pixel intensity values. Calculate 1st, 2nd and 3rd moments of the 4x4 image, $f(x, y) = (-1)^{(x+y)}$.	**07**
	(b)	Define the Haar transform for images. Calculate the Haar transform of the 8x8 image, $f(x, y) = 1+ (-1)^{(x+y)}$.	**07**

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