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B.E / B.Tech DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2019

ELECTRONICS AND COMMUNICATION ENGINEERING
BIOMEDICAL ENGINEERING

BM 8751 PRINCIPLES OF DIGITAL IMAGE PROCESSING
Regulations 2012

Time: 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. What is Mach band effect?
2. Determine the Intensity component of a RGB image whose colour triplet is given by (0.3, 0. 4, 0.3).
3. Determine the filtered value of the centre pixel by performing median filtering for f(x,y) = [1 2 5 ; 1 0 7 ; 6 4 3].
4. Write the expression for contra-harmonic filter and state how this filter would become effective in eliminating pepper noise.
5. Define the basic operations of geometric transformations.
6. Draw the block diagram of image restoration system with appropriate expression for transfer function .
7. Define local and global thresholding techniques.
8. Write the expression to find first and second derivatives of an image.
9. Define the performance measures used for evaluating image compression algorithms.
10. Define redundancy and compression ratio.

Part – B (5 x 16 = 80 marks)
(Question No.11 is Compulsory)

11 i)Derive transition and reconstruction levels of optimum mean square quantizer. Determine the SNR of the quantizer for uniform distribution. (8)

ii)Determine the convolution of two matrices A = [1 1 1 ; 1 0 1] and B = [1 -1 ; 1 1]. (8)

12 a.i) Perform histogram equalization and specification for the image f(x,y) = [2 2 3 3; 0 1 0 2; 3 1 0 1; 1 3 2 0]. The distribution of gray levels of the output image is given by $p(z_0) = 0.2$, $p(z_1) = 0.7$, $p(z_2) = 0.1$, $p(z_3) = 0$. (10)

aii) Explain homomorphic filtering. (6)

(OR)

b.i) Obtain the filtered value of the centre pixel image by applying geometric mean, harmonic mean, Maximum and Minimum filters for a given image f(x,y) = [12 15 11 ; 16 13 14; 11 15 14]. Compare the performance of filters. (8)

ii) Write the probability density functions for any of four image noise models. (8)

13 a.i) Derive the expression for Wiener filter for the blurring degradation function modeled in spatial domain as $h(r) = [(r^2 - \sigma^2) / \sigma^4] \exp(-r^2 / 2\sigma^2)$. Assume the ratio of power spectra of the noise and undegraded signal is a constant. (8)

ii) Explain how degradation is modeled as a linear and position invariant system. (8)

(OR)

b.i) An image is at rest at time t =0 and accelerates with a uniform acceleration $x_0(t) = at^2/2$ in x direction for a time T. Determine the transfer function H(u,v). (8)

ii) Derive the transfer function of inverse filter employed for image restoration. (8)

14 a.i) Explain region growing, splitting and merging segmentation techniques. (8)

ii) Determine the edge detected output for the center 3X 3 window of input image f(x,y) = [0 0 0 0 0 ; 0 15 20 30 0 ; 0 20 30 10 0 ; 0 15 25 35 0 ; 0 0 0 0 0] using Prewitt's operator. (8)

(OR)

b.i) Explain in detail how watershed algorithm is employed for image segmentation. (8)

ii) Determine the edge detected output for the center 3X 3 window of image f(x, y) = [0 0 0 0 0; 0 20 1 1 0; 0 1 25 1 0; 0 1 1 22 0; 0 1 1 1 0] using edge operator defined by [2 -1 -1; -1 2 -1; -1 -1 2]. (8)

15 a.i) A source emits {a, b, c} with the probabilities 0.6, 0.2 and 0.2. Determine the tag for the message baccb using arithmetic coding method. (8)

ii) Describe LBG algorithm used in forming dictionary of vector quantisation. (8)

(OR)

b.i) Explain the JPEG encoder used for image compression. (8)

ii) Determine the entropy and average length of the Huffman code for the image f(x, y) = [1 2 1 3 1 1 1 1; 0 0 0 2 3 0 0 0 ; 0 0 0 1 1 2 3 0 ;0 0 0 1 1 1 2 3]. (8)