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ECE 1817 OE 21

Roll No. of candidate

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282/22 2021

BINA CHOWDHURY CENTRAL LIBRARY
(EIMT & GIPS)
BINA HATHI WAPARA,
KOLKATA-70017

B.Tech. 7th Semester End-Term Examination

ECE + ETE

IMAGE PROCESSING

New Regulation (w.e.f. 2017-18) & New Syllabus (w.e.f. 2018-19)

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer any *seven* questions.

1. (a) Explain how image is formed in human eye. Suppose, a camera is focused at a pillar of height 2m and situated at a distance of 10m. What is the focal length of the image produced in the camera? (3+3=6)
- (b) Explain the concept of sampling and quantization of an image. (4)
2. (a) Explain the term “m-connectivity” with respect to a digital image. (2)
- (b) Discuss the most commonly used distance measures in image processing. (4)
- (c) With mathematical equation, explain the bicubic interpolation. (4)
3. (a) Obtain the correlation of the following two matrices using matrix method. (5)

$$x(m, n) = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \quad h(m, n) = \begin{bmatrix} 3 & 4 \\ 4 & 4 \end{bmatrix}$$

- (b) Compute the 2D-DFT of matrix of $x = \begin{bmatrix} 4 & 6 \\ 3 & 4 \end{bmatrix}$

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4. (a) Perform histogram equalization of an image given below: (5)

$$f(m, n) = \begin{bmatrix} 3 & 2 & 4 & 5 \\ 7 & 7 & 8 & 2 \\ 3 & 1 & 2 & 3 \\ 5 & 4 & 6 & 7 \end{bmatrix}$$

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- (b) List and describe any two point processing operations with necessary graphs. (5)
5. (a) With appropriate equations, explain the issue with inverse filtering for restoring image. How does Wiener filtering eliminate the issue? (6)
- (b) Explain image degradation and restoration model. (4)
6. (a) Explain the smoothing of images in frequency domain using
- (i) ideal low-pass filter and
- (ii) Butterworth low-pass filter. (5)
- (b) What is median filtering? Calculate the median value for the underlined pixels given below using a 3×3 mask. (5)

$$f(m, n) = \begin{bmatrix} 12 & 13 & 22 & 26 & 32 & 24 \\ 34 & \underline{123} & \underline{24} & \underline{100} & \underline{34} & 22 \\ 14 & 15 & 13 & 32 & 31 & 21 \end{bmatrix}$$

7. (a) Differentiate between local, global and adaptive thresholding. (5)
- (b) How is Hough transform helpful in edge linking? (5)
8. (a) An information source produces sequences of independent symbols A, B, C, D, E, F, G with corresponding probability values of $1/3, 1/27, 1/3, 1/9, 1/9, 1/27, 1/27$. Construct a binary code using Huffman coding algorithm. (5)
- (b) What are the basic data redundancies exploited in image compression? Explain. (5)
9. (a) Write the formulae used for converting:
- (i) RGB to HSI (ii) HSI to RGB. (5)
- (b) Define the terms brightness, hue and saturation with respect to a digital image. (3)
- (c) What is pseudo color image processing? (2)
10. Write short notes on any two topics from the following list: (5+5)
- (a) Run length encoding (RLE)
- (b) Haar transform
- (c) Bit-plane Slicing
- (d) Fundamental steps in image processing.