**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI**
**(END SEMESTER EXAMINATION)**

**CLASS: BE** **SEMESTER : VII**
**BRANCH: ECE** **SESSION : MO/19**

**SUBJECT: MEC2011 DIGITAL IMAGE PROCESSING TECHNIQUES**

**TIME: 3.00Hrs.** **FULL MARKS: 60**

**INSTRUCTIONS:**
**1. The question paper contains 7 questions each of 12 marks and total 84 marks.**
**2. Candidates may attempt any 5 questions maximum of 60 marks.**
**3. The missing data, if any, may be assumed suitably.**
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
**5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.**

---

Q.1(a) Formulate a simple image formation model. [2]
Write the formula to find the Euclidian distance between two pixels p and q.

Q.1(b) Explain the fundamental steps in digital image processing with the help of neat block diagram. [4]

Q.1(c) Consider the image segment shown. Let intensities in domain are V = {1, 2}, Compute the lengths of shortest 4- path, 8-path, and m-path between p and q, if the particular path does not exist between these two points, explain why [6]

| | | | | | |
|---|---|---|---|---|---|
| | 5 | 1 | 2 | 1 | (q) |
| | 2 | 1 | 0 | 2 | |
| | 1 | 2 | 1 | 1 | |
| (p) | 1 | 0 | 1 | 4 | |

Q.2(a) Write down the property for orthogonal matrix and unitary matrix. [2]

Q.2(b) Perform the discrete convolution for X (m, n) and H (m, n). Where (0, 0) showing the element is at origin. [4]

| | | | |
|---|---|---|---|
| X(m, n) | 1 | 4 | 1 |
| | 2 (0,0) | 5 | 3 |
| H(m, n) | 1 | 1 | |
| | 1(0,0) | -1 | |

Q.2(c) For the 2-D discrete Fourier transform write the 2x2 kernel, find the coefficients for the given image below. And from the coefficients recover back the image. [6]

| | |
|---|---|
| 1 | 2 |
| 3 | 4 |

Q.3(a) Explain the image negative enhancement technique. Write one application. [2]

Q.3(b) Perform the median filtering on y (m) = {3, 2, 8, 4, 2, 4, 7}.The window w= {-1,0,1} [4]

Q.3(c) For the given image X and the histogram Y perform the histogram equalization and find the image. [6]

| | X0 | X1 | X2 | X3 | X4 | X5 | X6 | X7 |
|---|---|---|---|---|---|---|---|---|
| Intensities | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| P(Xi) | 0.1 | 0.2 | 0.4 | 0 | 0 | 0 | 0.2 | 0.1 |

Q.4(a) Explain degradation and restoration process with appropriate model. [2]

Q.4(b) Discuss Minimum Mean Square Error (Wiener) Filtering approach with appropriate mathematical expression. [4]

Q.4(c) Derive the mathematical Model of degradation function for uniform linear motion blur. [6]

Q.5(a) Name the three different types of discontinuities for gray level digital image. [2]

Q.5(b) Derive the Laplacian operator mask. [4]

Q.5(c) A binary image contains straight lines oriented horizontally, vertically at 45 and at -45, Give the set of 3x3 masks that can be used to detect one pixel long breaks in these lines. Assume that the gray levels of the lines are one (1) and that the gray level of background is zero (0). [6]

Q.6(a) Define the moment and central moment for random variable. Also write the formula for covariance. [2]

Q.6(b) Explain the Boundary descriptor (Fourier descriptor). Also write any one property. [4]

Q.6(c) Find the Eigen values of the following matrix. [6]

| | |
|---|---|
| 2 | 3 |
| 4 | 5 |

PTO

Q.7(a) Differentiate Arithmetic coding and Huffman coding. [2]

Q.7(b) Explain Bit-Plane Coding with example. [4]

Q.7(c) For the given 4X8 image. 1). Compute the entropy of the image. [6]

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 21 | 21 | 21 | 95 | 169 | 243 | 243 | 243 |
| 21 | 21 | 21 | 95 | 169 | 243 | 243 | 243 |
| 21 | 21 | 21 | 95 | 169 | 243 | 243 | 243 |
| 21 | 21 | 21 | 95 | 169 | 243 | 243 | 243 |

**:::::06/12/2019E::::**