Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

SEVENTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION
NOV 2017
SUBJECT: DIGITAL IMAGE PROCESSING (ECE - 4006)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates
- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Perform the linear convolution between the two matrices $x(m,n)$ and $h(m,n)$ through graphical method: $x(m,n) = \begin{bmatrix} 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ $h(m,n) = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$

1B. Can circular convolution be used to perform "zooming" operation? Justify with an example.

1C. The pixel values of the following 5×5 image f are represented by 8 bit integers. Determine f with a gray-level resolution of 2^k for : (i) k=5 (ii) k=3.

$$f = \begin{bmatrix} 123 & 162 & 200 & 147 & 93 \\ 137 & 157 & 165 & 232 & 189 \\ 151 & 155 & 152 & 141 & 130 \\ 205 & 101 & 100 & 193 & 115 \\ 250 & 50 & 75 & 88 & 100 \end{bmatrix}$$

(5+3+2)

2A. Discuss the different representations of the fast Fourier transform of an image with neat diagrams. Also, prove that if an image $f(m,n), 0 \le m \le M-1$ and $0 \le n \le N-1$ is multiplied by $(-1)^{m+n}$ then its DFT is centred at $\left(\frac{M}{2}, \frac{N}{2}\right)$.

2B. Derive expression for the 3×3 Laplacian operator. Also, list the properties and drawbacks of the Laplacian operator.

2C. What do you mean by sub-band coding? Draw and discuss the first level wavelet decomposition of an image.

(5+3+2)

3A. Describe Otsu's threshold selection method from gray-level histogram with the help of necessary equations.

3B. Explain the main stages of Homomorphic filtering.

3C. Discuss low pass filtering in the frequency domain.

(5+3+2)

4A. Distinguish lossless and lossy compression. What are the different modes of JPEG compression? Explain the main stages associated with the baseline mode.

4B. Explain the principle of the following segmentation procedures: (i) split and merge (ii) region growing (iii) local thresholding

4C. What is slope overload error and granular noise in delta-modulation based image compression?

(5+3+2)

5A. What is digital watermarking? Classify them. Also, draw the flowchart of the least significant bit (LSB) watermarking and its extraction.

5B. How do you perform detection of boundaries in a binary image with the help of morphological operators? Explain with a simple example.

5C. What is 'blocking artifact' in DCT-based image compression scheme?

(5+3+2)