Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
MAKEUP EXAMINATIONS, DECEMBER 2019

APPLICATIONS OF DSP [ELE 4014]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 31 December 2019** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. (i) What is an eigen function of a 2D discrete space LSI system?

(ii) Prove separability property of a 2D continuous space Fourier transform. ***(03)***

1B. Perform the linear convolution of the following 2D sequences: [you may use separability property]

$x[n1,n2] = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 0 & 0 \end{pmatrix}$ and $h[n1,n2] = \begin{pmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{pmatrix}$

Consider first row and first column entry as the information at the origin. ***(04)***

1C. State and prove the Parseval's energy preservation property of 2D discrete space Fourier transform. ***(03)***

2A. (i) What is Gamma correction?

(ii) Write an algorithm to perform piece-wise linear thresholding. ***(03)***

2B. What is a histogram of an image? Plot histogram of the 3-bit image given below:

5	5	5	5	5
3	4	5	4	3
7	7	7	7	7
3	4	5	4	3
5	5	5	5	5

How do you perform histogram equalization? Explain with a flowchart. ***(04)***

2C. Explain the mathematical model of the bilateral filter. ***(03)***

3A. Derive an expression for 2D difference-of-Gaussian (DoG) for a unit valued, zero mean and constant variance Gaussian. Draw waveforms for the Gaussians used and DoG. ***(03)***

3B. Identify the salt and pepper noise location in the 8-bit image given below:

000	122	133	125	132	124
134	255	124	000	126	123
123	121	132	131	128	255

Perform the (3×3) median filtering assuming mirror boundary condition on the given image. ***(04)***

3C. What is normalized cross-correlation technique? What are its advantages? ***(03)***

4A. With a neat block diagram explain the image restoration model. ***(03)***

4B. Explain 2D Butterworth high-pass filter. ***(02)***

4C. Write short notes on geometric transformations of an image such as translation, scaling, and rotation. Give a unified mathematical representation of all the operations aforementioned. ***(05)***

5A. Explain the following morphological operations:
(i) Dilation (ii) Erosion (iii) Opening (iv) Closing. ***(04)***

5B. Derive expressions for 1D-DCT using DFTs. Use the same to write expression for 2D-DCT. List the uses of DCTs. ***(04)***

5C. Write short notes on: (i) Bit plane slicing (ii) Compass operator with Prewitt kernel ***(04)***