Reg. No.									

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

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
MAKEUP EXAMINATIONS, DECEMBER 2017
SUBJECT: APPLICATIONS OF DSP [ELE 4014]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 30 December 2017** **Max. Marks: 50**

Instructions to Candidates:

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

1A. Define 2D discrete space unit impulse function. What is its Fourier transform? Sketch the sequence $f[x, y] = \delta[2x - y]$. ***(03)***

1B. State and prove the convolution in spatial domain property of 2D discrete space Fourier transforms. ***(03)***

1C. What are multiplicatively and additively separable functions in continuous space domain? Prove or disprove the statement "if the 2D function is multiplicatively separable then its Fourier transform also multiplicatively separable." ***(04)***

2A. State and explain Nyquist sampling theorem applicable to 2D signals. Write relevant expressions for 2D sampling and its effect in the frequency domain. ***(03)***

2B. What is histogram of an image? What do you achieve by histogram equalization? ***(03)***

2C. Filter the following (4×4) image using a (3×3) neighborhood averaging by assuming zero padding on the boundary. ***(04)***

1	2	3	2
4	2	5	1
1	2	6	3
2	4	6	7

3A. The gray level probability density function of an image is given by $f[r] = 5e^{-5r}, 0 \leq r \leq 1$. Which of the transformations $s = r^2$ or $s = r^{0.5}$ would produce a better image? Explain. ***(02)***

3B. Analyze a (3×3) mean filter in the frequency domain and prove that it behaves like a low pass filter. ***(04)***

3C. (i) Explain the block diagram model for image degradation/restoration. ***(04)***
(ii) Write short notes on noise models.

4A. An (8×8) image $f[x, y]$ has gray levels given by the following equation: ***(04)***

$$f[x, y] = |x - y|; \quad x, y = 0, 1, 2, 3, 4, 5, 6, 7.$$

Find the output image obtained by applying a (3×3) median filter on the image $f[x, y]$; ignore the border pixels.

4B. Write short notes on Butterworth low pass filter. Is it possible to construct a high pass filter using a low pass and an all pass filter? If yes, how? If no, why? ***(02)***

4C. Derive a (3×3) Laplacian kernel for edge detection by second order derivatives method. Mention its drawbacks. ***(04)***

5A. Explain the following morphological operations: ***(03)***
(i) Erosion (ii) Dilation

5B. Derive expressions for 1D-DCT using DFTs. Use the same to write expression for 2D-DCT. ***(03)***

5C. Write short notes on (i) Canny edge detection, (ii) Hit-or-miss transform ***(04)***