Reg. No.



MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL

(A constituent Institution of MAHE, Manipal)

## VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

## **MAKEUP EXAMINATIONS, DECEMBER 2018**

## SUBJECT: APPLICATIONS OF DSP [ELE 4014]

REVISED CREDIT SYSTEM

Time: 3 Hours		Date: 31 December 2018	Max. Marl	ks: 50			
Instructions to Candidates:							
	✤ Answer ALL the questions	5.					
	<ul> <li>Missing data may be suita</li> </ul>	bly assumed.					
1A.	State and prove the multiplicat transforms.	ion in the spatial domain property of 2D discrete sp	bace Fourier	(03)			
1B.	Define 2D discrete space point	spread function. What is its Fourier transform?					
	Sketch the sequence $f[x, y] = 0$	$\delta[x-2y].$		(03)			
<b>1C.</b>	(i) What are eigen functions of 2D continuous space LTI systems?						
	(ii) What are multiplicatively s	eparable functions in continuous space domain?		(04)			
2A.	Write relevant expressions for	2D sampling and its effect in the frequency domain	n.	(03)			
2B.	Filter the following $(5 \times 5)$ 3-b assuming the mirror boundary	it image using a $(3 \times 3)$ neighborhood weighted a conditions on the boundary of the image.	veraging by				

1	2	3	0	2
4	2	5	2	1
1	2	6	5	3
2	4	6	5	7
1	2	3	4	5

(04)

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

- **3A.** The gray level probability density function of an image is given by  $f[r] = e^{-5r}$ ,  $0 \le r \le 1$ . Which of the transformations  $s = r^2$  or  $s = r^{0.5}$  would produce a better image? Explain. (02)
- **3B.** Explain bit plane slicing operation on an 8-bit grayscale image. (02)
- **3C.** Write short notes on Canny edge detection algorithm.
- **3D.** An  $(8 \times 8)$  image f[x, y] has gray levels given by the following equation:

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

Find the output image obtained by applying a  $(3 \times 3)$  median filter on the image f[x, y]; Keep the border pixels unchanged. (04)

(02)

4A.	(i) Explain the block diagram model for image degradation/restoration.				
	(ii) Write short notes on any two noise models.	(04)			
4B.	Write short notes on Butterworth high pass filter. Is it possible to construct a low pass filter using a high pass and an all pass filter? If yes, how? If no, why?				
4C.	Derive a 2D Laplacian of Gaussian (LoG) filter for edge detection. Draw relevant waveforms for Gaussian and the LoG functions.	(04)			
5A.	Explain the following morphological operations:				
	(i) Erosion (ii) Opening (iii) Dilation.	(03)			
5B.	Write short notes on (i) Sobel edge detector (ii) Hit-or-miss transform.	(04)			
5C.	Derive expressions for 1D-DCT using DFTs. Use the same to write expression for 2D-DCT.	(03)			