Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

SECOND SEMESTER M.TECH (DEAC & ME) DEGREE
END SEMESTER EXAMINATION - APRIL /MAY 2017
SUBJECT: DIGITAL IMAGE PROCESSING (ECE - 5239)

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

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

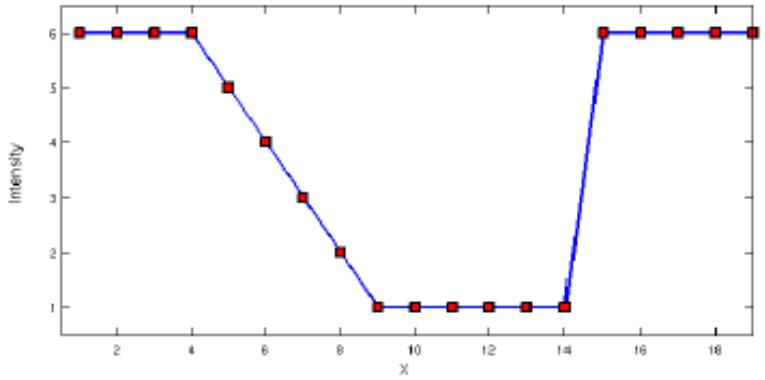
1A. A certain X- ray imaging geometry produces a blurring degradation that can be modelled as a convolution of the sensed image with the spatial, circularly symmetric function.

$$h(x,y) = \frac{x^2 + y^2 - 2\sigma^2}{\sigma^4} e^{-\frac{x^2+y^2}{2\sigma^2}}$$

Assuming continuous variables, show that the degradation in the frequency domain is given by the following expression.

$$H(u,v) = -8\pi^2\sigma^2(u^2 + v^2)e^{-2\pi^2\sigma^2(u^2+v^2)}$$

1B. Find first and second order derivative on the following gray level profile as shown below. Discuss the significance of the derivative on edge detection.



1C. Explain the energy minimization equation in Active Contour Models.

(5+3+2)

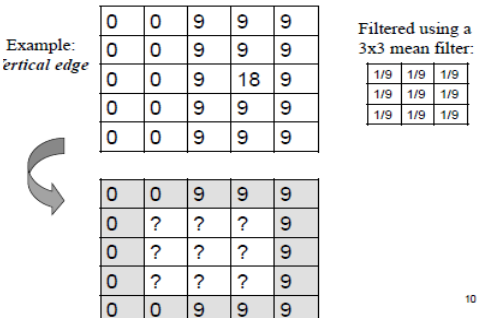
2A. A Gaussian low pass filter in the continuous frequency domain has the transfer function.

$$H(u,v) = Ae^{-(u^2+v^2)/2\sigma^2}$$

Show that the corresponding filter in the spatial domain has the following form

$$h(t,z) = A2\pi\sigma^2 e^{-2\pi^2\sigma^2(t^2+z^2)}$$

2B. Estimate the pixel value in the question marked position by performing the spatial mean filters.



2C. Show that the subtracting the Laplacian from an image is proportional to unsharp masking

(5+3+2)

3A. a. Consider a 3X3 spatial mask that averages the four closest neighbours of a point (x,y), but excludes the point itself from the average , find the equivalent filter H(u,v) in the frequency domain. Show that the result is a low pass filter.

b. Explain unsharp masking and high boost filtering.

3B. Find the connectivity between p and q as shown below with set V = {1, 2}. Write the minimum distance between p and q for all (4, 8 and m) connectivity.

3 1 2 1^q

2 2 0 2

1 2 1 1

$_p$1 0 1 2

3C. Describe the sequence lauer , GOP picture layer in MPEG-1 architecture.

(5+3+2)

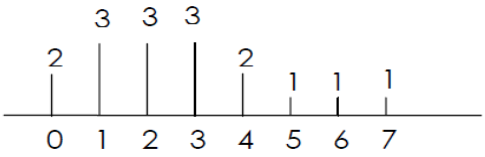
4A. Given a four symbol source {a b c d } with source probabilities {0.1 0.4 0.3 0.2} arithmetically encode the sequence bbadc. Write the arithmetic decoding algorithm.

4B. What is image compression. Explain any four variable length coding compression scheme.

4C. Write a complete MATLAB program to enhance a given image using 2nd order derivatives.

(5+3+2)

5A. Illustrate the concept of histogram specification for the following sub-image with 4X4 matrix of a 3 bit image and the specified histogram as shown below



0	0	0	4
1	1	1	5
1	2	2	7
2	2	2	7

5B. Draw a two dimensional four –band filter bank decoder to reconstruct input f(m,n).

5C. What is pseudo color image processing? Explain grey level to color transformation.

(5+3+2)