Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

SECOND SEMESTER M.TECH (DEAC & ME) DEGREE END SEMESTER EXAMINATION
MAY/JUNE 2016
SUBJECT: DIGITAL IMAGE PROCESSING (ECE - 558)

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

Instructions to candidates
- Answer **ANY FIVE** full questions.
- Missing data may be suitably assumed.

1A. Explain in detail the algorithm for histogram matching. Differentiate between histogram matching and histogram equalization methods.

1B. Describe in detail the homomorphic filtering approach for image enhancement.

1C. Define log transformations used in image enhancement. Give an example image where the log transformation could be used.

(5+3+2)

2A. Discuss in detail the three principal ways to estimate the degradation function for use in image restoration. Suppose an image $f(x,y)$ undergoes planar motion. Assume $x_0(t)$ and $y_0(t)$ are the time varying components of the motion in x and y direction respectively. Show that the degradation can be modelled as $H(u,v) = \int_0^T e^{-j2\pi[ux_0(t)+vy_0(t)]}dt$.

2B. Define direct inverse filtering approach used in image restoration. Discuss its disadvantages.

2C. Given an image corrupted with additive periodic noise (eg: periodic sinusoidal noise), and we wish to remove this noise. Indicate whether a frequency domain filter or a spatial domain filter would give better result. Justify your answer.

(5+3+2)

3A. Define two color models: CMY and CMYK. Given an RGB color image which has been converted to HSI color space. Suppose R_{all} represents the output image after applying a uniform 5 x 5 averaging filter to each component (H,S,I). and R_I denotes the resulting image after applying a uniform 5 x 5 averaging filter to I component only. Discuss the difference (if any) between R_{all} and R_I. Justify your answer.

3B. Differentiate between full-color image processing and pseudo-color image processing. Discuss at least two applications of pseudo color image processing.

3C. Define the following operations for a grayscale image: i) Dilation ii) Erosion.

(5+3+2)

4A. Given data points drawn from a probability density $p(x) = \sum_i c_i e^{\frac{-(x-x_i)^2}{2\sigma^2}}$ where x_i is the i[th] data point, σ is the standard deviation and c_i is a constant. Show that the mean shift vector has the direction of the gradient of the density estimate. Explain the mean shift segmentation algorithm.

4B. Differentiate between three region-based segmentations: region growing, region splitting and merging.

4C. Discuss two difficulties of Hough transform algorithm for fitting a straight line.

(5+3+2)

5A. Given a binary image shown in **Figure 5A**. Discuss in detail an algorithm based on mathematical morphology operations to extract the 8-connected components present in the image.

0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	1	1	0
0	0	0	0	0	0	1	1	1	0
0	0	0	0	0	1	1	0	1	0
0	0	0	0	0	1	1	1	1	0
0	0	0	1	1	1	0	0	0	0
0	0	1	1	1	0	0	0	0	0
0	1	0	0	1	0	0	0	0	0
0	0	1	1	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

Figure 5 A

5B. **Figure 5B** shows a binary image which consists of squares of size 1,3 5, 7,9 and 15 pixels. The squares are represented as 1 and the background as 0. Describe a procedure based on mathematical morphological operations to remove all the squares of size less than 13 pixels.

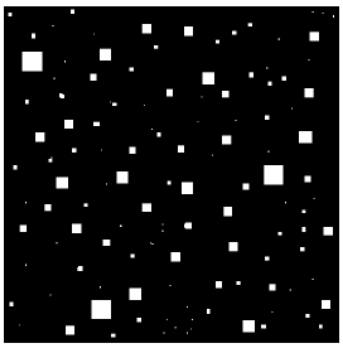

Figure 5B

5C. Differentiate between objective fidelity criterion and subjective fidelity criterion used in image compression.

(5+3+2)

6A. Discuss the encoder and decoder of a lossless predictive coding model used in image compression.

6B. Given the following 4x4 8-bit image (Figure 6B). Calculate the Lempel-Ziv-Welch (LZW) coding scheme for this image.

39	39	126	126
39	39	126	126
39	39	126	126
39	39	126	126

Figure 6B

6C. Describe RANSAC algorithm for increasing the robustness of line fitting.

(5+3+2)