Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

FIFTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION - NOV/DEC 2016
SUBJECT: COMPUTER VISION (ECE - 333)

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

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

1A. Define histogram of an image. Give one example of a dark image, bright image, low contrast image and high contrast image. Sketch the histogram for each of these four images assuming them to be an 8-bit grayscale image. Given an 8 x 8, 4-bit grayscale image shown below, compute the normalized histogram of this image.

4	5	4	4	4	4	4	4
4	5	4	4	4	4	4	4
4	5	4	4	4	4	4	4
5	5	4	4	4	4	4	4
5	5	4	4	4	4	4	4
5	5	8	8	8	8	8	8
8	8	8	8	8	8	8	8
5	4	4	4	4	4	4	4

1B. Given an image corrupted with additive periodic noise. Assume that the noise can be approximated as a 2D sine function. Describe a filter to recover the original image without noise. Justify your answer. Describe the procedure to create a Gaussian Pyramid of N x N image.

1C. With the help of a diagram, define the normalized image plane. Give a 3 x 4 matrix *M*, state the necessary and sufficient condition for the *M* to be a perspective projection matrix.

(5+3+2)

2A. Given an image consisting texture (eg: bricks etc), describe the different steps of the algorithm (in detail) to represent the texture using filters.

2B. State the Hessian matrix H used in Harris corner detector. Describe the characteristics of this matrix in a window containing a) edge only b) a corner only and c) flat/uniform region. Discuss the Harris corner detector algorithm.

2C. Differentiate between HOG and SIFT features. Describe one application of HOG features.

(5+3+2)

3A. Describe the algorithm for agglomerative clustering and divisive clustering. Discuss the two limitations of agglomerative and divisive clustering.

3B. Describe HSI color model. Clearly state what each component (H, S and I) represents.

3C. Differentiate between distant point light source and area source. Give an example for each.

(5+3+2)

4A. Define a gray scale co-occurrence matrix used for texture representation. Given the following image patch calculate $C_{(1,2)}$, $C_{(2,2)}$ gray scale co-occurrence matrices. Describe three application areas/images where a user would want to synthesize textures.

1	1	0	0
1	1	0	1
2	1	1	1
2	2	2	2

4B. Describe two different approaches to build multi-class classifier from a binary classifier. Discuss the disadvantage(s) of each approaches.

4C. With the help of a suitable example/diagram, describe the phenomena of over-fitting in classification. List one possible solution to avoid over-fitting.

(5+3+2)

5A. Discuss in detail the different steps of background subtraction algorithm used in image segmentation. List at least two example application/images where background subtraction can be used for segmentation.

5B. Define radial distortion. Describe the process of estimating the camera parameters in the presence of radial distortion.

5C. Define Essential matrix and Fundamental matrix.

(5+3+2)

6A. With the help of a suitable example, describe in detail the different steps of Hough Transform algorithm for fitting a straight line. Discuss at least two demerits of Hough Transform algorithm.

6B. Describe the algorithm for a *(k, l)* nearest neighbor classification. List at least one problem faced while building this classifier.

6C. Differentiate between class confusion matrix and Receiver Operating Curve (ROC).

(5+3+2)