Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

SEVENTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION - NOV/DEC 2016
SUBJECT: MOTION AND GEOMETRY BASED METHODS IN COMPUTER VISION (ECE – 445)

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

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

1A. Differentiate between Euclidean, affine and projective space. Explain the utility of the circular points, situated on the line at infinity, in recovering Euclidean geometry from Affine geometry. Justify your answer. For the following two lines, find the point of intersection using homogenous vector representation a) x= 4, y=5, b) x= 1, x=2

1B. Define textures. Describe the procedure to synthesize one missing pixel from a texture image.

1C. With the help of a figure, define the following terms for a pin hole camera model: Optical axis, principal point, optical center.

(5+3+2)

2A. Define image registration. Describe the eight categories for classifying registration methods.

2B. Assume we wish to register a rigid object by searching the space of correspondence. But there might be multiple correspondences between source and the target. Describe an RANSAC-based approach to estimate the transformation parameters in this scenario.

2C. Describe the procedure to build image mosaics from more than two images.

(5+3+2)

3A. Define optical flow. Describe in detail the method proposed by Horn and Schunck to compute optical flow.

3B. Assuming tracking as a probabilistic inference problem, describe the prediction and correction steps for tracking. Assume we wish to track an object which has moved at a considerable distance between two consecutive frames. Discuss whether it is possible to track this object by combining the simple tracking by detection approach and Kalman filtering approach. Justify your answer.

3C. Describe at least four application of tracking from a video.

(5+3+2)

4A. Show the algebraic and geometric derivation of fundamental matrix.

4B. Given corresponding points x_i, x_i' for 3D scene points X_i. Differentiate between affine and projective reconstruction. List the scene properties that can be measured under these two reconstructions.

4C. Given two static cameras observing a scene. Assume the camera parameters (camera projection matrices) and the image points x, x' corresponding to the scene point X are known. Describe two triangulation methods for computing the scene point X.

(5+3+2)

5A. Define affine camera. Explain affine epipolar geometry and affine epipolar constraint. Assume that the affine fundamental matrix has been computed, describe the procedure to compute the camera matrix from the affine fundamental matrix using the affine epipolar constraint.

5B. Assume we wish to compute the corresponding image points x, x'. With the help of a suitable example, explain how dynamic programming could be used to develop an algorithm incorporating ordering constraint to compute corresponding image points.

5C. Given the corresponding image points x, x', describe a least square approach for calculating the fundamental matrix from these points.

(5+3+2)

6A. Define step and roof edges in range images. Describe in detail the procedure for finding step and roof edges in range images using computational molecules. Explain why the methods using to calculate edges in grayscale images cannot be used in case of range images.

6B. State two application of range images. Discuss two disadvantages of triangulation-based range sensors.

6C. For an internally calibrated perspective camera, discuss the usefulness of data normalization proposed by Hartley in estimating the fundamental matrix.

(5+3+2)