Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

SEVENTH SEMESTER B.TECH. (E & C) DEGREE END SEMESTER EXAMINATION
NOVEMBER 2018
SUBJECT: MOTION AND GEOMETRY BASED METHODS IN COMPUTER VISION(ECE-4039)

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

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Describe Similarity, Euclidean, and Projective 3D transformations. Also, state the transformation equation indicating the size/dimension of the respective matrices. Explain the utility of absolute conic situated at the line at infinity in recovering 2D Euclidean geometry from affine geometry.

1B. Describe optical flow. Describe in detail the method proposed by Horn and Schunck to compute optical flow.

(5+5)

2A. Describe range images and triangulation-based range sensors. Explain the utility of range images in 3D reconstruction. Explain the utility of Quaternions in computing the rigid transformation for registering range images.

2B. Describe the bundle adjustment-based method for creating image mosaic from four (*I1, I2, I3, I4*) images. State one limitation of this approach. Explain why a RANSAC based approach cannot be used to register deformable objects.

(6+4)

3A. Given two images consisting of deformable objects. Describe image registration approach using mutual information for these two images. List at least two applications that require registering deformable objects.

3B. Assume x and x' are the two image points of the 3D scene point X. Define the following terms with the help of a figure: Epipolar line, baseline, epipolar plane, epipoles for the corresponding points x and $x.'$

3C Describe the correlation-based method for finding the pixel-wise image correspondence. State one limitation of the correlation-based approaches for binocular fusion.

(4+3+3)

4A. Describe affine epipolar geometry and affine epipolar constraint. Assume that the affine fundamental matrix has been computed, explain the procedure to compute the camera matrices from the affine fundamental matrix using the affine epipolar constraint.

4B Define the affine camera. State the appropriate uncalibrated reconstruction needed to measure the following geometric entities

i) intersection of a line with a plane

ii) ii) distance (in cm) between two image points.

Justify your answer.

4C. Given an 8-bit grayscale image shown in Figure 4C. A uniform averaging filter with a kernel size of 3x3 is applied to this image. Calculate the output image.

(4+3+3)

5A. Show the geometric derivation of the fundamental matrix with an appropriate figure.

5B. Describe Lukas and Kanade method to compute optical flow. Suggest a possible improvement in the Lukas and Kanade method to compute optical flow in case of large motion (for instance motion of more than 50 pixels).

5C 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* is known. Describe two triangulation methods for computing the scene point *X* with the help of appropriate figures.

(4+3+3)

0	255	0	255	0
0	255	0	255	0
0	255	0	255	0
0	255	0	255	0
0	255	0	255	0

Figure. 4C