Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (INFORMATION TECHNOLOGY | COMPUTER AND COMMUNICATION TECHNOLOGY)

END SEMESTER EXAMINATIONS, NOV 2019

SUBJECT: PROGRAM ELECTIVE- IV COMPUTER VISION [ICT 4018]

REVISED CREDIT SYSTEM

(23/11/2019)

Time: 3 hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data if any, may be suitably assumed.

1A. Explain the steps involved in detecting the edge using Marr-Hildreth in edge detection. Prove that Laplacian of Gaussian is separable. **5**

1B. Provide the properties of **3**

i. Orthogonal transforms
ii. Linear transforms
iii. Euclidean transforms.
iv. Affine transformation.

Are they related? Justify. What does each of the transformations preserve?

1C. What are orthographic and perspective projections? Show that in the perspective projection, nearer objects look lower in the image. **2**

2A. What is the Hessian matrix? How it is used in the Harris detector and SIFT descriptor to identify the interest points. **5**

2B. A part of the image matrix with gradient magnitude and gradient direction is shown in fig. Q.2B(a) and fig. Q.2B(b) respectively. Using non-maximum suppression check whether pixel with gradient magnitude value 30 is an edge pixel. After that apply the hysteresis thresholding method and check if the pixel with gradient magnitude 30 forms an edge pixel. Note that the high and low value of the threshold is 50 and 20 respectively. **3**

50	40	35	20
45	40	**30**	20
53	45	42	36
20	38	49	40

Fig Q.2B(a) Gradient Magnitude

50	48	39	27
40	20	85	25
30	45	120	38
40	30	48	42

Fig. Q.2B(b) Gradient direction **2**

2C. What effects are observed on the edges of an image, when the image is smoothed with different σ (standard deviation) value?

3A. Using RANSAC method find the best fit line for the data given below: (5, 20), (10, 30), (15, 35), (20, 45), (25, 55), (30, 65), (50, 105) [Note that line should fit at least 5 points, Threshold: 2] **5**

3B. Briefly describe the main steps of creating the SIFT keypoint descriptor at a given feature point. What is the effect of rotation on the keypoint descriptor? **3**

3C. Explain a method to identify circles in an image. **2**

4A. What is the relationship between the essential matrix and fundamental matrix? Give step by step procedure to compute the fundamental matrix using Hartley's normalized 8-point method. What is rank of a fundamental matrix? **5**

4B. Write an algorithm for segmenting an image using region merge and split method. **3**

4C. Let gradient at point (x, y) is given by (f_x, f_y). Assume that the object is rotated around Z-axis, the point (x, y) moves to point (x', y'). Show that $f_x^2 + f_y^2 = f_{x'}^2 + f_{y'}^2$. Is this implies that gradient magnitude is rotation invariant? **2**

5A. Discuss the importance of optical flow. Explain the Lucas and Kanade method for finding optical flow. **5**

5B. What is Eigenfaces? Write an algorithm for face recognition and clearly mention the steps to find Eigenfaces. **3**

5C. What is the computational complexity of Canny's edge detector? **2**