Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (COMPUTER SCIENCE & ENGINEERING)

END SEMESTER EXAMINATION, NOVEMBER 2019

SUBJECT: ELECTIVE – IV– COMPUTER VISION [CSE 4002]

REVISED CREDIT SYSTEM
(23/11/2019)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Missing data may be suitably assumed.

1A. Briefly explain the following image enhancement methods: **3M**
(i) Power-law (Gamma) transformation.
(ii) Histogram equalization.

1B. Mathematically show that correlation and sum of squared differences are one and the same. **2M**

1C. What is the importance of edge detection? Mention any four factors that cause edges in an image. Explain Non maxima suppression and Hysteresis thresholding method to detect pixels close to the true edges in a given image. **5M**

2A. What are the requirements of a good feature detector? Explain the mathematics of Harris corner detector. **5M**

2B. With respect to Scale Invariant Feature Transform, explain the following steps to extract and describe key points in an image. **5M**
(i) Scale space peak selection.
(ii) Key point localization.
(iii) Orientation assignment.
(iv) Key point descriptor.

3A. Derive the number of trials needed to find the parameters of a model that best fit the data. **2M**

3B. Suppose you are given a relationship between point in 3D to corresponding point in 2D using $C_h = A W_h$, where C_h is a column matrix of 2D point, A is 4×4 camera matrix containing unknown coefficients and W_h is a point in 3D space. **4M**

(i) Provide a method to determine these 12 unknowns in camera matrix.
(ii) Once you determine the camera matrix, how do you use it to find camera location and orientation?

3C How do you constrain your search of a point in the first image to the corresponding point in the second image using Epipolar geometry? With the help of a neat diagram, derive the Fundamental matrix F such that it satisfies the condition $X_r^T F X_l = 0$, where X_r^T is a point in right image, X_l is a point in left image. **4M**

4A. Provide the steps involved in Hartley's 8-point algorithm to compute Fundamental matrix. **3M**

4B. What are the two types of motion estimation techniques? Derive the brightness constancy constraint equation. **3M**

4C. Derive the motion estimation parameters required to align successive frames in a video using KLT tracking method. **4M**

5A. What is the reason behind tilting of epipolar lines? How do you correct this to get a horizontal line to simplify the search for corresponding points between two images? Derive the necessary transformation matrix. **3M**

5B. How do you detect humans using Histogram of Oriented Gradient features? **3M**

5C. Explain the Bag of words method for visual feature recognition. **4M**

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