Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

SIXTH SEMESTER BTECH. (E & C) DEGREE END SEMESTER EXAMINATION
AUGUST 2021
SUBJECT: COMPUTER VISION (ECE-4051)

TIME: 2 HOURS **MAX. MARKS: 40**

Instructions to candidates

- Answer **ANY FOUR full question**
- Missing data may be suitably assumed.

1A. State the expression for Gaussian kernel $G_\sigma(x, y)$. Differentiate between Gaussian smoothing and a uniform smoothing filter. In the implementation of Gaussian or uniform smoothing filter, discuss the challenges that arise at the boundary pixels (margins of an image). Describe two possible solutions to overcome these challenges.

1B. Define histogram of an image. Given an 8-bit grayscale image, suppose the lower bit (LSB) representing the grayscale intensity is set to 1 for all the pixels in this image. Describe the corresponding change in the histogram of this image.

(5+5)

2A. Given an image of size 256 x 256 consisting of textures only. Describe an algorithm in detail to synthesize textures, so the output image is of larger size (i.e. greater than 257 x 257).

2B. With the help of a suitable example, explain the non-maximum suppression and hysteresis thresholding algorithm. Describe a scenario where these two algorithms could be used.

(5+5)

3A. Define area sources. Give two examples of area source. Describe the three different types of reflection commonly observed at a surface.

3B. Describe in detail the Harris corner detector algorithm. With the help of a suitable example, explain why Harris corner detector is invariant to rotation and translation.

(5+5)

4A. Define shot in a video. Describe four different methods for shot boundary detection using interframe distance.

4B. Describe in detail k-means segmentation algorithm to segment the image shown in **Figure. 4B**. The pixels in the segmented image should be grouped into three groups:

i. greenery (trees, grass, etc)
ii. road and
iii. c) others (all other pixel not included in group a) or (group b).

(5+5)

5A. With the help of a suitable example for line fitting, explain RANSAC algorithm. Compare RANSAC with M-estimator.

5B. Describe Hough Transform for line fitting. Discuss three limitations of Hough Transform.

(5+5)

6A Assume that *L(i->j)* is the loss incurred when an object of class *i* is classified as having class *j*. For a two-class classifier with class 1 and class 2, show that we select class 1 if
p(1|x)L(1->2) > p(2 | x) L(2 ->1)
where *p(k|x)* is the posterior probability of class *k* given feature vector *x*. Describe the multi-class Bayes classifier that minimizes total risk.

6B Describe the algorithm for a (k,0) nearest neighbour classification. Discuss at least one challenge in building this classifier.

(5+5)

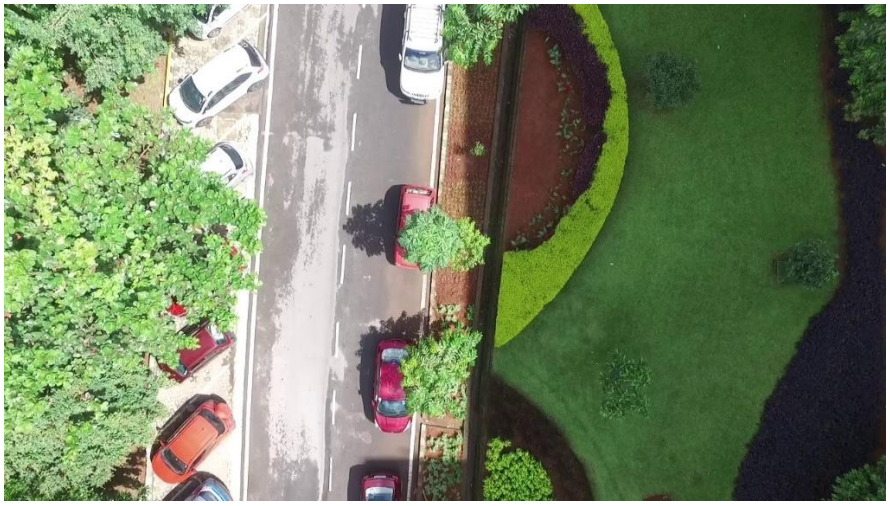

Figure. 4B