Name: Enrolment No:	

UPES
End Semester Examination, May 2024

Course: Machine Vision Applications for Vehicle **Semester: 6**
Program: B.Tech Automotive Design Engineering **Time : 03 hrs.**
Course Code: MECH3043 **Max. Marks: 100**

Instructions:
1) This is a MATLAB based test and the duration of the test is 3 hours.
2) A student could refer to the MATLAB documentation section for help. Usage of AI based interactive models are prohibited.
3) The data for each question will be available in the computer allotted for each student. The name of each data is given in the respective question.
4) Please read the questions carefully and write your code in the allotted MATLAB client.
5) At the end of the test, take a print of the code written along with the obtained output for each question.
6) Both code and output of each question must be attached in the provided answer sheet. Additional time will be given to execute Instruction (6).

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain the concept of supervised learning in the domain of machine learning and deep learning with a practical example?	**4**	**CO1**
Q 2	With help of a schematic diagram describe the principle of K-Nearest Neighbors algorithm?	**4**	**CO2**
Q 3	Briefly explain Support Vector Machines (SVMs) in not more than 300 words.	**4**	**CO2**
Q 4	Discuss any 4 limitations of using Machine learning techniques.	**4**	**CO1**
Q 5	Deduce a formula to compute velocity of a moving object when the instantaneous 3D position coordinates of objects are given?	**4**	**CO3**

SECTION B
(4Qx10M= 40 Marks)

Q 6	**Given data name:** **Q6_ Population_of_states_Vs_Accidents.mat**		

	(a) Illustrate the application of linear regression analysis for the given data. Explain how a best fit line is estimated for the given set of input and output variable by plotting the best fit line for the given data. (b) Additionally, embed the equation of the best fit line in a scatter plot.	**10**	**CO1**
Q 7	**Given data name:** **Q7_ Students_Marks_In_Machine_Vision.mat** For the given normal distribution of marks scored by 100 students in machine vision course, (a) Compute the average mark and standard deviation of the distribution. (b) Plot a neat histogram with proper labels indicating the average mark scored by the students along with the standard deviations (1sig, 2 sig and 3 sig) of the average mark obtained.	**10**	**CO1**
Q 8	**Given data name:** **Q8_Circles.png** For the given input image, write a MATLAB program to compute the diameter of three different circles in the given image.	**10**	**CO3**
Q 9	**Given data name: Q9_Option_1_Cats_and_Dogs.mat** (a) Transform the given dataset consisting of images of cats and dogs to principal component space by plotting the components of first (PC1) and second principal components (PC2). (b) After obtaining PC1 and PC2 components, color code the data so that one could clearly visualise the clustered data based on the input data. **Or** **Given data name: Q9_Option_2_IrisFishers.mat** (a) Using principal component analysis, transform the given data to principal component space by plotting the components of first (PC1) and second principal components (PC2).	**10** **Or** **10**	**CO2** **Or** **CO2**

	(b) After obtaining PC1 and PC2 components, color code the data so that one could clearly visualise the clustered data based on the input data.		
SECTION-C (2Qx20M=40 Marks)			
Q 10	**Given data name: Q10(a)_to_Q10(c)_Test_data_Img_Comp.png** Demonstrate the application of image compression using SVD for the given test image. a) Plot the cumulative sum of eigen values (sigmas) to explain how a high dimensional data could be represented using minimal columns of eigen vectors obtained from the process of SVD. b) Furthermore, display the compressed image for the following 3 cases: (a) rank =10; (b) rank =50; and (c) rank =85. c) Save the compressed image and show that the space occupied in bytes is significantly less than the input image.	**7.5 + 7.5 +5**	**CO2**
Q 11	**Given data name: Q11_Ball_Tracking_Video.mp4** For the given input data (**Q11_Ball_Tracking_Video.mp4)**, track the moving ball in the video by performing mathematical operations of mean and subtraction of the video frames. **Or** **Given data name: Q11_Adelaide_Housing.mat** The 14th column in the given data indicate the price of individual apartments in Australian dollar. Also, the columns (from 1 to 13) are the parameters determining the final price of an apartment. Please answer the question given below using the data **Q11_Adelaide_Housing.mat.** (a) Using singular value decomposition (SVD) technique, train and build a model that would predict the cost of a new apartment. (b) Compute the cumulative sum of sigmas to show the percentage amount of information hidden in the first 4 columns of the sigmas (or eigen values).	**20** **&** **20**	**CO3** **&** **CO3**