Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

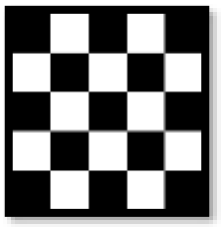
Programme Name: M. Tech Automation & Robotics Engineering **Semester : II**
Course Name : Image Processing and Machine Vision **Time : 03 hrs**
Course Code : ECEG-7004 **Max. Marks : 100**
Nos. of page(s) : 03
Instructions: Assume any data in programming, if required

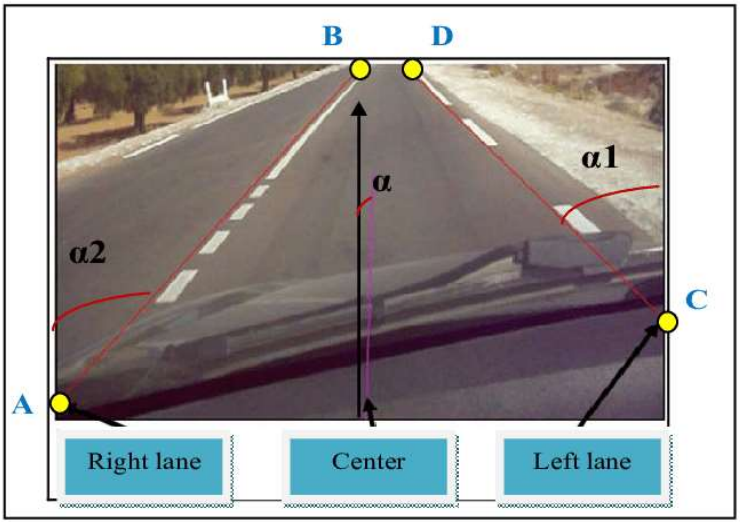
SECTION A (5 x 4 = 20 Marks)

S. No.	Attempt ***all*** the questions	**Marks**	**CO**
Q.1	What is the different between machine learning and artificial intelligence? Classify the machine learning algorithms.	**4**	**CO5**
Q.2	Prove mathematically that a 3 x 3 mean filter in frequency domain behaves like a low pass filer.	**4**	**CO2**
Q.3	Distinguish between monochrome and grayscale image. You have a digital image that takes up 240 kB. The spatial resolution of the image is given by 600 x 200. What is bit depth? **OR** A 4 x 4 bits/pixel image is given by $\begin{bmatrix} 1 & 3 & 5 & 7 \\ 0 & 2 & 4 & 6 \\ 8 & 12 & 15 & 13 \\ 4 & 8 & 9 & 10 \end{bmatrix}$ Sketch its four bit planes	**4**	**CO1**
Q.4	The fig.1 presents the edge enhancement of an image. What type of enhancement method can be employed in the image. Write the MATLAB script to support the functionality.  Fig.1	**4**	**CO3**
Q.5	Explain the concept of bit plain slicing and image negatives in image processing.	**4**	**CO4**

SECTION B (4 x 10 = 40 Marks)

Q.6	Attempt ***all*** the questions **(a)** Define CDF and PDF. How do you calculate CDF from PDF? **(b)** Write the significance of Baye's Theorem and Conditional Probability. **(c)** The statistics of male and female students in different branches are given below; Find the probability of meeting a female employee in Robotics Engineering. **OR** How K- Means clustering is helping in predicting the score based on trained data and test data. Write the mathematical equations, algorithm and flow. Apply the same concept on the image given below and predict possible score if the cluster size is varying from 8, 16, 32, 64,	**10**	**CO5**

	128 to 256 pixels.  Fig.2		
Q.7	**(a)** Draw the detailed diagram of image processing system. **(b)** How image arithmetic is helping for image processing. Write the MATLAB/ SCILAB script for at least 4 operations of image arithmetic.	**5** **5**	**CO1**
Q.8	Apply the region splitting and merging technique for the image given below. Draw the quadtree for (8 x 8), 2D image. Explain the detailed operation to support your answer.  Fig. 3	**10**	**CO3**
Q.9	**(a)** Perform the histogram equalization of the image and plot the histogram. $\begin{bmatrix} 4 & 4 & 4 & 4 & 4 \\ 3 & 4 & 5 & 4 & 3 \\ 3 & 5 & 5 & 5 & 3 \\ 3 & 4 & 5 & 4 & 3 \\ 4 & 4 & 4 & 4 & 4 \end{bmatrix}$ (**b)** Draw the block diagram of the automated pattern recognition system.	**6** **4**	**CO2**
	SECTION-C (2 x 20 = 40 Marks)		
	Attempt any ***two*** of the followings		
Q.10	**(a)** Consider a case of multiclustering image processing system (8 x 8). Explain the optimal routing scheme with the mathematical calculations about maximum availability and links. **(b)** Classify the neural networks based on their architecture. Detail the perceptron training algorithm and functionality of BPN network.	**10** **10**	**CO4**
Q.11	**(a)** Explain the role of median filter in image processing and derive the mathematical expression for its behavior as low pass filter. Compute the value of the marked pixels shown in 3 x 3 mask. $\begin{bmatrix} 18 & 22 & 33 & 25 & 32 & 24 \\ 34 & 128 & 24 & 172 & 26 & 23 \\ 22 & 19 & 32 & 31 & 28 & 26 \end{bmatrix}$ **(b)** Detail the wavelet decomposition technique using HAAR wavelet. Consider 256 x 256	**10** **10**	**CO2**

	DWT and decompose the image shown in fig. till 2nd level.  Fig.4		
Q.12	**Case Study** The next promising key issue of the automobile development is a self-driving technique. One of the challenges for intelligent self-driving includes a lane-detecting and lane-keeping capability for advanced driver assistance systems as shown in Fig.5. The concept can be introduced by an efficient and lane detection method, which may be designed, based on top view image transformation that converts an image from a front view to a top view space. After the top view image transformation, an image transformation technique can be integrated by using a parabolic model of a curved lane in order to estimate a parametric model of the lane in the top view space. The parameters of the parabolic model are estimated by utilizing a least-square approach. The simulation results can be used for proposed lane detection method with the top view transformation is very effective in estimating a sharp and curved lane leading to a precise self-driving capability.  **Fig.5** **(a)** Based on the given problem suggest what types of image transform can be applied to solve such problems**.** **(b)** Give the mathematical modeling, derivation to support your answer. It may be any image transform. **(c)** Write the MATLAB/SCILAB/ Python code to support the algorithm. **(d)** Write the flow of optical character recognition-based machine vision system with example.	**20**	**CO5**