Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, June 2021

Programme Name: M. Tech Automation & Robotics Engineering **Semester : II**

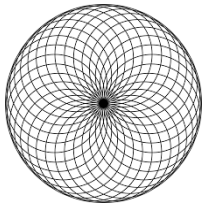
Course Name : Image Processing and Machine Vision **Time: 03 hrs**

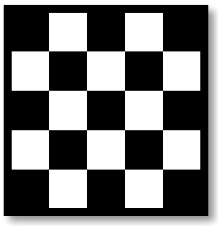
Course Code : ECEG-7004 **Max. Marks: 100**

Nos. of page(s) : 03

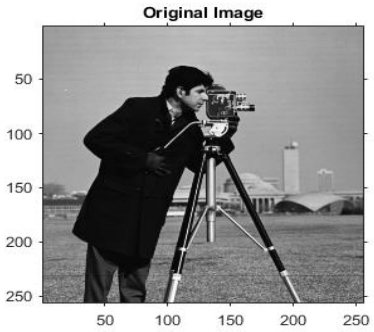
Instructions: Assume any data in programming, if required

SECTION A (5 x 6 = 30 Marks)

S. No.	Attempt ***all*** the questions	**Marks**	**CO**
Q.1	What is the function of image sensor? Distinguish between monochrome and grayscale image.	**5**	**CO1**
Q.2	What is the use of weighted average filter? Detail the functionality for image enhancement.	**5**	**CO2**
Q.3	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	**5**	**CO2**
Q.4	Detail the watershed algorithm for image segmentation.	**5**	**CO3**
Q.5	(a) what is Bayes Theorem? (b) Define CDF and PDF. How do you calculate CDF from PDF?	**5**	**CO1**
Q.6	Detail the 2D-DCT and properties for image processing applications. Compute the Discrete Cosine Transform (DCT) matrix for N=4.	**5**	**CO1**

SECTION B (5 x 10 = 50 Marks)			
	Attempt ***all*** the questions		
Q.7	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, 128 to 256 pixels.  Fig.2 ***OR*** 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.	**10**	**CO5**
Q.8	**(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 5 operations of image arithmetic.	**5** **5**	**CO1**
Q.9	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.10	**(a)** Perform the histogram equalization of the image and plot the histogram. $\begin{bmatrix} 3 & 4 & 5 & 6 & 2 \\ 3 & 4 & 5 & 6 & 2 \\ 3 & 4 & 5 & 6 & 2 \\ 3 & 4 & 5 & 6 & 2 \\ 3 & 4 & 5 & 6 & 2 \end{bmatrix}$ (**b)** Draw the block diagram of the automated pattern recognition system.	**6** **4**	**CO2**
Q.11	Prove mathematically that a 3 x 3 mean filter in frequency domain behaves like a low pass filer.	**10**	**CO2**

SECTION-C (1 x 20 = 20 Marks)

	Attempt any ***One*** of the followings		
Q.12	**(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 DWT and decompose the image shown in fig. till 2nd level. Can we use DWT to extract the watermark from a watermark embedded image? If yes. Suggest the appropriate scheme and MATLAB code for the same.  Fig.4	**10** **10**	**CO4**
Q.12	**(a)** Classify the neural networks based on their architecture. Detail the perceptron training algorithm and functionality of BPN network. **(b)** Write the flow of optical character recognition-based machine vision system with example. Can we apply DWT to detect the number plate of a car for security purpose at any tollbooth as depicted in Fig.5? Suggest the scheme to support your answer.  Fig.5 Car plate detection system	**10** **10**	**CO4**