Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Computer Vision (CSIP7003) (El - III) **Semester: II**

Programme: M.Tech. (CSE)

Time: 03 hrs. **Max. Marks: 100**

Instructions: Attempt all questions. There are internal choices in Q. No. 9 and 11.

SECTION A

Q 1	Differentiate between following: (a) Computer Vision and Image Processing (b) Convolution and Filtering	**4**	**CO1**
Q 2	State the properties of Two-dimensional Discrete Fourier Transform (DFT). How Fast Fourier Transform (FFT) improves the efficiency over DFT?	**4**	**CO1**
Q 3	Define Stereo Vision. Discuss the underlying principles for depth sensors.	**4**	**CO1, CO2**
Q 4	The modern age computer-vision applications rely on pattern classification techniques rather than on deterministic techniques. Identify the reason. Discuss two classification techniques that use probabilistic approaches for pattern identification.	**4**	**CO2**
Q 5	Define DC coefficient of the DFT. Differentiate between low pass and high pass filtering?	**4**	**CO2**

SECTION B

Q 6	Briefly explain following using suitable examples: (A) Histogram of Oriented Gradients (HOG) (B) SURF features	**10**	**CO2**
Q 7	Principal Component Analysis (PCA) is an important technique for dimension reduction. Justify the statement with a suitable example.	**10**	**CO2**
Q 8	Explain Fourier transform. Compute the Discrete Fourier Transform (DFT) for the following sequence 2, -3, 4, -5.	**10**	**CO3**
Q 9	Define Histogram Equalization clearly stating its advantage. 2 3 3 2 4 2 4 3 3 2 3 5 2 4 2 4 Fig. 1	**10**	**CO3**

	The image snippet given in Fig. 1 shows grey levels within the range 0-9. Draw the histogram corresponding to these grey levels, and then perform a histogram equalization and draw the resulting histogram.		
	OR		
	Devise and explain an algorithm to mark connected components within a region. Execute the above algorithm upon the region in the image given below: 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 1 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 Fig. 2	**10**	**CO4**
	SECTION C		
Q 10	Assuming suitable scenario explain the following: (a) Background Subtraction technique (b) Augmented Reality	**20**	**CO4**
Q 11	Explain the following classifiers suggesting a fitting application scenario for each one: (a) KNN (b) Artificial Neural Network (ANN)	**20**	**CO4, CO5**
	OR		
	2 3 4 3 4 3 3 2 13 13 12 2 4 3 12 12 14 2 3 2 13 12 12 4 2 2 13 15 13 4 3 3 3 4 3 3 Compare the edge-based and region-based segmentation approaches. Segment the following gray scale image using region-growing method. Consider the rule for merging as ‘difference of neighbor intensity as less than equal to 2’. Fig. 3 ->	**20**	**CO5**

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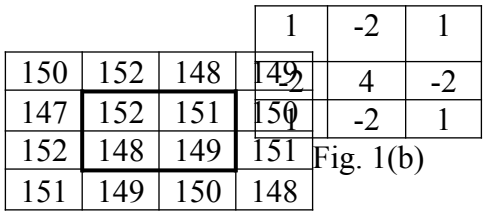
SECTION A

Q 1	Fill up the blanks with most appropriate answer: (a) _____ is an example of orthogonal transform. (b) A_____ is an estimate of the probability distribution of a continuous variable. (c) Smooth and uniform areas in an image correspond to _____ frequency components. (d) The size of a 640×480 image at 240 pixels per inch resolution is _____.	**4**	**CO1**
Q 2	Differentiate between the following: (a) Sampling and Quantization (b) Image Processing and Computer Vision	**4**	**CO1**
Q 3	Define Stereo Vision. Discuss the underlying principles for depth sensors.	**4**	**CO1, CO2**
Q 4	Discuss the following in brief: (a) Contrast Stretching (b) Canny Edge Detection	**4**	**CO2**
Q 5	Explain K-means clustering algorithm in brief. Give one suitable application for it.	**4**	**CO2**

SECTION B

Q 6	(a) State and discuss the Convolution theorem. (b) Show the impact on an image block given below in Fig. 1(a) if a filter mask shown in Fig. 1(b) is applied on central four pixels.  Fig. 1(a) Fig. 1(b)	**5, 5**	**CO2**
Q 7	(a) Justify how we can remove the Salt and pepper, Gaussian, and Periodic noise from an intensity image. Can we apply a median filter to remove the Salt and pepper noise?	**5, 5**	**CO3**

	(b) Considering an image block given below, show how a 3×3 median filter mask can remove the Salt and pepper noise in the image block. Fig. 2		
Q 8	Elaborate the following with examples:- (A) Histogram of Oriented Gradients (HOG) (B) SIFT features	**10**	**CO2**
Q 9	The following table (Fig. 3) gives the number of pixels at each of the grey levels 0-15 in an image with those grey values only. Draw the histogram corresponding to these grey levels, and then perform a histogram equalization and draw the resulting histogram. Fig. 3	**10**	**CO3**
	OR		
	Write an algorithm to mark connected components within a region. Execute the algorithm so written over a small, example binary image.	**10**	**CO4**
	SECTION C		
Q 10	Elaborate the following with suitable examples: (a) Principal Component Analysis (PCA) (b) KLT Feature tracker	**20**	**CO4**
Q 11	(a) Write an algorithm to detect boundary pixels of a region. Consider 8-connectivity of the pixels. Apply the algorithm to detect the boundary pixels in the region given in the following image.	**12, 8**	**CO4**

50	65	52
63	255	58
61	60	57

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
20	40	60	75	80	75	65	55	50	45	40	35	30	25	20	30

0	0	0	0	0	0	0
0	1	1	1	1	0	0
0	1	1	1	1	1	0
0	0	1	1	1	1	0
0	0	1	1	1	0	0

	0 0 0 0 0 0 0 (b) Define following with example: (I) m-adjacency (II) Path (III) Connected Component (IV) Convex Hull		
	OR		
	Illustrate and explain Hough Transform with an example. Justify your views on the statement – "The application of Hough transform could be an appropriate choice for detecting four-wheeler objects in the vision-based traffic control system."	**20**	**CO5**