Name:

Enrolment No:

UPES
UNIVERSITY WITH A PURPOSE

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

Course: Machine Vision **Semester: VIII**
Program: B. Tech. (Mechatronics) **Time 03 hrs.**
Course Code: MEEL 4012 **Max. Marks: 100**

Instructions: Attempt all the questions.

SECTION A

S. No.		Marks	CO
Q1.	What is the mathematical and matrix representation of digital image? Discuss with suitable example. Write one example where human being is more powerful than computer in image processing.	**[4]**	**CO1**
Q2.	What is edge detection? Give the filter functions for the following edge based operators. i. Laplace ii. Prewitt	**[4]**	**CO2**
Q3.	What is distortion? How lossy compression is different from lossless compression?	**[4]**	**CO3**
Q4.	Discuss the motion flow field and optical flow field.	**[4]**	**CO4**
Q5.	Calculate the size of following images in bytes. i. 4 bit gray scale image of size 512X512 ii. 3 bit colour image of size 128X128	**[4]**	**CO1**

SECTION B

Q6.	Dilation and Erosion are two primitive operators, which may be used to define other morphological operations. i. Explain how erosion is performed. ii. Explain how dilation is performed.	**[10]**	**CO4**
Q7.	What is image filtering? Write the steps of frequency domain filtering. Discuss the image Ideal High Pass filter with its function in the frequency domain.	**[10]**	**CO1**
Q8.	Discuss the use of Baye's theorem. A company buys 70% of its computers from company X and 30% from company Y. Company X produces 1 faulty computer per 5 computers and company Y produces 1 faulty computer per 20 computers. A computer is found faulty what is the probability that it was bought from company X?	**[10]**	**CO3**
Q9.	Gray level histogram of an image given below.	**[10]**	**CO2**

Gray level	0	1	2	3	4	5	6	7
Frequency	0	0	100	350	200	500	0	0

Compute the histogram of the output image obtained by enhancing the input by suitable contrast stretching technique.

OR

How can we covert an image from spatial domain to frequency domain? Find the two dimensional Discrete Fourier Transform (2D-DFT) of the following gray scale image [1 0 1 0].

SECTION-C

Q10. Discuss following terms in details:
i. Reflectance Model and it's application **[20] CO4**
ii. ill posed problem in shape from shading

Q11. Consider the following image with ten different gray levels. Apply the Region merging and splitting segmentation approach using the uniformity predicate is for regions to merge when the difference in grey-level intensity between adjacent regions is 1.

4	4	4	2	2	1	2	3	2	2
1	4	4	4	1	1	2	2	3	3
2	1	4	4	4	1	1	2	3	2
2	3	1	5	5	4	1	2	1	3
1	2	1	1	4	4	5	1	1	2
2	2	2	2	1	5	4	4	1	3
2	3	1	1	1	1	4	5	5	1
2	2	1	2	1	1	1	5	4	4

[20] CO3

OR

Compute the degree of the compression that can be achieved for the following gray scale image using (a) Huffman coding of pixel values, (b) run-length coding, assuming 2 bits to represent the pixel value and the 2 bits to represent the run length.

4	5	1	2
3	3	0	0
2	1	1	1
4	5	3	3
7	5	6	7

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SECTION A

S. No.		Marks	CO
Q1.	What is digital image? Discuss the process of sampling and quantization. Why do we need digital image processing?	**[4]**	**CO1**
Q2.	What is optical flow field? Discuss use of optical flow field in short.	**[4]**	**CO4**
Q3.	Calculate the memory required to store the following images in bits. i. 4 bit gray scale image of size 512X512 ii. 3 bit colour image of size 128X128	**[4]**	**CO1**
Q4.	Give the filter functions for the following edge based operators. i. Kirch ii. Sobel	**[4]**	**CO2**
Q5.	Discuss the lossless and lossy compression.	**[4]**	**CO4**

SECTION B

Q6.	Write the statement of Baye's theorem. A chartered analyst can choose any one of three routes to get to work-A, B or C. The probabilities that she arrives on time using routes A, B, and C are 50%, 52%, and 60% respectively. If she is equally likely to choose any one of the routes and arrives on time, calculate the probability that she chose route A.	**[10]**	**CO3**
Q7.	What is image morphology? Discuss the following morphological operations with suitable examples. i. Dilation ii. Erosion	**[10]**	**CO2**
Q8.	What are steps involved in frequency domain filtering? Discuss the image Ideal Low Pass filter with its function in the frequency domain.	**[10]**	**CO1**
Q9.	Find the two dimensional Discrete Fourier Transform (2D-DFT) of the following gray scale image [1 1 1 1]. **OR** Consider the following image of size 3x5. Apply the following 3 X 3 smoothing	**[10]**	**CO1**

filters on this pixel.

1	2	7	2	7
5	1	0	1	6
6	2	5	2	6

i. Mean Filter
ii. Min Filter
iii. Max Filter
iv. Median Filter

SECTION-C

Q10. Discuss following terms in detail:
i. Rule based image segmentation
ii. Shape from shading

[20] **CO4**

Q11. Design a 2-bit uniform quantizer, compress the following image using it, and calculate the distortion in terms of PSNR after compression.

14	5	5	7
10	4	3	2
0	3	6	6
12	8	15	11

[20] **CO3**

OR

What is image segmentation? How region based segmentation is different from edge-based segmentation. Discuss the Region split and merge algorithm for image segmentation with suitable example.