Name:

Enrolment No:

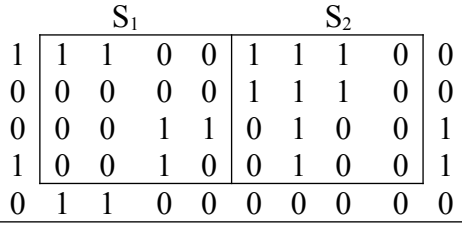
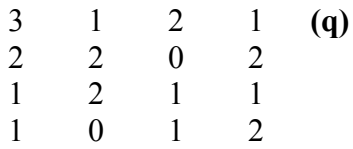
UPES
UNIVERSITY WITH A PURPOSE

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

Course: Document Image Processing and Compression **Semester: II**
Program: M. Tech. (CSE) **Time 03 hrs.**
Course Code: CSIP7004 **Max. Marks: 100**

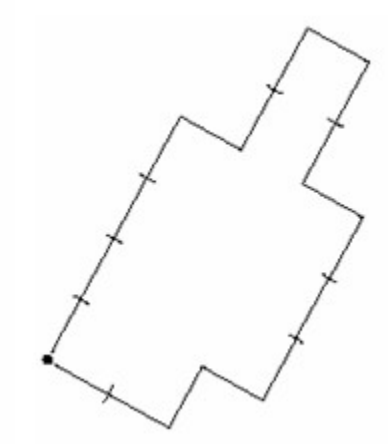
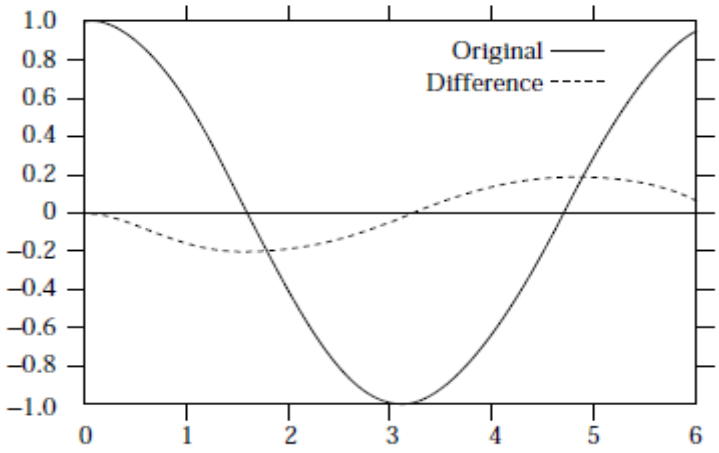
Instructions: Attempt all the questions.

SECTION A

S. No.		Marks	CO
Q1.	Consider the two image subsets S_1 and S_2. For V = {1}, determine whether S_1 and S_2 are: i. 4-connected ii. 8-connected iii. m-connected  	**[4]**	**CO1**
Q2.	Consider the following image segment  Let set of intensities V= {1, 2}. Compute the D_4, and D_8 distances (if any) between pixels **p** and **q**.	**[4]**	**CO1**
Q3.	What is image thresholding? What are its types?	**[4]**	**CO2**
Q4.	Explain region based segmentation and region growing with an example.	**[4]**	**CO3**
Q5.	What are the useful descriptors of a boundary?	**[4]**	**CO4**

SECTION B

Q6.	What is edge detection? Give the filter functions for the following edge based operators. **i.** Laplace **ii.** Prewitt **iii.** Kirch **iv.** Sobel	**[10]**	**CO2**
Q7.	Discuss the various steps involved to design an Optical Character Recognizer (OCR) for document written in Devanagari Lipi.	**[10]**	**CO5**

Q8.	Find the shape number and the order of shape number for image given below. 	**[10]**	**CO3**
Q9.	What is the role of differential encoding techniques in audio compression? Consider the half cycle of a sinusoid shown in figure that has been sampled at the rate of 30 samples per cycle. The value of the sinusoid ranges between 1 and −1. If we wanted to quantize the sinusoid using a uniform four-level quantizer, we would use a step size of 0.5, which would result in quantization errors in the range [-.25, .25]. If we take the sample-to-sample differences (excluding the first sample), the differences lie in the range [-.2, .2] as shown in figure. Suggest the step size of a four-level quantizer to quantize this range of values. Also, find the range of quantization noise (error).  **OR** Compress the following image using 2-bit uniform quantizer and calculate the distortion after compression. 8 17 12 7 4 5 30 23 9 5 30 21 13 14 6 0	**[10]**	**CO4**

SECTION-C

Q10. Write short note on the following

i. Discrete Cosine Transform (DCT)
ii. JPEG standard
iii. MPEG standard

[20] CO5

Q11. Discuss the following region based feature descriptors.

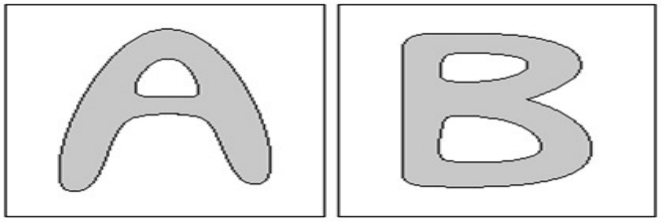
i. Area
ii. Perimeter
iii. Convex Area
iv. Euler Number
v. Solidity

OR

Define object classification. What is the role of feature extraction in object classification? Find following topological descriptors for the image shown below.

[20] CO4

(i) Number of holes
(ii) Number of connected components
(iii) Euler Number



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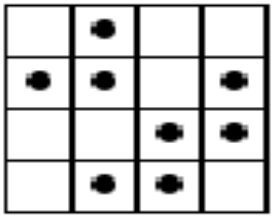
SECTION A

S. No.		Marks	CO
Q1.	A common measure for transmission of digital data is baud rate; generally, transmission is accomplished in packets consisting of a start bit, a byte (8 bits) of information, and a stop bit. How many minutes would it take to transmit 1024 X 1024 image with 256 gray levels using a 56 K baud modem?	**[4]**	**CO1**
Q2.	Do the labeling of 4 and 8 connected components in the following image segment. 	**[4]**	**CO2**
Q3.	What is an 'edge' in an image? On what mathematical operation are the two basic approaches for edge detection based on? Discuss in brief.	**[4]**	**CO3**
Q4.	What are the basic steps in JPEG image compression? What is zig-zag sequence?	**[4]**	**CO4**
Q5.	What is image thresholding? Discuss different types of image thresholding.	**[4]**	**CO1**

SECTION B

Q6.	Draw the functional block diagram of document image processing system and explain the purpose of each block in designing an Optical Character Recognizer (OCR) for document written in Devanagari Lipi.	**[10]**	**CO4**
Q7.	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.	**[10]**	**CO1**

5	5	5	5	5	5	6	6	6	6

5	10	10	10	10	10	10	6	6	6
5	5	5	9	9	6	6	6	6	6
6	6	6	9	9	6	6	6	6	6
6	6	6	10	10	6	6	6	6	6
6	6	6	10	10	7	7	7	7	7
7	7	7	10	10	7	7	7	7	7
6	7	7	10	9	6	7	7	9	7
6	9	9	9	9	9	9	7	10	7
6	6	6	6	6	7	7	7	7	7

Q8.	For the following gray scale image shown below, compute the degree of the compression that can be achieved 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.	**[10]**	**CO3**

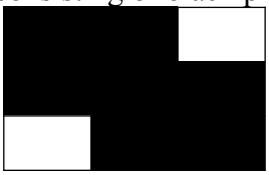
3	3	3	2
2	3	3	3
3	2	2	2
2	1	1	0

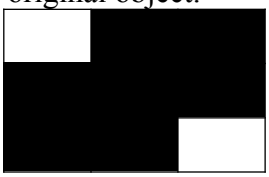
OR

Consider an image strip of size 50 X 100 shown below. The image consists of five vertical stripes. The gray levels of the stripes from left to right are 128, 64, 32, 16 and 8. The corresponding widths of stripes are 35, 30, 20, 10 and 5 pixels respectively. If this stripe image is coded by Huffman coding, determine it's efficiency.

Q9.	Write short note on the MPEG standard.	**[10]**	**CO2**

SECTION-C

Q10.	Discuss the following region based feature descriptors. i. Area ii. Perimeter iii. Convex Area iv. Circularity v. Eccentricity	**[20]**	**CO4**
Q11.	You are given a binary object consisting of black pixels in an image as 	**[20]**	**CO3**

	i. Compute the chain code for this particular object using 4-connectivity, starting with the top left pixel and moving in the clockwise direction. ii. Explain how you can make the chain code independent of the starting point, and demonstrate this by starting from bottom right corner pixel. iii. Explain how you can make a simple transform to make a chain code invariant to rotation. Demonstrate the concept on the object given below which is the rotation of original object.  OR What are called statistical moments? Discuss all the statistical moments up to order five.		