Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2021

Course: Digital Image Processing **Semester: II**

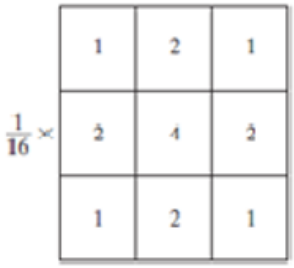
Program: M. Tech- CSE **Time 03 hrs.**

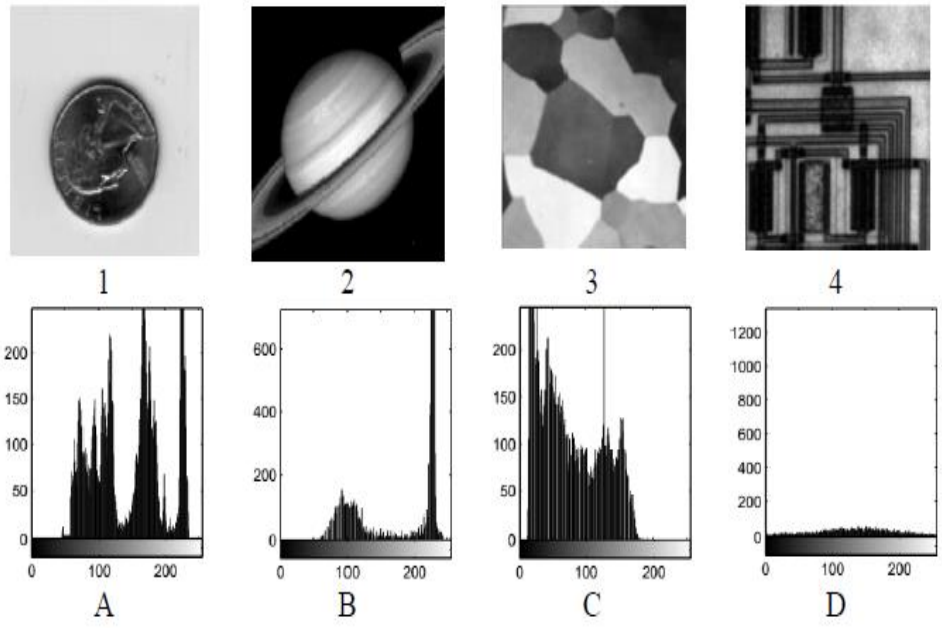
Course Code: CSIP7004P **Max. Marks: 100**

SECTION A

1. Each Question will carry 5 Marks
2. Instruction: Multiple choice questions.

S. No.		Marks	CO
Q 1	Consider the following 8-bit image: 16 16 64 64 4 16 16 4 4 16 16 4 100 225 225 100 $S = c \times r^{1/2}$ Assume **c=1**. Apply the following transformation to this image and a) 4 4 8 8 2 4 4 2 2 4 4 2 10 15 15 10 b) 10 15 15 10 2 4 4 2 2 4 4 2 4 4 8 8 c) 2 4 4 2 2 4 4 2 4 4 8 8 10 15 15 10 c) 2 4 4 2 10 15 15 10 4 4 8 8 2 4 4 2	5	CO1

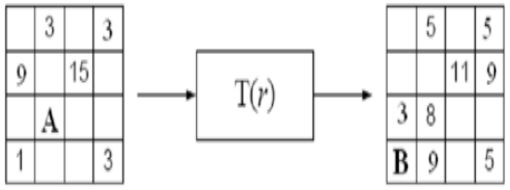
Q2	If ***h(rk)*** = ***nk***, ***rk*** the ***k***th gray level and ***nk*** total pixels with gray level ***rk***, is a histogram in gray level range [0, L – 1]. Then how can we normalize a histogram? a) If each value of histogram is added by total number of pixels in image, say ***n***, ***p(rk)=nk+n*** b) If each value of histogram is subtracted by total number of pixels in image, say ***n, p(rk)=nk-n*** c) If each value of histogram is multiplied by total number of pixels in image, say ***n, p(rk)=nk * n*** d) If each value of histogram is divided by total number of pixels in image, say ***n***, ***p(rk)=nk / n***	**5**	**CO2**
Q3	The mask shown in the figure below belongs to which type of filter?  a) Sharpening spatial filter b) Median filter c) Sharpening frequency filter d) Smoothing spatial filter	**5**	**CO3**

Q4	Match the images with their distribution of gray level's probability.  a) 1-A, 2-B, 3-C, 4-D b) 1-B, 2-A, 3-D, 4-C c) 1-C, 2-D, 3-A,4-B d) 4-C, 2-A, 1-B, 3-D	**5**	**CO4**
Q5	A 4x4 image is shown below. Let V = {1, 2}. Compute the lengths of the shortest 8-path between p and q. **3 1 2 1 (q)** **2 2 0 2** **1 2 1 1** **(p) 1 0 1 2** a) 1-1-2-2-1-2-1 b) 1-2-2-2-1 c) 1-1-2-2-1 d) 1-1-2-1-2-1	**5**	**CO1**

Q6	How much memory is required for storing 256 x 256 colored image with pixel depth of 8 bits? a) 192 KB b) 65536 KB c) 64 KB d) 96 KB	**5**	**CO2**

SECTION B

1. Each question will carry 10 marks
2. Instruction: Write short / brief notes.

Q 7	a) Draw and explain the fundamental steps involved in image processing. b) Describe in brief the terms: Gray level slicing and Bit plane slicing.	**7+3**	**CO1**
Q8	a) Given an image of size 4 x 4, 4-bits passes through an intensity transformation function given by $S=T(r) = a \log_2(1+r)+b$ Where, a and b are constants, few pixels are available in the input and output images, as shown below.  input image output image Find out the values of the pixels **A** and **B** in the input and output images respectively? b) Name various spatial filtering methods. Below are the pixel values in a 5x5 grey level image. Find the value of pixels (Pixel enclosed in parenthesis) after applying 3x3 median filter? **(1)** 2 3 1 2 4 5 2 3 3 3 3 **(5)** 4 4 1 3 2 **(3)** 5 2 1 3 1 3	**5+5**	**CO3**

Q9	a) Perform histogram equalization of the given image. If pixels in an image are shuffled, will there be any change in the histogram? Justify. 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 b) In an application, an averaging mask is applied to input images to reduce noise and then a Laplacian mask is applied to enhance small details. Would the result be the same if the order of these operations is reversed? Justify your answer.	**7+3**	**CO3**
Q10	a) Solve the given problem as shown in figure by using Region growing algorithm? The seed points are highlighted in a given image and the stopping criteria is the difference between seeds and image pixels which should be less or equal to threshold=3. 0 2 0 1 0 1 0 **(1)** 1 2 5 7 6 5 7 6 6 **(7)** 8 6 5 6 7 7 5 b) Segment the image shown by using split and merge procedure. Let $P(R_i)$= ***TRUE*** if all pixels in R_i have the same gray level. Show the quadtree corresponding to your segmentation. 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 0 3 1 4 9 9 8 1 0 1 1 8 8 8 4 1 0 1 1 6 6 6 3 1 0 1 1 5 6 6 3 1 0 1 1 5 6 6 2 1 0 1 1 1 1 1 1 0 0	**6+4**	**CO2**
Q11	a) Why do we perform image processing in frequency domain although images are generally represented in spatial domain? Give a general procedure to implement filtering in frequency domain. b) How is smoothing achieved in the frequency domain? Explain the three types of low pass filter.	**7+3**	**CO2**

SECTION-C **1. Question (a) and (b) carries 10 Marks each.** **2. Instruction: Part (b) has a choice question. Attempt any one question from part (b).**			
Q12	a) Draw a block diagram of an image compression system and describe role of different components. b) Obtain the Huffman code for the word 'COMMITTEE'. c) Determine the: (i) average length (L) (ii) entropy (H(S)) (iii) efficiency	**10+7+ 3**	**CO4**