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**Enrolment No:** 



## **UPES**

## **End Semester Examination, December 2023**

Course: Image Processing and Pattern Analysis Semester: V

Program: B.Tech. Time : 03 hrs.
Course Code: CSEG 3041 P Max. Marks: 100

Instructions: Attempt all the questions. All questions are compulsory.

## SECTION A (5Qx4M=20Marks)

											Marks	CO
Define the 4-neighbours and 8-neighbours with examples.											4	CO1
Explain linear and non-linear filters with examples.											4	CO2
Describe about contrast stretching in spatial domain.											4	CO2
A function $f(x)$ is sampled at four points at $x = 0.50, 0.75, 1.00$ and 1.25, respectively and the sampled values are $f(x) = \{2, 3, 4, 4\}$ , respectively. Find out the Fourier transform coefficients for the sampled function.											4	CO3
Explain the Principal Component Analysis.											4	CO4
			(4									
Perform histogram equalization of the following 3-bit grayscale image whose gray level distribution is given as follows:											10	CO2
Grey levels  No. of pixels	0 20	1 16	2 8	8			5	6 2	7 2			
Let $I = \begin{pmatrix} 2 & 3 \\ 4 & 1 \end{pmatrix}$ be an image and $K = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$ be a mask. Write the output images after correlation and convolution.										10	CO2	
Determine 2D Haar transform of the image as shown below:											10	CO3
		1		2	2	3						
		4		5	6	7						
		1		2	3	7						
		8		2	8	1						
	Explain linear at Describe about  A function $f(x)$ and the sample transform coeff  Explain the Print  Perform histograph level distribution  Grey levels  No. of pixels  Let $I = \begin{pmatrix} 2 & 3 \\ 4 & 1 \end{pmatrix}$ after correlation	Explain linear and non- Describe about contras  A function $f(x)$ is samp and the sampled value transform coefficients:  Explain the Principal Comparison of the principa	Explain linear and non-linear for Describe about contrast stretch.  A function $f(x)$ is sampled at for and the sampled values are $f$ transform coefficients for the second Explain the Principal Components.  Perform histogram equalization level distribution is given as for $f$	Explain linear and non-linear filters where $f(x)$ is sampled at four point and the sampled values are $f(x)$ = transform coefficients for the sampled Explain the Principal Component And Internal Component	Explain linear and non-linear filters with explain linear and non-linear filters with explain linear and non-linear filters with explain the sampled values are $f(x)$ is sampled at four points at and the sampled values are $f(x) = \{2, 3, \text{transform coefficients for the sampled function}$ Explain the Principal Component Analysis.  SEC (4Qx10N)  Perform histogram equalization of the followed distribution is given as follows:  Grey levels 0 1 2 3  No. of pixels 20 16 8 8  Let $I = \begin{pmatrix} 2 & 3 \\ 4 & 1 \end{pmatrix}$ be an image and $K = \begin{pmatrix} 1 \\ 2 \\ 4 \end{pmatrix}$ after correlation and convolution.  Determine 2D Haar transform of the image $\frac{1}{4}$	Explain linear and non-linear filters with examples  Describe about contrast stretching in spatial domain  A function $f(x)$ is sampled at four points at $x = 0.50$ and the sampled values are $f(x) = \{2, 3, 4, 4\}$ , retransform coefficients for the sampled function.  Explain the Principal Component Analysis.  SECTION  (4Qx10M= 40 N)  Perform histogram equalization of the following 3 level distribution is given as follows:  Grey levels 0 1 2 3 4 4 5 6 6 6 1 2 3	Explain linear and non-linear filters with examples.  Describe about contrast stretching in spatial domain.  A function $f(x)$ is sampled at four points at $x = 0.50$ , 0.75, and the sampled values are $f(x) = \{2, 3, 4, 4\}$ , respective transform coefficients for the sampled function.  Explain the Principal Component Analysis.  SECTION B  (4Qx10M= 40 Marks)  Perform histogram equalization of the following 3-bit grallevel distribution is given as follows:  Grey levels 0 1 2 3 4 No. of pixels 20 16 8 8 4 4  Let $I = \begin{pmatrix} 2 & 3 \\ 4 & 1 \end{pmatrix}$ be an image and $K = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$ be a mask after correlation and convolution.  Determine 2D Haar transform of the image as shown below 1 2 3 7 7	Explain linear and non-linear filters with examples.  Describe about contrast stretching in spatial domain.  A function $f(x)$ is sampled at four points at $x = 0.50, 0.75, 1.00$ a and the sampled values are $f(x) = \{2, 3, 4, 4\}$ , respectively. It transform coefficients for the sampled function.  Explain the Principal Component Analysis.  SECTION B  (4Qx10M= 40 Marks)  Perform histogram equalization of the following 3-bit grayscal level distribution is given as follows:  Grey levels 0 1 2 3 4 5 No. of pixels 20 16 8 8 4 4  Let $I = \begin{pmatrix} 2 & 3 \\ 4 & 1 \end{pmatrix}$ be an image and $K = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$ be a mask. Write after correlation and convolution.  Determine 2D Haar transform of the image as shown below: $1  2  2  3  4  5  6  7  1  2  3  4  5  6  7  1  2  3  7  1  2  3  7  1  2  3  7  1  3  4  5  6  7  1  2  3  7  1  2  3  7  1  3  4  5  6  7  1  2  3  7  1  3  4  5  6  7  1  2  3  7  1  3  4  5  6  7  1  2  3  7  1  3  4  5  6  7  1  2  3  7  1  3  4  5  6  7  1  2  3  7  1  4  5  6  7  1  2  3  7  1  4  5  6  7  1  2  3  7  1  4  5  6  7  1  2  3  7  1  4  5  6  7  1  2  3  7  1  4  5  6  7  1  2  3  7  1  4  5  6  7  1  2  3  7  1  4  5  6  7  1  2  3  7  1  4  5  6  7  1  2  3  7  1  4  5  6  7  1  2  3  7  1  4  5  6  7  1  2  3  7  1  4  5  6  7  1  2  3  7  1  4  5  6  7  1  2  3  7  1  4  5  6  7  1  2  3  7  1  4  5  6  7  1  2  3  7  1  4  5  6  7  1  2  3  7  1  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1  4  6  6  7  7  7  7  7  7  7  7$	Explain linear and non-linear filters with examples.  Describe about contrast stretching in spatial domain.  A function $f(x)$ is sampled at four points at $x = 0.50$ , $0.75$ , $1.00$ and $1.25$ , and the sampled values are $f(x) = \{2, 3, 4, 4\}$ , respectively. Find out transform coefficients for the sampled function.  Explain the Principal Component Analysis.  SECTION B  (4Qx10M= 40 Marks)  Perform histogram equalization of the following 3-bit grayscale image level distribution is given as follows:  Grey levels 0 1 2 3 4 5 6  No. of pixels 20 16 8 8 4 4 2  Let $I = \begin{pmatrix} 2 & 3 \\ 4 & 1 \end{pmatrix}$ be an image and $K = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$ be a mask. Write the outp after correlation and convolution.  Determine 2D Haar transform of the image as shown below: $1  2  2  3  4  5  6  7  1  2  3  4  5  6  7  1  2  3  4  5  6  7  1  2  3  7  6  7  7  7  7  7  7  7  7$	Explain linear and non-linear filters with examples.  Describe about contrast stretching in spatial domain.  A function $f(x)$ is sampled at four points at $x = 0.50$ , $0.75$ , $1.00$ and $1.25$ , respect and the sampled values are $f(x) = \{2, 3, 4, 4\}$ , respectively. Find out the Fourier coefficients for the sampled function.  Explain the Principal Component Analysis.  SECTION B  (4Qx10M= 40 Marks)  Perform histogram equalization of the following 3-bit grayscale image whose level distribution is given as follows:  Grey levels 0 1 2 3 4 5 6 7  No. of pixels 20 16 8 8 4 4 2 2  Let $I = \begin{pmatrix} 2 & 3 \\ 4 & 1 \end{pmatrix}$ be an image and $K = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$ be a mask. Write the output image after correlation and convolution.  Determine 2D Haar transform of the image as shown below: $1  2  2  3  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1  4  5  6  7  1 $	Explain linear and non-linear filters with examples.  Describe about contrast stretching in spatial domain.  A function $f(x)$ is sampled at four points at $x = 0.50$ , 0.75, 1.00 and 1.25, respectively and the sampled values are $f(x) = \{2, 3, 4, 4\}$ , respectively. Find out the Fourier transform coefficients for the sampled function.  Explain the Principal Component Analysis.  SECTION B  (4Qx10M= 40 Marks)  Perform histogram equalization of the following 3-bit grayscale image whose gray level distribution is given as follows:  Grey levels 0 1 2 3 4 5 6 7  No. of pixels 20 16 8 8 4 4 2 2 2  Let $I = \begin{pmatrix} 2 & 3 \\ 4 & 1 \end{pmatrix}$ be an image and $K = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$ be a mask. Write the output images after correlation and convolution.  Determine 2D Haar transform of the image as shown below: $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Define the 4-neighbours and 8-neighbours with examples.  Explain linear and non-linear filters with examples.  Describe about contrast stretching in spatial domain.  A function $f(x)$ is sampled at four points at $x = 0.50$ , $0.75$ , $1.00$ and $1.25$ , respectively and the sampled values are $f(x) = \{2, 3, 4, 4\}$ , respectively. Find out the Fourier transform coefficients for the sampled function.  Explain the Principal Component Analysis.  4  SECTION B  (4Qx10M= 40 Marks)  Perform histogram equalization of the following 3-bit grayscale image whose gray level distribution is given as follows:  Grey levels 0 1 2 3 4 5 6 7  No. of pixels 20 16 8 8 4 4 4 2 2  Let $I = \begin{pmatrix} 2 & 3 \\ 4 & 1 \end{pmatrix}$ be an image and $K = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$ be a mask. Write the output images after correlation and convolution.  Determine 2D Haar transform of the image as shown below:  10  11  12  13  14  15  16  17  10  10

Q 9	Given $x(n) = \{3, 4, 5, 6\}$ , determine $X(k)$ using DIT-FFT.									10	CO3		
	OR												
	Determine the 2D discrete Fourier transform (DFT) of the image as shown below:												
				1		2	3	4					
				2	2	1	4	5					
				3			2	3					
				4	1 :	5	3	1					
					(20		ION-C =40 Ma						
Q 10A	(2Qx20M=40 Marks)  Explain the image formation model. With a neat block diagram, explain the fundamental steps in digital image processing.										lain the	10	CO1
Q 10B	Explain th	ne follov	ving teri	ms: (i) 4	-adjacar	ncy, ( <i>ii</i> ) <i>l</i>	D <sub>4</sub> distan	ice, and	(iii) <i>D</i> <sub>8</sub> d	istance.		10	CO1
Q 11	What is meant by image segmentation? Give an application of image segmentation. For the given image, write the output image after performing the region growing algorithm:											20	CO4
				3	2	9	10	9					
				2	3	10	11	10					
				2	2	9	11	10					
				2	3	10	10	11					
				3	4	10	10	11					
	OR												
	Explain the K-NN algorithm. What are the advantages and disadvantages of this algorithm. Write the output after using this algorithm to the following example.												
	BMI	33.6	26.6	23.4	43.1	35.3	35.9	36.7	25.7	23.3	31		
	Age	50	30	40	67	23	67	45	46	29	56		
	Sugar	1	0	0	0	1	1	1	0	0	1		
	1												