Name:

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)

S. No.		Marks	CO
Q 1	Define the 4-neighbours and 8-neighbours with examples.	**4**	**CO1**
Q 2	Explain linear and non-linear filters with examples.	**4**	**CO2**
Q 3	Describe about contrast stretching in spatial domain.	**4**	**CO2**
Q 4	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**
Q 5	Explain the Principal Component Analysis.	**4**	**CO4**

SECTION B
(4Qx10M= 40 Marks)

Q 6	Perform histogram equalization of the following 3-bit grayscale image whose gray level distribution is given as follows:								**10**	**CO2**
	Grey levels	0	1	2	3	4	5	6	7	
	No. of pixels	20	16	8	8	4	4	2	2	
Q 7	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**
Q 8	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

<table>
<tr><td>Q 9</td><td>Given $x(n) = \{3, 4, 5, 6\}$, determine $X(k)$ using DIT-FFT.

OR

Determine the 2D discrete Fourier transform (DFT) of the image as shown below:

<table><tr><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>2</td><td>1</td><td>4</td><td>5</td></tr><tr><td>3</td><td>4</td><td>2</td><td>3</td></tr><tr><td>4</td><td>5</td><td>3</td><td>1</td></tr></table></td><td>10</td><td>CO3</td></tr>
<tr><td colspan="4">SECTION-C
(2Qx20M=40 Marks)</td></tr>
<tr><td>Q 10A</td><td>Explain the image formation model. With a neat block diagram, explain the fundamental steps in digital image processing.</td><td>10</td><td>CO1</td></tr>
<tr><td>Q 10B</td><td>Explain the following terms: (i) 4-adjacancy, (ii) D_4 distance, and (iii) D_8 distance.</td><td>10</td><td>CO1</td></tr>
<tr><td>Q 11</td><td>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:
<table><tr><td>3</td><td>2</td><td>9</td><td>10</td><td>9</td></tr><tr><td>2</td><td>3</td><td>10</td><td>11</td><td>10</td></tr><tr><td>2</td><td>2</td><td>9</td><td>11</td><td>10</td></tr><tr><td>2</td><td>3</td><td>10</td><td>10</td><td>11</td></tr><tr><td>3</td><td>4</td><td>10</td><td>10</td><td>11</td></tr></table>
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.

<table><tr><td>BMI</td><td>33.6</td><td>26.6</td><td>23.4</td><td>43.1</td><td>35.3</td><td>35.9</td><td>36.7</td><td>25.7</td><td>23.3</td><td>31</td></tr><tr><td>Age</td><td>50</td><td>30</td><td>40</td><td>67</td><td>23</td><td>67</td><td>45</td><td>46</td><td>29</td><td>56</td></tr><tr><td>Sugar</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td></tr></table></td><td>20</td><td>CO4</td></tr>
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