19/5/2022 (E)

K. J. Somaiya College of Engineering, Mumbai-77
(Autonomous College Affiliated to University of Mumbai)

End Semester Examinations
May-June 2022

Max. Marks: 100
Class: TY
Name of the Course: Digital Signal and Image Processing
Branch: Computer Engineering
Course Code: 2UCC601

Duration: 3 Hours
Semester: VI

Instructions:
(1) **All Questions are Compulsory**
(2) **Draw neat diagrams**
(3) Assume suitable data if necessary

Question No.		Marks
Q 1 (a)	Classify the following DT systems on linearity, time invariance, causality i. $y(n)=x^2(n)$ ii. $y(n)=e^{x(n)}$ iii. $y(n)=4x(n)+ x(n-3)$	10
Q 1 (b)	i. What is Unitary transform matrix? Explain with example. ii. Explain in short sampling and quantization method for digital image.	10
Q2 (a)	Perform histogram equalization and draw new equalized histogram of the following image data	10
Q2 (b)	Explain the use of high pass filter mask and high boost filter mask for spatial domain enhancement.	10
Q3 (a)	Compute DFT of the digital image given below using DIT-FFT algorithm (DIT- FFT signal flow graph/ Butterfly diagram)	10

Q2 (a) table:

Gray Level	0	1	2	3	4	5	6	7
No. of pixels	700	1000	950	600	300	250	105	95

Q3 (a) image data:

3	1	1	3
3	3	0	1
2	2	3	4
0	1	2	3

	— OR		
	Design 4 x 4 Haar transform matrix and represent the row basis functions (basis images) graphically.		
Q3 (b)	Write 8x8 Hadamard transform matrix and its signal flow graph. Using the Butterfly diagram, compute Hadamard transform for $$x(n) = \{2, 3, 1, 3, 4, 3, 1, 1\}$$	10 10	
— OR			
Q4 (a)	Apply Region Splitting algorithm for the given image and the predicate is $[\max\{f(x, y)\} - \min\{f(x, y)\} <= 4]$, where $(x, y) \in R$, where R is the given region. Show the quad Tree for the nodes.	10	

7	3	6	7	6	7	5	5
5	5	4	4	6	4	8	7
6	4	5	4	7	6	8	6
7	5	5	4	6	3	4	6
4	4	4	5	4	5	5	6
3	3	4	6	6	4	4	8
3	4	3	3	5	4	4	5
5	5	4	3	7	6	5	4

OR

What is image segmentation? Explain the following methods of image segmentation.

   i.   Region growing
  ii.   Split and Merge

10

Q4 (b)	Find variable length code using Huffman coding for the symbols and the data given below.	10

Symbol	Probability
a1	0.1
a2	0.2
a3	0.3
a4	0.14
a5	0.16
a6	0.1

Q5 (a)	Write a detail note on (any one)
	   i. Hough Transform
	  ii. Homomorphic filter
		10

Q5 (b)	Explain in detail Hit or Miss Transform with an example	10

(10)

Q.3(b) Compute the discrete cosine transform (DCT) matrix for N = 4.