Reg.No.:												

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 12002

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – MAY / JUNE 2024
Sixth Semester
Biomedical Engineering
U19BM612– MEDICAL IMAGE PROCESSING
(Regulation 2019)

Time: Three Hours | Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Identify the fundamental steps involved in digital image processing.	2	K2	CO1
2.	Define the RGB color model in the context of color image representation. Name one common application where the RGB model is widely used.	2	K2	CO1
3.	State the differences between smoothing and sharpening spatial filtering.	2	K2	CO2
4.	What is the primary goal of histogram processing? Name one application where histogram equalization is commonly used.	2	K3	CO2
5.	Identify the basic principle behind mean filters in image restoration.	2	K2	CO3
6.	Name one common noise model used in image restoration. Provide a brief description of how this noise model affects images.	2	K2	CO3
7.	Define thresholding in the context of image processing. Why it is an essential step in edge detection?	2	K2	CO4
8.	Give a mask that can be used to detect the horizontal and vertical line in an image.	2	K2	CO4
9.	What is the need for image compression standard? Give two valid differences between lossless and lossy compression techniques.	2	K2	CO5
10.	A 256 X 256 pixel digital image has eight distinct intensity levels. What is the minimum number of bits required to code the image in a lossless manner?	2	K3	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	Explain the concept of Nyquist frequency and its relevance to image sampling.	6	K2	CO1
		ii.	Discuss the challenges associated with determining an appropriate sampling rate for a given image.	7	K4	
			(OR)			
	b)	i.	Elaborate on the relationships between neighboring pixels in an image. How does this concept contribute to image processing techniques?	7	K3	CO1
		ii.	Prove the following properties of two dimensional discrete Fourier transform. a. Spatial shift property b. Convolution property	6	K3	
12.	a)	i.	Compare and contrast Ideal, Butterworth, and Gaussian frequency domain filters.	6	K4	CO2
		ii.	Explain the following gray level transformation techniques in detail a. Image negative b. Contrast stretching	7	K2	
			(OR)			
	b)	i.	Elaborate on the concept of homomorphic filtering. How does it contribute to image enhancement, and in what scenarios is it particularly useful?	10	K4	CO2
		ii.	Whether two different images can have same histogram? Justify your answer.	3	K4	
13.	a)	i.	Compare and contrast inverse filtering and Wiener filtering methods in image restoration.	7	K4	CO3
		ii.	Suggest a suitable filter with justification for the following situations: a. Image is corrupted by additive Gaussian noise. b. Image is corrupted by salt and pepper noise. c. Image is corrupted by periodic noise.	6		
			(OR)			
	b)	i.	Outline the step-by-step process involved in image restoration, considering degradation models, noise models, and the use of filters.	8	K4	CO3
		ii.	Explain the diffference between image enhancement and image restoration.	5	K2	

14.	a)	i.	Discuss the integration of edge detection and Hough transform for line detection in images. Provide a step-by-step explanation of the process and discuss its applications.	8	K3	CO4
		ii.	With a suitable illustration, explain split and merge technique for image segmentation.	5	K2	
			(OR)			
	b)	i.	Outline the step-by-step process of the watershed segmentation algorithm.	10	K2	CO4
		ii.	Discuss the strengths and weaknesses of the watershed segmentation algorithm.	3	K2	
15.	a)	i.	Obtain the Huffman code for the word 'COMMITTEE'.	6	K4	CO5
		ii.	With a neat block diagram, explain transform based image compression scheme. Also mention different modes in JPEG compression standard	7	K2	
			(OR)			
	b)	i.	Discuss the importance of boundary descriptors, including Fourier Descriptors and Regional Descriptors, in representing and characterizing object shapes.	8	K2	CO5
		ii.	Define texture in the context of image processing and computer vision, and discuss the importance of recognizing patterns and pattern classes.	5	K3	

PART – C

(1 x 15 = 15 Marks)

Q.No.			Questions	Marks	KL	CO
16.	a)	i.	Consider a case where a radiographic image has low contrast. Discuss the steps involved in enhancing the image using both spatial and frequency domain techniques.	10	K4	CO2
		ii.	Discuss the role of local contrast enhancement methods, such as adaptive histogram equalization, in improving specific regions of a radiographic image.	5	K3	
			(OR)			
	b)	i.	Explore how morphological processing integrates with other image processing techniques, such as edge detection or color segmentation, to improve overall traffic sign recognition accuracy.	10	K4	CO4
		ii.	With a suitable illustration explain region growing method of image segmentation.	5	K2	