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

**Question Paper Code: 60020**

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2025

Seventh Semester

Computer Science and Engineering

U19ITV35 – DIGITAL 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.	Define the fundamental steps involved in digital image processing.	2	K1	CO1
2.	Mention the difference between image sampling and image quantization in digital image processing.	2	K2	CO1
3.	How a gray level transformation is applied in the spatial domain for image enhancement?	2	K2	CO2
4.	Define histogram equalization and its purpose in image enhancement.	2	K1	CO2
5.	Mention one practical application of edge linking and boundary detection in image segmentation.	2	K2	CO3
6.	Compare the process of erosion and dilation in morphological processing.	2	K1	CO3
7.	What is the advantage of using wavelet transforms in a sub-band coding for image compression?	2	K1	CO4
8.	Define lossless predictive coding in the context of image compression	2	K2	CO4
9.	What do regional descriptors describe in image recognition?	2	K1	CO5
10.	Calculate the number of bits required to store a grayscale image of size 256 x 256 pixels with 8 bits per pixel.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	Describe the Nyquist-Shannon sampling theorem and its significance in image sampling. Explain the phenomenon of aliasing in digital images resulting from improper sampling. Discuss methods to prevent aliasing in image acquisition and processing. Further, illustrate the effects of quantization on image quality, including the introduction of quantization noise and banding artifacts, and methods to minimize these effects.	13	K3	CO1
	(OR)			
b)	“Pixel adjacency concepts like 4-neighbors, 8-neighbors, and m-adjacency are used to detect connected components in a binary image”. How? Justify your answer. Discuss practical applications where connected component analysis is crucial.	13	K3	CO1
12. a)	Discuss the differences between smoothing and sharpening filters in the spatial domain. Explain the effect of each filter type on an image and provide common techniques used for both.	13	K2	CO2
	(OR)			
b)	Describe the Fourier Transform in image processing. Explain how ideal, Butterworth, and Gaussian filters are designed and used for the smoothing and sharpening images in the frequency domain.	13	K2	CO2
13. a)	Explain the different noise models commonly encountered in image restoration. How do these noise models affect the choice of filtering techniques?	13	K3	CO3
	(OR)			
b)	Elucidate segmentation techniques based on detection of discontinuities and region-based segmentation. Include the role of morphological operations such as erosion and dilation in segmentation.	13	K3	CO3
14. a)	Discuss image compression models and the fundamental steps involved in both lossless and lossy compression. Include explanations of variable length coding, bit-plane coding, and predictive coding techniques with examples.	13	K2	CO4
	(OR)			

	b)	Given a 4x4 grayscale image matrix, demonstrate how to perform bit-plane coding for image compression. Explain the process of decomposing the image into its individual bit planes and how the original image can be reconstructed from these bit planes. Additionally, discuss the advantages and disadvantages of using bit-plane coding as a compression technique.	13	K2	CO4
15.	a)	Describe the role of topological features, texture, and pattern classes in image recognition. How is recognition achieved based on pattern matching?	13	K3	CO5
		(OR)			
	b)	Explain the process of pattern recognition based on matching. Discuss the different types of pattern classes and describe how matching algorithms can be used for effective recognition. Provide an example application where pattern recognition based on matching is crucial.	13	K3	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.	Questions	Marks	KL	CO
16.	a) Elucidate how images can be enhanced using techniques in both the spatial and frequency domains. Describe common methods like gray level transformations and histogram processing used in the spatial domain, as well as smoothing and sharpening filters. Explain how different frequency domain filters such as Ideal, Butterworth, and Gaussian filters work for image enhancement. Under what circumstances would spatial domain techniques be preferred over frequency domain methods in image processing?	15	K2	CO2
	(OR)			
	b) Discuss how different boundary representation techniques such as polygonal approximation and boundary signature impact the efficiency and accuracy of shape recognition in digital images. Compare the use of Fourier Descriptors and moments in boundary description and analyze their strengths and limitations. How do regional descriptors like topological features and texture complement boundary-based methods in enhancing pattern recognition accuracy?	15	K3	CO5