

THE KAVERY ENGINEERING COLLEGE*(An Autonomous Institution)***UG/PG DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL/MAY 2026***Fourth Semester**Electronics and Communication Engineering***UCT24403 - IMAGE PROCESSING***Regulations - 2024**Duration : 3 Hrs**Maximum : 100 Marks***PART - A (ANSWER ALL QUESTIONS) (Marks 10*2=20)**

<i>Q.No</i>	<i>Questions</i>	<i>BLT</i>	<i>CO</i>	<i>Marks</i>
1.	Define image sampling and quantization.	L1	1	2
2.	State the concept of color models and explain how the HSI model differs from the RGB model.	L2	1	2
3.	What are histogram processing techniques in the spatial domain?	L1	2	2
4.	Differentiate between smoothing and sharpening filters in the spatial domain and discuss at least one application.	L2	2	2
5.	List common noise models used in image restoration.	L1	3	2
6.	Consider an image degraded by uniform noise. If a mean filter with a 3 x 3 mask is applied to reduce the noise, calculate the number of operations required to filter a 512 x 512 image.	L3	3	2
7.	What is the basic principle behind region splitting and merging in image segmentation?	L1	4	2
8.	How do erosion and dilation improve the accuracy of segmented edges in binary images?	L1	4	2
9.	State the basics of Huffman coding in image compression.	L1	5	2
10.	Illustrate the run length coding with an example.	L2	5	2

PART - B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)

<i>Q.No</i>	<i>Questions</i>	<i>BLT</i>	<i>CO</i>	<i>Marks</i>
11.	a i Explain the components involved in a digital image processing system, and describe the function of each component in the image processing pipeline.	L2	1	8
	ii Analyze the process of image sampling and quantization. How do changes in sampling rate and quantization levels affect the quality of a digital image? Provide examples to support your analysis.	L4	1	8
	Or			
	b i Discuss the fundamentals of color image representation, specifically focusing on the RGB and HSI models. How do these models differ in representing color information?	L2	1	8
	ii Using DCT compute the $\psi(V)$ for the following image:	L4	1	8

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

12.	a	i	Explain the role of histogram processing in image enhancement. How does histogram equalization improve the contrast of an image?	L2	2	8
		ii	Apply a basic low-pass filter in the frequency domain to an image. Explain the steps involved and discuss the effect of this filter on the image's appearance.	L3	2	8
	Or					
	b	i	Describe the differences between smoothing and sharpening filters in spatial domain image processing. Provide examples of when each filter type would be appropriately applied.	L2	2	8
		ii	Using the Butterworth filter, design a frequency domain filter for image smoothing. Describe the parameters chosen and demonstrate how this filter reduces noise while preserving important image details.	L3	2	8
13.	a	i	Explain the concept of an image degradation model in the context of image restoration. What are some common causes of image degradation?	L2	3	8
		ii	A 512 x 512 image is degraded by Gaussian noise with a variance of 25. Apply the mean filter using a 5x5 mask and calculate the noise reduction in the output image.	L3	3	8
	Or					
	b	i	Discuss the properties of different noise models (such as Gaussian, salt-and-pepper, and Poisson noise) used in image restoration. How do these models affect the approach to noise reduction?	L2	3	8
		ii	Using Wiener filtering, restore an image degraded by Gaussian blur. Outline the steps and discuss how the Wiener filter helps in reducing blur while retaining important image details.	L3	3	8
14.	a	i	Describe edge detection and list some commonly used edge detection operators in image segmentation.	L2	4	8
		ii	Analyze the differences between thresholding-based segmentation and region-based segmentation techniques. Under what conditions would each technique be most effective?	L4	4	8
	Or					
	b	i	Describe the process of region growing in region-based segmentation. What are the basic criteria for selecting seed points in this approach?	L2	4	8
		ii	Given a binary image with noise, analyze the effect of morphological operations like erosion and dilation on the segmented regions. How do these operations improve the accuracy of segmentation?	L4	4	8
15.	a	i	Discuss the various stages involved in the JPEG compression standard.	L2	5	8
		ii	What are texture patterns in the context of image recognition? Briefly describe how texture patterns are used to classify images.	L2	5	8
	Or					
	b	i	state the differences between lossless and lossy compression techniques, such as Huffman coding and JPEG compression. In what scenarios would each technique be more suitable?	L2	5	8
		ii	Explain how boundary representation and regional descriptors aid in the recognition of image features.	L2	5	8