



**SIDDARTH INSTITUTE OF ENGINEERING AND TECHNOLOGY: PUTTUR
(AUTONOMOUS)**

Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (DESCRIPTIVE)

Subject with Code: DIGITAL IMAGE PROCESSING (23EC0433)

Course & Branch: B.Tech. – ECE Year & Sem: III-B.Tech.& II-Sem. Regulation: R23

**UNIT – I
INTRODUCTION
PART-A (2 MARKS)**

1	a	Define Pixel and Digital image?	[L1][CO1]	[2M]
	b	List out the applications of digital image processing?	[L1][CO1]	[2M]
	c	What are the classification of digital images and image types?	[L1][CO1]	[2M]
	d	Discuss the importance of phase in image transforms?	[L2][CO1]	[2M]
	e	Compare different image transforms.	[L2][CO1]	[2M]

PART-B (10 MARKS)

2	(a)	State the purpose of the image processing. Explain the fundamental steps in digital image processing which can be applied to images.	[L1][CO1]	[5M]
	(b)	Explain about the components of an image processing system with neat diagram?	[L2][CO1]	[5M]
3		Discuss the three principal sensor arrangements used to transform illumination energy into digital images.	[L2][CO1]	[10M]
4	(a)	Discuss the method of image sensing and acquisition along with suitable diagrams.	[L2][CO1]	[5M]
	(b)	Explain about image sampling and quantization process with proper steps.	[L2][CO1]	[5M]
5	(a)	Discuss the method for representation of a digital image.	[L2][CO1]	[5M]
	(b)	Calculate the number of bits required to store a digitized image if image sizes are 8×8, 32×32 for 8-bit pixel depth.	[L3][CO1]	[5M]
6	(a)	Explain about the basic pixel relationships and distance measures between pixels in a digital image.	[L2][CO1]	[5M]
	(b)	Let $V = \{1\}$, Compute the 4-adjacency, 8-adjacency and different paths between two pixels (1,1) and (3,3) for the center pixel in the given image. $A = \begin{matrix} & 1 & 4 & 7 \\ 2 & 1 & 1 & \\ 3 & 1 & 9 & \end{matrix}$	[L3][CO1]	[5M]
7	(a)	Summarize the following mathematical operations on digital images with relevant expressions and diagrams. a) Arithmetic operations b) Linear versus Nonlinear Operations c) Array & Matrix operations d) Set & Logical operations	[L2][CO1]	[5M]
	(b)	List out the properties of 2D – Discrete Fourier Transform. Prove the Separable and Periodicity property with suitable expressions.	[L1][CO1]	[5M]
8	(a)	Discuss the need of Image Transform and Define 1D and 2D – Discrete Fourier Transform with equations.	[L2][CO1]	[5M]
	(b)	Deduce the basis function of 2D – Discrete Fourier Transform for $N = 4$.	[L4][CO1]	[5M]
9	(a)	Deduce the basis matrix of Walsh Transform for $N = 4$.	[L4][CO1]	[5M]
	(b)	Evaluate Hadamard transform for the given image $f(x, y) = \begin{bmatrix} 1 & 0 \\ & \\ 0 & 1 \end{bmatrix}$	[L3][CO1]	[5M]

10	(a)	Compute Haar transform for the given image. $f(x, y) = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$	[L3][CO1]	[5M]
	(b)	Explain in brief about Hotelling (KL) and slant transform used in digital image processing.	[L2] [CO1]	[5M]
11	(a)	Compute 2D – Discrete Cosine Transform for the following image. $f(x, y) = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$	[L3][CO1]	[5M]
	(b)	Find the Singular Value Decomposition (SVD) of matrix $A = \begin{bmatrix} 3 & 1 \\ 1 & 3 \end{bmatrix}$	[L3][CO1]	[5M]

UNIT –II
INTENSITY TRANSFORMATIONS AND SPATIAL FILTERING
PART-A (2 MARKS)

1.	(a)	Define image enhancement?	[L1][CO2]	[2M]
	(b)	What are the drawbacks of histogram equalization?	[L1][CO2]	[2M]
	(c)	What is a spatial filter mask (kernel)?	[L1][CO2]	[2M]
	(d)	List the advantages of spatial domain filtering.	[L2][CO2]	[2M]
	(e)	Differentiate between smoothing and sharpening filters.	[L1][CO2]	[2M]

PART-B (10 MARKS)

2.	(a)	Explain the concepts of image negative and log transformation with suitable expressions.	[L2][CO2]	[5M]
	(b)	Describe power-law (gamma) transformation and discuss its effect on image contrast.	[L1][CO2]	[5M]
3.	(a)	Explain about Piecewise-linear transformation functions.	[L2][CO2]	[5M]
	(b)	Define histogram and draw the histogram for four basic image types.	[L2][CO2]	[5M]
4.		With suitable examples, Explain the histogram Processing and Histogram equalization.	[L2][CO2]	[10M]
5.	(a)	Explain the fundamentals of spatial filtering with the steps involved in applying a linear filter.	[L2][CO2]	[5M]
	(b)	Discuss about fundamental properties of convolution and correlation.	[L1][CO2]	[5M]
6.		Illustrate the smoothing spatial filters along with required expressions.	[L2][CO2]	[10M]
7.		Illustrate the sharpening spatial filters along with required expressions.	[L2][CO2]	[10M]
8.	(a)	Explain unsharp masking and high-boost filtering with a simple illustration.	[L2][CO2]	[5M]
	(b)	Describe the process of combining spatial enhancement methods for improved image quality.	[L2][CO2]	[5M]
9.	(a)	Compare and contrast spatial domain filtering and frequency domain filtering based on performance and applications.	[L4][CO2]	[5M]
	(b)	Explain the basics steps involved for filtering in frequency domain with neat diagram.	[L2][CO2]	[5M]
10.	(a)	Discuss the Image Smoothing techniques in the frequency domain.	[L2][CO2]	[5M]
	(b)	Discuss the Image sharpening techniques in the frequency domain.	[L2][CO2]	[5M]
11.	(a)	Summarize the steps involved in homomorphic filtering with a neat block diagram.	[L1][CO2]	[5M]
	(b)	Describe about selective filtering.	[L2][CO2]	[5M]

UNIT –III
IMAGE RESTORATION AND RECONSTRUCTION
PART-A (2 MARKS)

1.	(a)	Define Image restoration.	[L1][CO4]	[2M]
	(b)	Give the types of noise models.	[L1][CO4]	[2M]
	(c)	Draw the probability density function for Gaussian Noise.	[L1][CO4]	[2M]
	(d)	Give the expression of error measure and definition.	[L1][CO4]	[2M]
	(e)	What is the difference between restoration and enhancement?	[L1][CO4]	[2M]

PART-B (10 MARKS)

2.	(a)	Sketch a model of the image degradation and restoration process and give the brief explanation.	[L3][CO4]	[5M]
	(b)	Discuss the spatial and frequency properties of Noise.	[L2][CO4]	[5M]
3.		Explain the different noise models with clear expressions.	[L2][CO4]	[10M]
4.	(a)	Illustrate the different Mean filters for noise reduction capabilities of the spatial filters.	[L2][CO4]	[5M]
	(b)	Describe about Median filter and min and max filters with their equation.	[L2][CO4]	[5M]
5.	(a)	Give the detailed explanation of the mid-point filter with equation.	[L2][CO4]	[5M]
	(b)	Discuss briefly about the adaptive median filtering with algorithm.	[L1][CO4]	[5M]
6.		What is periodic noise in images? Explain the method of periodic noise reduction using frequency domain filtering.	[L2][CO4]	[10M]
7.	(a)	Determine the linear degradations in image restoration.	[L3][CO4]	[5M]
	(b)	Evaluate position invariant degradations in image restoration.	[L4][CO4]	[5M]
8.	(a)	Demonstrate the three principal ways to estimate the degradation function for use in image restoration.	[L2][CO4]	[5M]
	(b)	Derive the mathematical model from the basic principles to estimate the degradation.	[L3][CO4]	[5M]
9.	(a)	Compute the simplest approach inverse filtering for image restoration.	[L3][CO4]	[5M]
	(b)	Explain the use of Wiener filtering in Image restoration.	[L2][CO4]	[5M]
10.		Discuss about Constrained Least Square restoration of a digital image in detail	[L2][CO4]	[10M]
11.	(a)	Explain the Geometric Mean Filter used for image restoration. Discuss its advantages and limitations.	[L2][CO4]	[5M]
	(b)	Summarize the four generations of CT scanners for image reconstruction from projections.	[L2][CO5]	[5M]

UNIT-IV
IMAGE COMPRESSION
PART-A (2 MARKS)

1.	(a)	Define data redundancy in images.	[L1][CO6]	[2M]
	(b)	Discuss the different Image Formats	[L1][CO6]	[2M]
	(c)	Write short note on compression standards.	[L1][CO6]	[2M]
	(d)	Explain sub-band coding,	[L1][CO6]	[2M]
	(e)	What is the difference between 1D and 2D wavelet transforms?	[L1][CO6]	[2M]

PART-B (10 MARKS)

2.	(a)	Explain the Coding Redundancy with suitable example.	[L2] [CO6]	[5M]
	(b)	Explain the Spatial and Temporal Redundancy with suitable example.	[L2] [CO6]	[5M]
3.	(a)	Define Entropy and irrelevant information.	[L2] [CO6]	[5M]
	(b)	Explain the functional block diagram of a general image compression system	[L2] [CO6]	[5M]

4.	(a)	Explain the procedure for Huffman coding for image compression method.	[L2] [CO6]	[5M]												
	(b)	Consider an image strip of size 50×100 . The image consists of five vertical stripes. The gray levels of the stripes are 128, 64, 32, 16 and 8. The corresponding widths of the stripes are 35, 30, 20, 10 and 5 pixels respectively. If this stripe image coded is by Huffman coding, determine its efficiency.	[L3] [CO6]	[5M]												
5.	(a)	Describe Golomb coding in detail. Explain its encoding procedure and applications in image compression.	[L2] [CO6]	[5M]												
	(b)	Describe the working of the Lempel–Ziv–Welch (LZW) coding technique	[L2] [CO6]	[5M]												
6.		Explain the procedure for Arithmetic coding with suitable example.	[L2] [CO6]	[10M]												
7.	(a)	Explain the Run length coding with proper example.	[L2] [CO6]	[5M]												
	(b)	Compute the average length, compression and coding redundancy if the computer-generated image has the intensity distribution shown in table. If a natural 8-bit code is used to represent its 4 possible intensities.	[L4] [CO6]	[5M]												
		<table border="1"> <thead> <tr> <th>Intensities r_k</th> <th>Probabilities P_k</th> </tr> </thead> <tbody> <tr> <td>$r_{87}=87$</td> <td>0.25</td> </tr> <tr> <td>$r_{128}=128$</td> <td>0.47</td> </tr> <tr> <td>$r_{186}=186$</td> <td>0.25</td> </tr> <tr> <td>$r_{256}=256$</td> <td>0.03</td> </tr> <tr> <td>r_k for $k \neq 87, 128, 186, 256$</td> <td>0</td> </tr> </tbody> </table>	Intensities r_k	Probabilities P_k	$r_{87}=87$	0.25	$r_{128}=128$	0.47	$r_{186}=186$	0.25	$r_{256}=256$	0.03	r_k for $k \neq 87, 128, 186, 256$	0		
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8.	(a)	Differentiate lossy compression process and lossless compression process.	[L2] [CO6]	[5M]												
	(b)	Explain token-based coding technique. Discuss its advantages in image compression.	[L2] [CO6]	[5M]												
9.	(a)	Identify the coding technique which is based on the concept of decomposing a multilevel image into a series of binary images. Explain its working mechanism.	[L2] [CO6]	[5M]												
	(b)	Explain the principle of block transform coding used in image compression.	[L2] [CO6]	[5M]												
10.	(a)	Explain the principle of predictive coding used in image compression with block diagram for encoder and decoder.	[L2] [CO6]	[5M]												
	(b)	Explain Image Pyramids and their applications in image compression and image blending.	[L2] [CO6]	[5M]												
11.	(a)	Discuss the 1D Wavelet Transform and its extension to 2D Wavelet Transform for image processing. Explain the filtering and down sampling operations involved.	[L2] [CO6]	[5M]												
	(b)	Describe wavelet coding with a neat block diagram. Mention its advantages in image compression.	[L2] [CO6]	[5M]												

UNIT –V

IMAGE SEGMENTATION AND COLOR IMAGE PROCESSING

PART-A (2 MARKS)

1.	(a)	Define image segmentation	[L1][CO6]	[2M]
	(b)	Differentiate between region growing and region splitting.	[L1][CO6]	[2M]
	(c)	Define morphological erosion	[L1][CO6]	[2M]
	(d)	What are the three basic attributes of color?	[L1][CO6]	[2M]
	(e)	Why is color information useful in segmentation?	[L1][CO6]	[2M]

PART-B (10 MARKS)

2.	(a)	Discuss the fundamentals of image segmentation and explain the classification of segmentation techniques with examples.	[L2] [CO6]	[5M]
	(b)	Explain point detection techniques in image segmentation.	[L2] [CO6]	[5M]

3.	(a)	Explain line detection techniques in image segmentation.	[L2] [CO6]	[5M]
	(b)	Illustrate edge detection with necessary mathematical operators.	[L3] [CO6]	[5M]
4.		Describe thresholding techniques for image segmentation and explain the various methods of thresholding in detail.	[L2] [CO6]	[10M]
5.	(a)	Discuss region-based image segmentation techniques. Explain region growing and region splitting & merging.	[L2] [CO6]	[10M]
6.	(a)	Explain morphological image processing operations and algorithms in detail.	[L2] [CO6]	[5M]
	(b)	Explain erosion and dilation with mathematical expressions and examples.	[L2] [CO6]	[5M]
7.	(a)	Describe opening and closing operations. Explain their applications in noise removal and shape analysis.	[L2] [CO6]	[5M]
	(b)	Explain basic morphological algorithms for a) Boundary extraction b) Thinning	[L2] [CO6]	[5M]
8.	(a)	Explain gray-scale morphology and its importance.	[L2] [CO6]	[5M]
	(b)	Explain morphological watershed segmentation. Describe the algorithm and its applications.	[L2] [CO6]	[5M]
9.	(a)	Explain color image processing fundamentals. Discuss color models (RGB, CMY) and their applications.	[L2] [CO6]	[10M]
	(b)	Explain pseudo color image processing techniques.	[L2] [CO6]	[5M]
10.	(a)	Write short notes on basics of full color image processing	[L2] [CO6]	[5M]
	(b)	Explain noise in color images and its reduction.	[L2] [CO6]	[5M]
11.	(a)	Explain color image processing transformations	[L2] [CO6]	[5M]
	(b)	Explain color image compression and list its advantages.	[L2] [CO6]	[5M]