SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR
(AUTONOMOUS)
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QUESTION BANK (DESCRIPTIVE)

Subject with Code: **DIGITAL IMAGE PROCESSING (20EC0441)**

Course & Branch: B.Tech. – ECE **Year & Sem:** IV-B.Tech.& I-Sem. **Regulation:** R20

UNIT – I
INTRODUCTION TO DIGITAL IMAGE PROCESSING

1	a)	State the purpose of the image processing. List out the fundamental steps in digital image processing which can be applied to images.	[L1][CO1]	**[6M]**
	b)	Define image processing. Illustrate example fields of its usage.	[L2][CO1]	**[6M]**
2	a)	Discuss the three principal sensor arrangements used to transform illumination energy into digital images.	[L2][CO1]	**[6M]**
	b)	List out the applications of digital image processing.	[L1][CO1]	**[6M]**
3	a)	Discuss the method of image sensing and acquisition along with suitable diagrams.	[L2][CO1]	**[6M]**
	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]	**[6M]**
4	a)	Explain about image sampling and quantization process with proper steps.	[L2][CO1]	**[8M]**
	b)	Discuss the method for representation of a digital image.	[L2][CO1]	**[4M]**
5	a)	Discuss the classification of digital images and image types.	[L2][CO1]	**[6M]**
	b)	Explain the neighbors of a pixel with suitable example.	[L3][CO1]	**[6M]**
6	a)	Illustrate about the adjacency, connectivity, regions and boundaries.	[L2][CO1]	**[6M]**
	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. $A = \begin{bmatrix} 1 & 4 & 7 \\ 2 & 1 & 1 \\ 3 & 1 & 9 \end{bmatrix}$	[L3][CO1]	**[6M]**
7	a)	Discuss about the distance measures of a pixel with suitable example.	[L2][CO1]	**[6M]**
	b)	Demonstrate the Arithmetic operations on digital images with relevant expressions.	[L2][CO1]	**[6M]**
8	a)	List out the applications of image subtraction and image multiplication.	[L2][CO1]	**[6M]**
	b)	Explain the Linear versus Nonlinear operations on digital images with relevant equations.	[L2][CO1]	**[6M]**
9	a)	Compute the array product and matrix product for the following two images and comment the result. $A = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix}$	[L3][CO1]	**[6M]**
	b)	Explain the Array versus Matrix operations on digital images with relevant equations.	[L3][CO1]	**[6M]**
10	a)	Demonstrate the set operation and logical operations in digital image processing along with suitable example.	[L2][CO1]	**[6M]**

	b)	Compute the image addition, image subtraction and image multiplication operation for the following images. $f(x,y) = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ and $g(x,y) = \begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix}$	[L3][CO1]	**[6M]**

UNIT- II
IMAGE TRANSFORMS

1	a)	Discuss the need of image transforms.	[L2][CO2]	**[6M]**
	b)	Define 2D Orthogonal and Unitary transforms.	[L1][CO2]	**[6M]**
2	a)	Discuss the properties of Unitary transforms.	[L2][CO2]	**[6M]**
	b)	Define 1D and 2D – Discrete Fourier Transform with equations.	[L1][CO2]	**[6M]**
3	a)	Prove the Separable property of 2D – Discrete Fourier Transform.	[L3][CO2]	**[6M]**
	b)	Prove the Periodicity property of 2D – Discrete Fourier Transform.	[L3][CO2]	**[6M]**
4	a)	Deduce the basis function of 2D – Discrete Fourier Transform for N = 4.	[L4][CO2]	**[6M]**
	b)	Compute 2D – Discrete Fourier 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][CO2]	**[6M]**
5	a)	Define 2D – Discrete Cosine Transform with equations.	[L1][CO2]	**[4M]**
	b)	Deduce the Discrete Cosine Transform basis matrix for N = 4.	[L4][CO2]	**[8M]**
6	a)	List the applications of 2D-Discrete Cosine Transforms.	[L1][CO2]	**[4M]**
	b)	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][CO2]	**[8M]**
7	a)	Compute the image basis function of Hadamard Transform when N = 2.	[L3][CO2]	**[6M]**
	b)	Evaluate Hadamard transform for the given image $f(x,y) = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$	[L3][CO2]	**[6M]**
8	a)	Deduce the basis matrix of Walsh Transform for N = 4.	[L4][CO2]	**[6M]**
	b)	Calculate Walsh transform for the given image $f(x,y) = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$	[L3][CO2]	**[6M]**
9	a)	Define Haar transform and give the algorithm and flowchart to compute Haar basis.	[L1][CO2]	**[6M]**
	b)	Compute Haar transform for the given image. $f(x,y) = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$	[L3][CO2]	**[6M]**
10	a)	Compute the Haar basis for N=2.	[L3][CO2]	**[8M]**
	b)	Compare different Image Transforms.	[L2][CO2]	**[4M]**

UNIT- III
IMAGE ENHANCEMENT

1	a)	Define image enhancement and point operations in image enhancement?	[L1][CO3]	**[6M]**
	b)	Illustrate the contrast stretching in image enhancement with suitable example.	[L2][CO3]	**[6M]**
2	a)	Define negative image transformation and illustrate with suitable example.	[L1][CO3]	**[6M]**
	b)	Explain the Intensity level slicing operation and bit extraction operation in image enhancement with suitable example.	[L2][CO3]	**[6M]**
3	a)	Define histogram and draw the histogram four basic image types.	[L1][CO3]	**[6M]**
	b)	Explain the procedure for histogram process and uses of histogram.	[L2][CO3]	**[6M]**
4	a)	Discuss the mechanics of spatial filtering with suitable diagram.	[L2][CO3]	**[6M]**
	b)	Illustrate the smoothing spatial filters along with the required expressions.	[L2][CO3]	**[6M]**
5	a)	Illustrate the sharpening spatial filters along with the required expressions.	[L2][CO3]	**[6M]**
	b)	Define the image enhancement in frequency domain and give the expression.	[L1][CO3]	**[6M]**
6	a)	Discuss the smoothing filters in frequency domain along with the required expressions.	[L2][CO3]	**[6M]**
	b)	Explain the sharpening filters in frequency domain along with the required expressions.	[L2][CO3]	**[6M]**
7	a)	Define the following terms: Saturation, Hue and Brightness.	[L1][CO3]	**[6M]**
	b)	Draw the CIE chromaticity diagram and mention its significance.	[L1][CO3]	**[6M]**
8	a)	Define the following terms: Radiance, Luminance and Brightness.	[L1][CO3]	**[6M]**
	b)	Give the importance of the Color Models and explain the RGB models.	[L2][CO3]	**[6M]**
9	a)	Write brief notes on CMY and CMYK color models.	[L1][CO3]	**[6M]**
	b)	Explain the method of converting colors from RGB to HSI.	[L2][CO3]	**[6M]**
10	a)	Illustrate the method of converting colors from HSI to RGB.	[L2][CO3]	**[6M]**
	b)	Draw the functional block diagram of pseudo colour processing and explain each block.	[L1][CO3]	**[6M]**

UNIT- IV

IMAGE RESTORATION & IMAGE SEGMENTATION

1	a)	Draw the degradation/restoration model in image processing and describe the each part presented on it.	[L1][CO4]	**[6M]**
	b)	Differentiate the Image Enhancement and Image Restoration.	[L4][CO4]	**[6M]**
2	a)	Explain the Gaussian and Rayleigh noises with their PDF expressions.	[L2][CO4]	**[6M]**
	b)	Explain the Erlang and Exponential noises with their PDF expressions.	[L2][CO4]	**[6M]**
	a)	Explain the Uniform and Impulse noises with their PDF expressions.	[L1][CO4]	**[6M]**
3	b)	Explain the Normal and Gamma noises with their PDF expressions.	[L2][CO4]	**[6M]**
4	a)	Explain restoration in the presence of noise only using arithmetic and geometric mean filters.	[L2][CO4]	**[6M]**
	b)	Write the expression for Harmonic and contraharmonic mean filter and with their importance.	[L1][CO4]	**[6M]**
5	a)	Explain the method of inverse filtering for image restoration.	[L2][CO4]	**[6M]**
	b)	Give the advantages and disadvantages of the inverse filtering.	[L2][CO4]	**[6M]**
6	a)	Explain the method of the Least mean square filters for image restoration.	[L2][CO4]	**[6M]**
	b)	Discuss the method of constrained least square restoration for image restoration.	[L2][CO4]	**[6M]**
7	a)	Give the importance of image segmentation in image processing.	[L2][CO5]	**[6M]**
	b)	Explain the Region based Approach for image segmentation.	[L2][CO5]	**[6M]**
8	a)	Illustrate the Clustering techniques for image segmentation with example.	[L2][CO5]	**[6M]**
	b)	Discuss the basics of the intensity thresholding.	[L2][CO5]	**[6M]**
9	a)	List out the different types of thresholding.	[L1][CO5]	**[6M]**
	b)	Discuss the Edge detection with the help of the following operators: i) Gradient ii) Roberts iii) Prewitt iv) Sobel.	[L2][CO5]	**[6M]**
10	a)	Discuss the Laplacian operator in edge detection. Also mention its drawbacks.	[L2][CO5]	**[6M]**
	b)	Discuss the concept of Laplacian of Gaussian (LoG) operator for edge detection.	[L2][CO5]	**[6M]**

UNIT- V
IMAGE COMPRESSION

<table>
<tr><td></td><td>a)</td><td>Define the following terms :
Data, Information, Data Redundancy, Data compression and Compression Ratio.</td><td>[L1][CO6]</td><td>[6M]</td></tr>
<tr><td></td><td>b)</td><td>Explain the Coding Redundancy with suitable example.</td><td>[L2][CO6]</td><td>[6M]</td></tr>
<tr><td>1</td><td>a)</td><td>Explain the Spatial and Temporal Redundancy with suitable example.</td><td>[L2][CO6]</td><td>[6M]</td></tr>
<tr><td></td><td>b)</td><td>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.
<table>
<tr><th>Intensities r_k</th><th>Probabilities p_k</th></tr>
<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 $k\neq87,128,186,256$</td><td>0</td></tr>
</table></td><td>[L4][CO6]</td><td>[6M]</td></tr>
<tr><td>2</td><td>a)</td><td>Define Entropy and irrelevant information.</td><td>[L2][CO6]</td><td>[6M]</td></tr>
<tr><td></td><td>b)</td><td>Consider an image strip of size 50 $\times$ 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, 2 0, 10 and 5 pixels respectively. If this stripe image coded is by Huffman coding, determine its efficiency.</td><td>[L4][CO6]</td><td>[6M]</td></tr>
<tr><td>3</td><td>a)</td><td>Discuss the Objective fidelity criteria and subjective fidelity criteria with suitable example.</td><td>[L2][CO6]</td><td>[6M]</td></tr>
<tr><td></td><td>b)</td><td>Compare zero-memory source and Markov or finite memory source.</td><td>[L2][CO6]</td><td>[6M]</td></tr>
<tr><td>4</td><td>a)</td><td>Differentiate lossy compression process and lossless compression process.</td><td>[L2][CO6]</td><td>[6M]</td></tr>
<tr><td></td><td>b)</td><td>Explain the functional block diagram of a general image compression system with neat sketch.</td><td>[L2][CO6]</td><td>[6M]</td></tr>
<tr><td>5</td><td>a)</td><td>Explain the procedure for Huffman coding for image compression method.</td><td>[L2][CO6]</td><td>[6M]</td></tr>
<tr><td></td><td>b)</td><td>Justify Huffman coding is a uniquely decodable coding.</td><td>[L4][CO6]</td><td>[6M]</td></tr>
<tr><td>6</td><td>a)</td><td>For the image shown below, compute the degree of compression that can be achieved using Huffman coding of pixel values. Assume 2 bits to represent the pixel value.
$\begin{vmatrix} 3 & 3 & 3 & 2 \\ 2 & 3 & 3 & 3 \\ 3 & 2 & 2 & 2 \\ 2 & 1 & 1 & 0 \end{vmatrix}$</td><td>[L3][CO6]</td><td>[6M]</td></tr>
<tr><td></td><td>b)</td><td>Why Huffman coding is called as block code.</td><td>[L4][CO6]</td><td>[6M]</td></tr>
<tr><td>7</td><td>a)</td><td>Explain the procedure for Arithmetic coding with suitable example.</td><td>[L2][CO6]</td><td>[6M]</td></tr>
<tr><td></td><td>b)</td><td>Summarize the procedure of Bit plane coding with suitable example.</td><td>[L2][CO6]</td><td>[6M]</td></tr>
<tr><td>8</td><td>a)</td><td>Explain the Run length coding with proper example.</td><td>[L2][CO6]</td><td>[6M]</td></tr>
<tr><td></td><td>b)</td><td>Explain the functional block diagram of a transform coding technique.</td><td>[L2][CO6]</td><td>[6M]</td></tr>
<tr><td>9</td><td>a)</td><td>Compare the adaptive transform coding and non- adaptive transform coding.</td><td>[L2][CO6]</td><td>[6M]</td></tr>
<tr><td></td><td>b)</td><td>Discuss the different Image Formats and compression standards.</td><td>[L2][CO6]</td><td>[6M]</td></tr>
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