INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING

QUESTION BANK

Course Title	**IMAGE PROCESSING**				
Course Code	AECB57				
Program	B.Tech				
Semester	V	CSE			
Course Type	Open Elective-I				
Regulation	IARE - R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Ms M. Saritha, Assistant Professor				

COURSE OBJECTIVES:

The students will try to learn:

I	The fundamental concepts of digital image processing methods and techniques.
II	The image enhancement, image segmentation and compression techniques in spatial and frequency domains.
III	The algorithms to solve image processing problems to meet design specifications of various applications of image processing in industry, medicine and defense
IV	Fundamentals of image representation and processing in MATLAB

COURSE OUTCOMES:

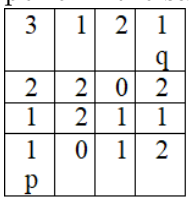
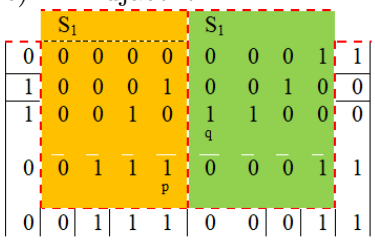
After successful completion of the course, students should be able to:

CO 1	**Outline** the principles and terminology of digital image processing for describing the features of image.	Understand
CO 2	**Design** systems using, 2D DFT transforms for image processing applications	Apply
CO 3	**Make use of** various image transform techniques like Walsh, Hadamard ,Slant, DCT and Haar transforms for analyzing images in transform domain.	Apply
CO 4	**Utilize** image processing techniques for image enhancement in spatial domain.	Apply

CO 5	**Identify** 2D convolution and filtering techniques for smoothening and sharpening of images.	Apply
CO 6	**Analyze** the histogram processing for improving the contrast of the image.	Analyze
CO 7	**Identify** spatial masks detection of discontinuities for segmentation of image.	Apply
CO 8	**Apply** region based image segmentation techniques for detection of objects in images.	Apply
CO 9	**Compare** lossy and lossless compression models for achieving image compression.	Analyze
CO 10	**Demonstrate** the source encoder and decoder techniques used for image compression.	Understand
CO 11	**Implement** standard image processing algorithms alone or as a member of a small group to meet design specifications.	Apply

QUESTION BANK:

MODULE I				
DIGITAL IMAGE FUNDAMENTALS				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
Q.No	**QUESTION**	**Taxonomy**	**How does this subsume the level**	**CO's**
1	Identify the relation among p and q in the given image segment and V={2,5} 1 2 p 3 2 4 5 q 2 3 5	Apply	This would require the learner to **recall** the concept of pixels and **understand** the relationship between pixels then **Apply** it on image to find the boundaries.	CO 1
2	Identify the distance between p and q in the given 2 p 3 2 6 1 6 2 3 6 2 5 3 2 3 5 2 4 3 5 2 4 5 2 3 6 q	Apply	This would require the learner to **recall** the concept of pixels and **understand** the relationship between pixels then **Apply** it on image to find distance from p to q.	CO 1

3	Consider the image segment shown in figure ii.a) Let V= 0, 1 and compute the lengths of the shortest 4-path, 8-path and m-path between pixels p and q. If any of the path not existed explain why?b) For V= 1, 2 perform the same.  	Apply	This would require the learner to **recall** the concept of pixels and **understand** the relationship between pixelsthen **Apply** it on image to find shortest path from p to q .	CO 1
4	Consider the two regions S1 and S2 shown in figure iii. V= 1. Determine whether these two regions are a) 4-Adjacent b) 8- Adjacent c) m- Adjacent  	Apply	This would require the learner to **recall** the concept of pixels and **understand** the relationship between pixels then **Apply** it on image to find adjacent pixels.	CO 1
5	Discuss about the following relationships between pixels with neat diagrams i) neighbors of pixels? i)connectivity iii)distance measures iv)path	Understand	This would require the learner to **recall** the relationship between pixels and **understand** the connectivity between pixels.	CO 1
6	Describe the functions of elements of digital image processing system with a diagram.	Understand	This would require the learner to **recall** the image processing concepts and **understand** the elements used in image processing	CO 1

7	Compare the linear and nonlinear operations of an digital image with suitable examples.	Analyze	This would require the learner to **recall** the fundamental concept of images and **understand** gray level concepts and **Apply** statistical measuresAnalyze for linear and non-linear operations.	
8	Explain when do you prefer non-uniform sampling and quantization? Justify	Understand	This would require the learner to **recall** the sampling and **understand** the non-uniform quantization	CO 1
9	Write the various distance measures used for image analysis?	Remember	—	CO 1
10	Explain the principle of sampling and quantization. Discuss the effect of increasing the a) Sampling frequency b) Quantization levels, on image	Understand	This would require the learner to **recall** the sampling and **understand** the quantization levels	CO 1
PART B-LONG ANSWER QUESTIONS				
1	Explain the steps involved in digital image processing with neat diagram	Understand	This would require the learner to **recall** the fundamentals of image processing and **understand** the steps involved in digital image processing.	CO1
2	Discuss about image sensing and acquisition process in detail	Understand	This would require the learner to **recall** the image coordinates and **understand** image sensing and acquisition process	CO1
3	Consider a digital image describe the steps involved converting continuous sensed data into digital form?	Understand	This would require the learner to **recall** the sampling and quantization techniques and **understand** the conversion of analog image in to digital image.	CO1

4	Write the basic relationships among the pixels in the image a) Neighbor of a pixel b)Adjacency	Understand	This would require the learner to **recall** the relationship between pixels and **understand** the Neighbor of pixels.	CO1
5	Illustrate the process of image sampling and quantization and discuss about gray-level resolution in image sampling.	Understand	This would require the learner to **recall** the sampling and quantization and **understand** the gray-levels of an image.	CO1
6	What are the elements required for visual perception and explain how image can be formed in human eye	Remember	—	CO1
7	Discuss about zooming and shrinking of digital images with examples	Understand	This would require the learner to **recall** the digital images and **understand** the zooming and shrinking of digital images	CO1
8	Define digital image. Discuss how digital images are represented with neat diagrams	Understand	This would require the learner to **recall** the representation of digital image and **understand** the processing of digital image.	CO1
9	List and explain applications of image processing	Remember	—	CO1
10	List different components present in image processing and explain each component in detail with diagram	Remember	—	CO1
11	What are the applications of ALU operations in image processing?	Remember	—	CO1
12	What is meant by perspective transform action? Derive the necessary relationships for perspective transformation.	Remember	—	CO1
13	What is meant by spatial resolutions? Discuss the effect on the image by reducing it.	Remember	—	CO 2

14	The image refers to a two dimensional light intensity function. Discuss in detail.	Understand	This would require the learner to **recall** the Gray levels and **understand** the Gray level to binary conversion	CO 2
15	State and Explain various methods of image acquisition	Understand	This would require the learner to **recall** the image acquisition and **understand** the various methods of image acquisition.	CO 2
16	Discuss the image acquisition using a single sensor, sensor strips and sensor arrays.	Understand	This would require the learner to **recall** the operation of sensor and **understand** the sensor strips and sensor arrays.	CO 2
17	Write short notes on imaging geometry	Remember	—	CO 2
18	Discuss the basic principle of imaging in different bands of electromagnetic spectrum.	Understand	This would require the learner to **recall** the operation of digital camera and **understand** the imaging geometry	CO 2
19	Show that the D4 distance between two points p and q is equal to the shortest 4-path between these points. Is this path unique?	Understand	This would require the learner to **recall** the relationship between pixels and **understand** the distance between two points.	CO 2
20	Explain frame buffer? Discuss the categories of digital storage for image processing applications.	Understand	This would require the learner to **recall** the frame buffer and **understand** the digital storage for images	CO 2
PART-C SHORT ANSWER QUESTIONS				
1	Define digital image processing	Remember	—	CO1
2	Write any two origins of image processing?	Remember	—	CO1
3	Mention different types of digital images	Remember	—	CO1
4	Mention different bands in electromagnetic spectrum	Remember	—	CO1
5	Which step is the objective of digital image processing	Remember	—	CO1

6	Explain the hardware components of an image processing	Understand	This would require the learner to **recall** the digital image and **understand** the components of an image processing	CO1
7	What is meant by Pixel?	Remember	—	CO1
8	What are the different fields in which Digital Image Processing is used?	Remember	—	CO1
9	What is the need of image processing?	Remember	—	CO1
10	Explain connectivity and path in relationship between pixels	Understand	This would require the learner to **recall** the digital image and **understand** the relationship between pixels	CO1
11	Discuss of N4,N8,ND	Understand	This would require the learner to **recall** the relationship between pixels and **understand** the image connectivity	CO1
12	Explain region and boundary in the image	Understand	This would require the learner to **recall** the image connectivity and **understand** the region and boundary of an image	CO1
13	Write the changes in sizes of different resolution images	Remember	—	CO1
14	What is meant by illumination and reflectance in image function?	Remember	—	CO1
15	What are the applications of image processing?	Remember	—	CO1
16	List the different components in a simple Image formation model	Remember	—	CO1
17	Explain about sampling role in digitization process	Understand	This would require the learner to **recall** the sampling theorem and **understand** the digitization process	CO1

18	Explain about quantization in digitization process	Understand	This would requirethe learner to **recall** the sampling and quantization techniques and **understand** the digitizing amplitude values	CO1
19	List the basic steps involved in image processing	Remember	—	CO1
20	Define distance measure and Give the different distance measures	Remember	—	CO1
MODULE II				
IMAGE TRANSFORMS				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	Analyze the Haar transformation matrix for N = 2.	Analyze	This would require the learner to **recall** the representation of digital image and **Understand** the properties of 2D FT and **Apply** haar transformation and Analyze the matrix for N=8 .	CO 3
2	Calculate the number of multiplications required to convolve a 2D filter with a 2D image (a)Compute the 2D convolution at a stretch. (b) Perform the 2D convolution as two 1D convolutions. Assume the image is of size 100 × 100 pixels, and the filter is of size 10 × 10.	Apply	This would require the learner to **recall** the representation of digital image and **Understand** the properties of 2D FT and **Apply** the convolution property on image.	CO 2
3	Construct Walsh transform basis for N=8.	Apply	This would require the learner to **recall** the representation of digital image and **Understand** the properties of 2D FT and **Apply** Walsh transform basis for N=8.	CO 3

4	The discrete Fourier transformperformed for the image f(m, n) is given below. What will be the value of F(0, 0)? $f[m,n]=\begin{bmatrix}0&1&2&1&4\\4&1&4&5&6\\1&2&1&0&4\\5&4&1&3&5\\4&2&4&5&6\end{bmatrix}$	Apply	This would require the learner to **recall** the representation of digital image and **Understand** the properties of 2D DFT and **Apply** it ongrayscale image f(x, y)	CO 2
5	Design the slant transforms matrix For N=4.	Apply	This would require the learner to **recall** the representation of digital image and **Understand** the properties of 2D FT and **Apply** slant transforms matrix For N=4.	CO 3
6	Compute the 2D Haar transform of the signal $\mathbf{f(m,n)}=\begin{vmatrix}4&-1\\2&3\end{vmatrix}$	Apply	This would require the learner to **recall** the representation of digital image and **Understand** the properties of 2D DFT and **Apply** it ontransform coefficients F (k, l).	CO 3
7	Compute the Hadamard transform matrix of the sizes N=8	Apply	This would require the learner to **recall** the representation of digital image and **Understand** the properties of 2D DFT and **Apply** Haar transform of the 2 x 2 image	CO 3
8	Find the 1D DCT basis for the system N = 2.	Apply	This would require the learner to **recall** the representation of digital image and **Understand** the properties of 2D DFT and **Apply** 1D Walsh basis for the fourth-order system.	CO 3

9	Compute the 2D DFT of the 4 × 4 grayscale image given below. $F[m,n]=\begin{vmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{vmatrix}$	Apply	This would require the learner to **recall** the representation of digital image and **Understand** the properties of 2D DFT and **Apply** 4 × 4 grayscale image	CO 3
10	Distinguish between various image transforms.	Understand	This would require the learner to **recall** the different transformation techniques and **Understand** the it's kernals.	CO 3
PART B-LONG ANSWER QUESTIONS				
1	Write few applications of 2D convolution in the field of image processing.	Remember	—	CO 2
2	Explain the forward and inverse transformation kernels' of image transforms	Understand	This would require the learner to **recall** the transformation kernals and **Understand** the forward and inverse transformation kernels' of image transforms	CO 3
3	State and prove separability property of 2D-FFT	Remember	—	CO 2
4	State and prove the translation property. Write the expressions for Walsh transforms kernel (1D &2D)?	Remember	—	CO 3
5	Extend the Walsh transform forward and reverse kernels.	Understand	This would require the learner to **recall** the fourier transform and **Understand** the Walsh transform forward and reverse kernels.	CO 3

6	Recall the need for transform? Specify the properties of 2D Fourier transform.	Remember	—	CO 2
7	State and prove distributivity and scaling property.	Remember	—	CO 2
8	How digital images can be represented? What is Image Transform?	Remember	—	CO 2
9	Explain about the discrete cosine transform and write its applications.	Understand	This would require the learner to **recall** the properties of 2D transform and **Understand** discrete cosine transform	CO 3
10	Explain about intensity transformation functions.	Understand	This would require the learner to **recall** the properties of 2D transform and **Understand** theintensity transformation functions.	CO 2
11	Summarize the elements of visual perception and define Haar transform.	Understand	This would require the learner to **recall** the properties of 2D transform and **Understand** theHaar transform	CO 3
12	State and prove conjugate symmetry and orthoganality property of 2D DFT.	Understand	This would require the learner to **recall** the Fourier transform properties and **Understand** to symmetry and orthoganality property of 2D DFT	CO 2
13	Distinguish the forward and inverse transformation kernals of image transforms	Understand	This would require the learner to **recall** and understand the transformation process and **Understand** the software and hardware requirements	CO 3
14	Explain about KL Transform and Write its properties.	Understand	This would require the learner to recall the Fourier transform and **Understand** the KL transform with properties.	CO 3

15	What is Hadamard transform? Explain in detail and Write its properties.	Understand	This would require the learner to **recall** the analog to digital conversion and **Understand** the Sampling and Quantization process	CO 3
16	Explain the following two properties of 2D-DFT: i) Convolution ii) Correlation	Understand	This would require the learner to recall the fourier transform and **Understand** the transformation methods	CO 2
17	Explain about Haar transform with algorithms, What are the properties of Haar transform. State and prove separability property of 2D-FFT.	Understand	This would require the learner to **recall** the Fourier transform and **Understand** the algorithm and properties ofHaar transform.	CO 3
18	List the properties of Walsh transform, Write about Walsh transform. State distributivity and scaling property	Remember	—	CO 3
19	Explain the need of image transform? List out various transform used in image processing.	Understand	This would require the learner to **recall** the Properties of image transformand **Understand** the various transforms	CO 2
20	Explain the following mathematical operations on digital images i) Array versus Matrix operations ii) Linear versus Nonlinear Operations	Understand	This would require the learner to **recall** the mathematical operations of an image and **Understand** the linear andmatrix operations	CO 3

PART-C SHORT ANSWER QUESTIONS				
1	What is the necessity of imagev transformation	Remember	—	CO 2
2	List out the properties of 2D FFT	Remember	—	CO 2
3	Develop the Slant transform(1-D &2-D)	Remember	—	CO 3
4	Distinguish between Walsh and haar transform	Understand	This would require the learner to **recall** the image transform techniques and **Explain** the differences between Walsh and Haar.	CO 3
5	Write the advantages of image transformation	Remember	—	CO 2
6	Write short notes on convolution property.	Remember	—	CO 2
7	Write short notes on separability property.	Remember	—	CO 2
8	Relate the linear and circular convolution.	Remember	—	CO 2
9	Classify the Fourier Transform and its inverse.	Understand	This would require the learner to **recall** the concepts of fourier transform and **Understand** algorithms in the transform and inverse transform techniques.	CO 2
10	List what are the properties of Hotelling transform?	Remember	—	CO 3
11	Recall the distributive and scaling property.	Remember	—	CO 2
12	What is the basic principle of Hotellingtransform.	Remember	—	CO 3
13	Illustrate the Slant transform with example.	Understand	This would require the learner to **recall** FT and **Understand** the transformation properties	CO 2
14	List the properties of Slant transform?	Remember	—	CO 3
15	What is Hadamard transform relate with one example.	Remember	—	CO 3

16	Summarize the discrete cosine transform with example.	Understand	This would require the learner to **recall** the fast Fourier transform and **Understand** transformation method.	CO 3
17	What are the properties of Hadamard transform?	Remember	—	CO 3
18	Relate the discrete Fourier transform and its inverse.	Remember	—	CO 3
19	Write short notes on slant transform.	Remember	—	CO 3
20	What is the need of transform for digital Image processing?	Remember	—	CO 3
MODULE III				
IMAGE ENHANCEMENT				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	What is the objective of image enhancement and explain the point processing process. (i) Digital Negative of image/Negation, (ii) Bit plane Slicing by using concept on Image Enhancement in Spatial domain	Apply	This would require the learner to **recall** the properties of arrays and matrix and **relate** in neighborhood process and **Apply** in given parameter.	CO 4
2	What is the value of the marked pixel after a 5×5 median filter? $\begin{bmatrix} 2 & 1 & 3 & 4 & 5 \\ 1 & 1 & 0 & 2 & 3 \\ 2 & 0 & \textcircled{0} & 1 & 2 \\ 5 & 1 & 2 & 3 & 1 \\ 4 & 3 & 1 & 2 & 0 \end{bmatrix}$	Apply	This would require the learner to **recall** the properties of arrays and matrix and **relate** in neighborhood process and **Apply** in given parameter.	CO 4

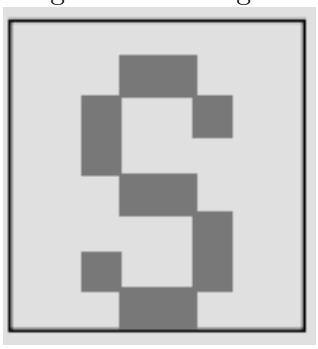
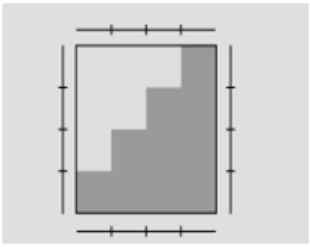
3	Given an image size 3x3 as f(m,n)= $\begin{vmatrix} 128 & 212 & 255 \\ 52 & 62 & 124 \\ 140 & 152 & 156 \end{vmatrix}$ Determine the output image g(m,n) uisng logorthamic transformation g(m,n)=[Clog10(1+f(m,n))] by choosing C as (i) c=1 and (ii)C= L/ log10(1+L)	Apply	This would require the learner to **recall** the properties of arrays and matrix and **relate** transformation process and **Apply** in logorthamic transformation.	CO 5
4	Explain in detail the method for smoothening the image in frequency domain	Understand	This would require the learner to **recall** low pass and high pass filters and **Understand** the smoothening the image in frequency domain	CO 5
5	Explain in detail linear spatial smoothing filters	Understand	This would require the learner to **recall** low pass and high pass filters and **Understand** the linear spatial smoothing filters.	CO 5
CIE-II				
6	Classify the 2-D IHPF, BHPF and GHPF with sketches. Explain their useful ness in image enhancement.	Understand	This would require the learner to **recall** low pass band high pass filters and **relate** in image processing for image enhancement	CO 5
7	What is the value of centre pixel if it is smoothened by a 3x3 box filter. $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 4 & 3 \end{bmatrix}$ 3x3 box filter $\longrightarrow$ $\begin{bmatrix} ? \end{bmatrix}$	Understand	This would require the learner to **recall** low pass band high pass filters and **relate** in image processing for image enhancement	CO 5

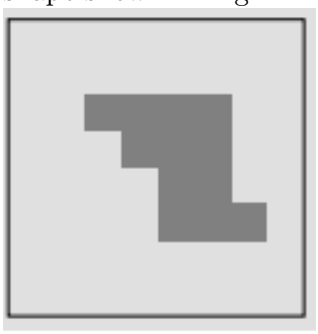
8	What is the value of the marked pixel after a 5 × 5 median filter? $\begin{vmatrix} 2 & 1 & 3 & 4 & 5 \\ 1 & 1 & 0 & 2 & 3 \\ 2 & 0 & \underline{0} & 1 & 2 \\ 5 & 1 & 2 & 3 & 1 \\ 4 & 3 & 1 & 2 & 0 \end{vmatrix}$	Understand	This would require the learner to **recall** low pass band high pass filters and **relate** in image processing for image enhancement	CO 5
9	Illustrate the with the help of block diagram of homomorphic filtering.	Understand	This would require the Learner to **recall** low pass filter in frequency domain and **Understand** the homomorphic filtering.	CO 5
10	Write image processing programs using point processing method 1. Obtain Negative image. 2. Thresholding 3. Contrast stretching	Understand	This would require the learner to **recall** the image processing programs **relate** point processing method.	CO 4
PART-B LONG ANSWER QUESTIONS				
1	Explain in detail about histogram processing.	Understand	This would require the learner to **recall** the operation of pixels and gray levels and **Understand** the Histogram processing.	CO 6
2	Elaborate on homomorphic Filtering	Understand	This would require the learner to **recall** filtering techniques and **Understand** the homomorphic Filtering	CO 5
3	Describe in detail about various types of mean filters	Understand	This would require the learner to **recall** filter functions and **Understand** the various types of mean filters.	CO 5
4	Demonstrate how do you enhance monochrome image by Histogram	Understand	This would require the learner to **recall** the monochrome technique and **Understand** the monochrome image by Histogram	CO 6

5	What is Histogram Equalization ?Discuss in detail about the procedure involved in Histogram matching	Understand	This would require the learner to **recall** the operation of pixels and gray levels and **Understand** the Histogram Equalization and matching.	CO 6
6	Describe how homomorphic filtering is used to separate illumination and reflectance component?	Understand	This would require the learner to **recall** the homomorphic filtering and U**Understand** the separate illumination and reflectance component.	CO 5
7	How mean filters are used for image enhancement?.	Understand	This would require the learner to **recall** the filtering operation and **Understand** the Mean filters used in image enhancement	CO 5
8	Explain the various ofgray level transformation used for image enhancement.	Understand	This would require the learner to **recall** the operation of pixels and gray levels **Understand** the gray level transformation for image enhancement	CO 5
9	Briefly discuss about the histogram equalization and histogram specification Techniques	Understand	This would require the learner to **recall** the operation of pixels and gray levels and **Understand** the Histogram Equalization and matching.	CO 6
10	Describe in detail about low pass and high pass Butterworth filters	Understand	This would require the learner to **recall** low pass and high pass filters and **Understand** the Butterworth filter	CO 5
CIE-II				
11	What are the salient features of image histogram	Remember	—	CO 5
12	Discuss the following spatial enhancement techniques. (i) Spatial averaging. (ii)Median filtering.	Understand	This would require the learner to **recall** the spatial filters and **Understand** the enhancement techniques.	CO 5

13	list the various image enhancement techniques in the frequency domain	Remember	—-	CO 5
14	Explain in detail linear spatial smoothing filters	Understand	This would require the learner to **recall** the spatial filters and **Understand** the linear spatial smoothing filters.	CO 4
15	Explain in detail the method for smoothening the image in frequency domain	Understand	This would require the learner to **recall** the spatial filters and **Understand** the method in frequency domain	CO 5
16	Explain about noise reduction in an image using band reject and band pass filters.	Understand	This would require the learner to **recall** concept of noise reduction in an image and **Understand** the band reject and band pass filters..	CO 5
17	List the types of Image enhancement technique in spatial domain and differentiate them.	Remember	———	CO 5
18	Discuss the role of gradient and laplacian operator in image enhancement.	Understand	This would require the learner to **recall** operation of pixels and gray level and **Understand** the concept of Gradient and the Laplacian.	CO 5
19	Sketch perspective plot of an 2 -D Ideal Low pass filter transfer function and filter cross section and explain its usefulness in Image enhancement.	Understand	This would require thelearner to **recall** FT and prepare algorithms and **Understand** in point processing for image enhancement.	CO 5
20	Explain the following operations: i) Contrast stretching ii) Bit-plane slicing	Understand	This would require the learner to **recall** filtering techniques and **Understand** the concept of bit-plane slicing and Contrast stretching.	CO 5
PART-C SHORT ANSWER QUESTIONS				
1	Specify theobjectiveofim-ageenhancementtechnique	Remember	—	CO 4
2	Explain the 2 categories of image enhancement	Remember	—	CO 4
3	What is point Processing?	Remember	—	CO 4

4	What is mask processing?	Remember	—	CO 4
5	What is contrast stretching?	Remember	—	CO 4
6	What is thresholding?	Remember	—	CO 4
7	Explain grey level slicing?	Understand	This would require the learner to **recall** gray levels of an image and understand the gray level slicing	CO 4
8	What is image averaging? Give its application	Remember	—	CO 5
9	Explain the purpose of image averaging?	Understand	This would require the learner to **recall** filter operation and **Understand** the image averaging.	CO 5
10	Give the formula for negative and log transformation	Remember	—	CO 5
CIE-II				
11	What is meant by bit plane slicing?	Remember	—	CO 5
12	Define histogram	Remember	—	CO 6
13	What is Image Negative?	Remember	—	CO 5
14	Define first order derivative filter	Remember	—	CO 5
15	what is spatial filtering?	Remember	—	CO 5
16	Recall the median filter?	Remember	—	CO 4
17	What is a smoothing filter?	Remember	—	CO 4
18	What is a sharpening filter?	Remember	—	CO 4
19	What is unsharp masking?	Remember	—	CO 4
20	What is high boost filtering?	Remember	—	CO 4

MODULE IV				
IMAGE SEGMENTATION				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	Apply the split-and-merge technique for the given image shown in Fig 	Understand	This would require the learner to**recall** the image into segments of its constituents and **Understand** the CNNs for semantic segmentation.	CO 7
2	Apply split and merge techniques to segment the image. 	Apply	This would require thelearner to **recall** the image into segments of its constituents and **Understand** the information contained and **Apply** the split and merge techniques to segment the image	CO 8
3	Show that a two dimensional Gaussian is separable while the laplacian of Gaussian operator (LOG) is not seperable.	Understand	This would require thelearner to **recall** separable property and **Understand** the laplacian of Gaussian operator.	CO 7
4	What is the best segmentation algorithm for segmenting of leaf region from the real field images	Understand	This would require the learner to **recall** segment of an image and **Understand** the leaf region from the real field images.	CO 8
5	Distinguish between local and global thresholding techniques for image segmentation	Understand	This would require the learner to **recall** the image into segments of its constituents and **Understand** the Half transformfor edge linking	CO 7

6	Segment the given arbitrary shape shown in Fig 	Understand	This would require the learner to **recall** the image into segments of its constituents and **Understand** global thresholding techniques miss morphing and merging based on segmentation	CO 8
7	Illustrate the extract single object from overlapping objects?	Understand	This would require the learner to **recall** binary image representation and **Understand** the Single object from overlapping objects.	CO 7
8	Consider the image segment 128 128 128 64 64 32 32 8 64 64 128 128 128 8 32 32 32 8 64 128 128 64 64 64 8 128 128 64 64 8 64 64 128 64 64 64 128 128 8 8 64 64 64 128 128 128 32 32 8 128 32 64 64 128 128 128 8 8 64 64 128 128 64 64 Based on the histogram, segment the image into two regions.	Understand	This would require the learner to **recall** the image into segments of its constituents and **Understand** k-means segmentation	CO 8
9	Explain the basics of intensity thresholding in image segmentation	Apply	This would require the learner to **recall** the FT and properties of arrays and matrix compute and **Understand** the understand for image representation and **Apply**in to 1-D transformation.	CO 7

10	Give one representation scheme for the boundary of an object and describe how it can be Computed	Apply	This would require the learner to **recall** the image into segments of its constituents and **Understand** to separate the information contained in the image margin and **Apply** boundary of an object	CO 8
PART B-LONG ANSWER QUESTIONS				
1	What are the derivative operators useful in image segmentation? Explain their role in segmentation.	Understand	This would require the learner to **recall** the image into segments of its constituents and **Understand** smaller entities for region based segmentation.	CO 8
2	Explain about the edge linking procedures.	Understand	This would require the learner to **recall** the image into segments of its constituents and **Understand** smaller entities for Edge linking based segmentation.	CO 8
3	What is thresholding and explain about global thresholding.	Understand	This would require the learner to **recall** the image into segments of its constituents and **Understand** smaller entities for global thresholding.segmentation.	CO 8
4	Explain about region based segmentation.	Understand	This would require the learner to **recall** the image into segments of its constituents and **Understand** smaller entities for region based segmentation.	CO 8
5	Write the example of discontinuity approach in image segmentation processes.	Understand	This would require the learner to **recall** the image into segments of its constituents and **Understand** smaller entities for region based segmentation.	CO 8

6	First derivative approximation says that values of intensities at the onset must be nonzero Justify	Understand	This would require the learner to **recall** the image into segments of its constituents and **Understand** the closing operation in image morphology segmentation.	CO 7
7	Write the mask for prewitt operator in image segmentation Explain in details?	Remember	—	CO 7
8	Write the mask for sobel operator in image segmentation. Explain in details?	Remember	—	CO 7
9	Write the mask for Robert operator in image segmentation. Explain in details?	Remember	—	CO 7
10	Write the mask for laplacian operator in image segmentation. Explain in details?	Understand	This would require the learner to recall the image into segments and **Understand** in to morphing for dilation and erosion.	CO 7
11	Define image segmentation. Give classification. Explain region based Segmentation.	Understand	This would require the learner to **recall** the image into segments and **Understand** theregion based Segmentation.	CO 7
12	Compare the Roberts, Prewitt and Sobel edge detectors.	Understand	This would require the learner to **recall** the image into segments and **Understand** the boundary characteristics	CO 7
13	Explain the detection of isolated points in an image.	Understand	This would require the learner to **recall** the image into segments and **Understand** the image segmentation	CO 8

14	Give the linear filter masks for the following operations i)+45 degrees ii) -45 degrees	Understand	This would require the learner to **recall** the image into segments and **Understand** the Hough Transform for edge linking image segmentation	CO 8
15	Explain about the Global processing via graph-theoretic techniques for edge linking	Understand	This would require the learner to **recall** the image into segments and **Understand** the edge linking in image segmentation	CO 8
16	Demonstrate about Region Splitting and Merging with an example	Understand	This would require the learner to **recall** the image into segments of its constituents and **Understand** smaller entities for region splitting and merging based on segmentation.	CO 8
17	Give the linear filter masks for the Detecting horizontal lines	Understand	This would require the Learner to **recall** the image into segments and **Understand** the of Hit-or-Miss morphological transformation	CO 8
18	Explain edge linking using Hough transform.	Understand	This would require the Learner to **recall** the image into segments and **Understand** in to morphing image processing	CO 8
19	Explain the significance of thresholding in image segmentation.	Understand	This would require the Learner to **recall** the image into segments and **Understand** in to morphing for dilation and erosion of image processing.	CO 8
20	Give the linear filter masks for the Detecting vertical edges	Understand	This would require the Learner to **recall** the image into segments and **Understand** the of Hit-or-Miss morphological transformation	CO 8

PART C-SHORT ANSEWR QUESTIONS				
1	Specify the objective of image enhancement technique	Remember	—	CO 4
2	Write the applications of segmentation	Remember	—	CO 7
3	What are the three types of discontinuity in digital image?	Remember	—	CO 7
4	How the derivatives are obtained in edg edetection during formulation?	Remember	—	CO 7
5	What are the two properties used for establishing similarity of edge pixels?	Remember	—	CO 7
6	Give the properties of the second derivative around an edge?	Remember	—	CO 7
7	Define gradient operator?	Remember	—	CO 7
8	What is meant by zero crossing property of second order derivative?	Remember	—	CO 8
9	What are the disadvantages of Laplacian operator?	Remember	—	CO 8
10	What are the various techniques that can be used for edge linking?	Remember	—	CO 8
11	Explain a Simple edge model	Remember	—	CO 11
12	Label why edge detection is a non-trivial task	Remember	—	CO 9
13	What is object point and background point?	Remember	—	CO 8
14	Whatis thresholding? What are its types?	Remember	—	CO 8
15	What is Global Thresholding?	Remember	—	CO 8
16	What is variable Thresholding?	Remember	—	CO 8
17	What are the disadvantages of thresholding?	Remember	—	CO 8
18	Define regiongrowing?	Remember	—	CO 8

19	Specify thesteps involved in splitting	Understand	This would require the learner to **recall** the image into segments and **relate** in to smaller entities for image segmentation	CO 8
20	Specify thesteps involved in merging	Remember	—	CO 8
MODULE V				
IMAGE COMPRESSION				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1. .	Determine the Huffman code for the following data. SYMBOL PROBABILITY a1 0.1 a2 0.4 a3 0.06 a4 0.1 a5 0.04 a6 0.3 .	Analyze .	This would require the learner to **recall** compression technique **Understand** the encoding process then **Apply** Huffman code procedure and **Analyze** fallowing symbol and probability values. .	CO 10
2. .	A source emits letters from an alphabet A=a1,a2,a3,a4,a5 with probabilities P(a1)=0.2, P(a2) = 0.4 , P(a3) = 0.2 , P(a4) = 0.1 and P(a5) = 0.1.Find Huffman code for this source? Find the average length of the code and its redundancy .	Analyze .	This would require the learner to **recall** compression technique **Understand** the encoding process then **apply** Huffman code for given source and **Analyze** average length of the code and its redundancy .	CO 10
3. .	For the image shown below compute the compression ratio that can be achieved using Huffman coding. $\begin{bmatrix} 3 & 3 & 3 & 2 \\ 2 & 3 & 3 & 3 \\ 3 & 2 & 2 & 2 \\ 2 & 1 & 1 & 0 \end{bmatrix}$.	Apply .	This would require the learner to **recall** compression technique **Understand**the encoding process then **apply** Huffman code for given image. .	CO 10

4. .	A source emits three symbols A,B,C with a probability0.5,0.25,0.25 respectively. Construct an arithmetic code to encode the word 'C A B' .	Understand .	This would require the learner to **recall** the encoding techniques and **Understand** the arithmetic code to encode the word 'C A B' .	CO 10
5. .	Encode the word a1,a2,a3,a4 using arithmetic coding and find tag for the given probabilities.a1=0.2, a2= 0.2,a3=0.4, a4=0.2 .	Apply .	This would require the learner to **recall** the codeword and **Understand** the procedure for Huffman coding and **apply** it to find the word length and code length .	CO 10
6. .	Calculate the Huffman code for the following symbol whose probability of occurrenceis given below Symbol | Probability a1 | 0.9 a2 | 0.06 a3 | 0.02 a4 | 0.02 .	Apply .	This would require the learner to **recall** the code efficiency and **Understand** the intensity distribution and**apply** Huffman algorithm .	CO 10
7. .	A source emits letters from asn alphabet A=a1,a2,a3,a4,a5 with probabilities P(a1)=0.3, P(a2) = 0.4 , P(a3) = 0.15 , P(a4) = 0.05 and P(a5) = 0.1.Find Huffman code for this source? Find the average length of the code and its redundancy .	Apply .	This would require the learner to **recall** the codeword and **Understand** the procedure for Huffman coding and **apply** it to find the average length of the code and its redundancy .	CO 10
8. .	Obtain the Huffman code for the word 'COMMITTEE' .	Understand .	This would require the learner to **recall** the encoding techniques and **Understand** the Huffman coding for source symbols and probabilities .	CO 10

9. .	For the image shown below, compute the degree of compression that can be achieved using Huffman coding of pixel values.Assuming 2 bits to represent the pixel value. $\begin{pmatrix} 3 & 3 & 3 & 2 \\ 2 & 3 & 3 & 3 \\ 3 & 2 & 2 & 2 \\ 2 & 1 & 1 & 0 \end{pmatrix}$.	Understand .	This would require the learner to **recall** the encoding techniques and **Understand** the Huffman coding forsource symbols and probabilities .	CO 10
10 .	For the image shown below, compute the degree of compression that can be achieved using run-length coding, assuming 2 bits to represent the run length. $\begin{pmatrix} 3 & 3 & 3 & 2 \\ 2 & 3 & 3 & 3 \\ 3 & 2 & 2 & 2 \\ 2 & 1 & 1 & 0 \end{pmatrix}$.	Understand .	This would require the learner to **recall** the compression technique and **Understand** the JPEG is better than a Raw free. .	CO10

PART B-LONG ANSWER QUESTIONS				
1	Differentiate lossless and lossy compression	Understand	This would require the learner to **recall** the techniques and **Understand** the redundancies in a digital image	CO 10
2	Explain the run length encoding for achieving image compression	Understand	This would require the learner to **recall** the techniques and **Understand** the compression models in digital image	CO 10
3	Explain the need for image compression .How run length encoding approach is used for compression? Is it Lossy? Justify	Understand	This would require the learner to **recall** the need for image compression and **Understand** therun length encoding	CO 10
4	Elaborate the Arithmetic Coding for image compression	Understand	This would require the learner to **recall** the need for image compression and **Understand** theArithmetic Coding.	CO 10
5	Is Huffman code uniquely decodable? If so , Justify your answer	Understand	This would require the learner to **recall** average length of the code and **Understand** Huffman code.	CO 10
6	How an image is compressed using JPEG image compression standard?	Understand	This would require the learner to**recall** the compression standard and **Understand** the JPEG image.	CO 10
7 .	Explain in detail about predictive coding .	Understand .	This would require the learner to **recall** the compression techniques and **Understand** the arithmetic coding in a digital image .	CO 10
8 .	Describe variable length encoding with examples .	Understand .	This would require the learner to**recall** the compression techniques and **Understand** therun length encoding in a digital image .	CO 10

9 .	What is mean by bit plane slicing and write the applications of it .	Understand .	This would require the learner to**recall** the image to take number of bits and **Understand** bit plane slicing .	CO 10
10 .	List out and explain in detail about the image compression .	Remember .	— .	CO 10
11 .	Relate the JPEG compression standard and the steps involved in JPEG compression .	Remember .	— .	CO 10
12 .	Which type of method to generating variable length codes with an example? .	Understand .	This would require the learner to **recall** the compression techniques and **Understand** thevariable length encoding in a digital image .	CO 10
13 .	Show Huffman process with an example. .	Understand .	This would require the learner to **recall** the FT and prepare algorithms and **Understand** the arithmetic encoding .	CO 10
14 .	Why LZW coding and what is the need for image relate with an example. .	Understand .	This would require the learner to **recall** the compression techniques and **Understand** theLZW coding compression in a digital image .	CO 10
15 .	Explain the need for image compression. .	Remember .	— .	CO 10
16 .	Select and match the Redundancies and their removal methods with examples .	Understand .	This would require the learner to **recall** the compression techniques and **Understand** theremoval methods in a digital image .	CO 10
17 .	Demonstrate with example source encoder and decoder .	Understand .	This would require the learner to **recall** the FT and prepare algorithms and **Understand** the coding for binary arithmetic process for source encoder and decoder. .	CO 10

18 .	Compare error free compression and lossy compression .	Understand .	This would require the learner to **recall** the FT and prepare algorithms and **Understand** to image intensity levels for error free compression .	CO 10
19 .	List JPEG 2000 standard with merits and demerits .	Understand .	This would require the learner to **recall** the compression techniques and **Understand** theJPEG compression in a digital image .	CO 10
20 .	Draw a transform coding system and relate with image compression. .	Understand .	This would require the learner to **recall** the compression techniques and **Understand** thetransform coding compression in a digital image .	CO 10
PART C-SHORT ANSWER QUESTIONS				
1	What is image compression?	Remember	—	CO 9
2	What is the need for Compression?	Remember	—	CO 9
3	What are the types of redundancy?	Remember	—	CO 9
4	Define coding redundancy?	Remember	—	CO 9
5	Define inter pixel redundancy?	Remember	—	CO 9
6	Define psychovisual redundancy	Remember	—	CO 10
7	What is run length coding?	Remember	—	CO 10
8	Define compression ratio	Remember	—	CO 10
9	Define source encoder	Remember	—	CO 10
10	Define channel encoder	Remember	—	CO 10
11	What are the redundancies can occur in error free compression?	Remember	—	CO 10
12	What is variable length coding?	Remember	—	CO 10
13	What is JPEG?	Remember	—	CO 10
14	What are the coding systems inJPEG?	Remember	—	CO 10
15	What are the basic steps in Huffman coding	Remember	—	CO 10

16	State whether the following huffman code 0,01, 10,011 for the given symbols a1,a2,a3,a4 is uniquely decodable or not.	Remember	—	CO 10
17	Match the Lossless compression–coding with example.	Remember	—	CO 10
18	Explain the Data Compression and Data Redundancy	Understand	This would require the learner to **recall** the FT and prepare algorithms and **Understand** to image intensity levels for data compression.	CO 10
19	Draw and relate block diagram of Lossy Compression	Remember	—	CO 10
20	Draw and relate block diagram of Loss less Compression.	Remember	—	CO 10

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