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

COMMPUTER SCIENCE AND ENGINEERING (Data Science)

QUESTION BANK

Course Title	**IMAGE PROCESSING AND ANALYSIS**				
Course Code	ACDC08				
Program	B.Tech				
Semester	V	CSE(DS)			
Course Type	Professional Elective-I				
Regulation	IARE - UG20				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Dr. G.Ganapathi Rao, Asst. Professor				

COURSE OBJECTIVES:

The students will try to learn:

I	Image processing concepts, analysis and techniques.
II	The image analysis and its classifications.
III	Visualization of different kinds of images.

COURSE OUTCOMES:

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

CO 1	**Understand** the principles of image processing and techniques for describing the Digital Imaging System (DIS).	Understand
CO 2	**Analyze** various techniques for for image enhancement and develop image restoration models.	Analyze
CO 3	**Apply** image segmentation methos for transforming the image and conduct Image Morphology.	Apply
CO 4	**Apply** the image segmentation techniques for the classification of image registration.	Apply
CO 5	**Understand** the different techniques for image registration.	Understand
CO 6	**Analyze** the visualization methods and apply them for 2D and 3D images.	Analyze

QUESTION BANK:

MODULE I				
IMAGE PROCESSING FUNDAMENTALS				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
Q.No	**QUESTION**	**Taxonomy**	**How does this subsume the level**	**CO's**
1	Explore the steps of specifications of Image Sensing and Acquisition for CT-scan image application	Understand	The learner to **Recall** the image processing and **Understand** components and understanding the image processing.	CO1
2	Determine the arithmetic by image operations between the following two images pixels functions f1 and f2 respectively. $\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$	Understand	The learner to **Recall** the representation of digital image and **Apply** the image operations and understand the convolution and correlation property on image.	CO 1
3	Obtaine the simple relation of sampling and quantization With necessary steps.	Understanding	The learner to **Recall** the sampling of the image , and **Understand** grey levels, quantization and apply for the calculation of time taken for the image .	CO 1
4	Compute the some of the frequently used image file formats with suitable examples.	Understand	The learner to **Recall** the image transforms frequently and **Understand** basis function and image file formats.	CO1

5	Obtain the intensity transformation matrix For 4x4 of f(M.N) with suitable examples.	Apply	The learner to **Recall** the representation of digital image and **Understand** basis function apply intensity transformation matrix 4x4 of f(m.n).	CO2
6	Compute the pixel relations of the 4 × 4 grayscale image f(x, y) shown below. $f(x,y) = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \end{bmatrix}$	Apply	The learner to **Recall** the representation of digital image and **Understand** the properties of Pixel Relationships and apply it on image coefficients f(x,y).	CO 2
7	Compute the transpose of (F*) image operation of the transform coefficients F(k, l) given below. $f(k,l) = \begin{bmatrix} 16 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$	Apply	The learner to **Recall** the representation of digital image and **Understand** the properties of pixel relationships and apply it on transform coefficients F (k,l).	CO 2
8	Obtain the intensity transform basis for the following matrix of samples $f(m,n) = \begin{bmatrix} 4 & -2 \\ -1 & 3 \end{bmatrix}$	Apply	The learner to **Recall** the representation of digital image and **Understand** the properties of Pixel Relationships and apply transform of the 2 x 2 image	CO2

9	Find hadamard forward and reverse transformation of given matrix $u = \begin{bmatrix} 1 & 2 & 1 & 3 \\ 2 & 3 & 4 & 1 \\ 3 & 4 & 2 & 1 \\ 4 & 1 & 2 & 3 \end{bmatrix}$	Apply	The learner to **Recall** the representation of digital image and **Understand** the properties of Reverse transformation and apply hadamard forward and reverse transformation	CO2
10	Obtain the Noise model of matrix for N = 4 and verify with suitable example.	Analyze	The learner to **Recall** the representation of digital image and **Understand** the properties of Noise model and analyze the matrix for N=4 .	CO2
PART B-LONG ANSWER QUESTIONS				
1	Explain any four basic relationships between pixels.	Understand	The learner to **Recall** the relationship between pixels and **Understand** the Neighbor of a pixels	CO 1
2	Demonstrate the components of digital image processing system and explain each block.	Understand	The learner to **Recall** the image coordinates and **Understand** elements of image processing system.	CO 1
3	Define digital image and Discuss how digital images are represented with neat diagrams.	Understand	The learner to **Recall** the representation of digital image and **Understand** the processing of digital image.	CO 1
4	Discuss sampling and quantization With necessary diagrams.	Understand	The learner to **Recall** the sampling and quantization techniques and **Understand** the conversion of analog image in to digital image.	CO 1
5	Discuss the effect of increasing sampling frequency and quantization levels on image	Understand	The learner to **Recall** the sampling and quantization and **Understand** effect of increasing the sampling frequency and greylevels	CO 1
6	List and explain applications of image processing	Remember	—	CO 1

7	Define spatial resolutions? Discuss the effect on the image by reducing it.	Understand	The learner to **Recall** the sampling and quantization **Understand** effect of increasing the sampling frequency.	CO 1
8	Interpret the concept of non-uniform sampling and quantization.	Understand	The learner to **Recall** quantization and **Understand** the non uniform quantization.	CO 1
9	Discuss the most commonly used distance measures in image processing	Understand	The learner to **Recall** digital image, neighbours and **Understand** various distance measures.	CO 1
10	The image refers to a two dimensional light intensity function. Discuss in detail.	Understand	The learner to **Recall** the Gray levels and **Understand** the Gray level to binary conversion.	CO 1
11	Discuss the image acquisition using a single sensor, sensor strips and sensor arrays.	Understand	The learner to **Recall** image acquisition and **Understand** various sensors	CO 1
12	What is restoration models? Explain in detail and Write its properties.	Understand	The learner to **Recall** nthe image transforms and **Understand** basis function of transform.	CO 2
13	Explain about intensity Transform and Write its properties .	Understand	The learner to **Recall** the image transforms and **Understand** basis function of intensity transformation	CO 2
14	Explain the following two image operations of i) spatial operations ii) stastical operations	Understand	The learner to **Recall** the discrete fourier transform and **Understand** the properties of 2D DFT	CO 2
15	Explain the following mathematical operations on digital images i) Array versus Matrix operations ii) Linear versus Nonlinear Operations	Understand	The learner to **Recall** the fundamental concept of images and **Understand** various mathematical operations on digital image.	CO 1
16	Describe the need of image transform? List out various transform used in image processing.	Understand	The learner to **Recall** the image transforms and **Understand** different transforms.	CO 2

17	Explain the following terms of conceptual arrangement: (i) Adjacency (ii) Connectivity (iii) Regions (iv) Boundaries	Understand	The learner to **Recall** the concept of pixels and **Understand** the relationship between pixels	CO 1
18	State the following two properties of image operations i) Translation ii) Rotation	Understand	The learner to **Recall** the discrete fourier transform and **Understand** the properties of image operations	CO 2
19	Derive the basis function for restoration model	Understand	The learner to **Recall** the image transform and **Understand** the basis function of restoration model.	CO2
20	Prepare the 4,8-,m-adjacancy based on the lengths of shortest 4,8,m-paths between pixels with suitable examples.	Understand	The learner to **Recall** the concept of pixels and **Understand** the relationship between pixels	CO 1
PART C-SHORT ANSWER QUESTIONS				
1	Define digital image processing	Remember	—	CO 1
2	Write any two origins of image processing?	Remember	—	CO 1
3	Mention different types of digital images.	Remember	—-	CO 1
4	Mention different bands in electromagnetic spectrum.	Remember	—-	CO 1
5	Which step is the objective of digital image processing?	Remember	—-	CO 1
6	Explain the hardware components of an image processing.	Understand	The learner to **Recall** the digital image and **Understand** the components of an image processing	CO 1
7	What is meant by Image Pixel?	Remember	—-	CO 1
8	What are the different fields in which Digital Image Processing is used?	Remember	—-	CO 1
9	What is the need of image processing?	Remember	—-	CO 1

10	Explain connectivity and path in relationship between pixels.	Understand	The learner to **Recall** the digital image and **Understand** the relationship between pixels	CO 1
11	Discuss about 4,8,diagonal neighbours.	Understand	The learner to **Recall** the relationship between pixels and **Understand** the image connectivity	CO 1
12	Explain region and boundary in the image.	Understand	The learner to **Recall** the image connectivity and **Understand** the region and boundary of an image	CO 1
13	Write the changes in sizes of different resolution images?	Remember	—	CO 1
14	What is meant by illumination and reflectance in image function?	Remember	—	CO 1
15	What are the applications of image processing?	Remember	—-	CO 1
16	List the different components in a simple Image formation model.	Remember	—	CO 1
17	Explain about sampling role in digitization process.	Understand	The learner to **Recall** the sampling theorem and **Understand** the digitization process	CO 1
18	Explain about quantization in digitization process.	Understand	The learner to **Recall** the sampling and quantization techniques and **Understand** the digitizing amplitude values	CO 1
19	List the basic steps involved in image processing?	Remember	—	CO 1
20	Define distance measure and Give the different distance measures.	Remember	—	CO 1

MODULE II

IMAGE ENHANCEMENT AND RESTORATION

PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS

<table>
<tr><td>1</td><td>Obtain histogram equalization characterstics, suppose that a 3-bit image (L = 8) of size 64 X 64 pixels (MN = 4096) has the intensity distributuon shown in Table</td><td>Understand</td><td></td><td>CO 3</td></tr>
<tr><td colspan="5"><table>
<tr><th>r_k</th><th>n_k</th><th>$P_r(rk) = n_k/MN$</th></tr>
<tr><td>$r_0 = 0$</td><td>790</td><td>0.19</td></tr>
<tr><td>$r_1 = 1$</td><td>1023</td><td>0.25</td></tr>
<tr><td>$r_2 = 2$</td><td>850</td><td>0.21</td></tr>
<tr><td>$r_3 = 3$</td><td>656</td><td>0.16</td></tr>
<tr><td>$r_4 = 4$</td><td>329</td><td>0.08</td></tr>
<tr><td>$r_5 = 5$</td><td>245</td><td>0.06</td></tr>
<tr><td>$r_6 = 6$</td><td>122</td><td>0.03</td></tr>
<tr><td>$r_7 = 7$</td><td>81</td><td>0.02</td></tr>
</table></td></tr>
<tr><td>2</td><td>Apply the steps involved in histogram equalization on the image.
$\begin{bmatrix} 4 & 4 & 4 & 4 & 4 \\ 3 & 4 & 5 & 4 & 3 \\ 3 & 5 & 5 & 5 & 3 \\ 3 & 4 & 5 & 4 & 3 \\ 4 & 4 & 4 & 4 & 4 \end{bmatrix}$</td><td>Apply</td><td>The learner to Recall the operation of pixels and gray levels and Understand the histogram equalization and apply image segment of size 5 X 5 and analyze the result with original image</td><td>CO 3</td></tr>
<tr><td>3</td><td>Obtain histogram equalization for the following image segment of size 5 X 5? Write the inference on image segment before and after equalization
200 200 200 180 240
180 180 180 180 190
190 190 190 190 180
190 200 220 220 240
230 180 190 210 230</td><td>Apply</td><td>The learner to Recall the operation of pixels and gray levels and Understand the histogram equalization and apply image segment of size 5 X 5</td><td>CO 3</td></tr>
</table>

4	A 4 × 4, 4bits/pixel image f(m, n) is passed through point-wise intensity transformation $g(m, n) = \text{round}(10\sqrt{f(m,n)})$. Determine the output image g(m,n) if f (m,n) is given by $\begin{bmatrix} 12 & 8 & 4 & 9 \\ 10 & 5 & 3 & 6 \\ 8 & 12 & 9 & 13 \\ 4 & 12 & 9 & 10 \end{bmatrix}$	Apply	The learner to **Recall** point processing and **Understand** the round operation and **apply** on image.	CO 3
5	Given an image of size 3 × 3 as $f(x, y) = \begin{bmatrix} 128 & 212 & 255 \\ 54 & 62 & 124 \\ 140 & 152 & 156 \end{bmatrix}$ $f(m, n) =$. Determine the output image $g(m, n) = [c \log_{10}(1 + f(m, n))]$ using logarithmic transformation by choosing c as i. c = 1 and ii $c = \frac{L}{\log_{10}(1+L)}$	Apply	The learner to **Recall** point processing and **Understand** the log transformation and **apply** on image.	CO 3
6	Obtain histogram equalization for the following image segment of size 5 X 5? Write the inference on image segment before and after equalization $g(m, n) = \text{round}(10\sqrt{f(m,n)})$. Determine the output image g(m,n) if f (m,n) is given by $\begin{bmatrix} 12 & 8 & 4 & 9 \\ 10 & 5 & 3 & 6 \\ 8 & 12 & 9 & 13 \\ 4 & 12 & 9 & 10 \end{bmatrix}$	Analyze	The learner to **Recall** the operation of pixels and gray levels and **Understand** the histogram equalization and **apply** image segment of size 5 X 5 and **analyze** the result with original image	CO 3

7	Compute the bit planes of the given 8 bit image $f(x,y) = \begin{bmatrix} 255 & 138 & 30 \\ 65 & 12 & 201 \\ 183 & 111 & 85 \end{bmatrix}$	Apply	The learner to **Recall** point processing and **Understand** the round operation and **apply** on image .	CO 3
8	Compute the value of the marked pixels if it is smoothened by a 3 × 3 average filter. $\begin{bmatrix} 0 & 1 & 2 & 3 & 2 \\ 5 & 6 & 7 & 8 & 4 \\ 4 & (3) & (2) & (1) & 2 \\ 8 & 7 & 6 & 5 & 3 \\ 1 & 5 & 3 & 7 & 8 \end{bmatrix}$	Apply	The learner to **Recall** low pass and high pass filters and **Understand** in image processing for image enhancement and **apply** on a segment of image.	CO 3
9	If a low pass filter is formed that averages the 4 neighbours of a point (x,y) but excludes point itself. Find the equivalent transfer function in frequency domain. Show that it is low pass filter	Apply	The learner to **Recall** low pass filter and **Understand** the kernel in image processing for image enhancement and **apply** fourier transform for spatial filter.	CO 3
10	Discuss on Image Morphology and basic algorithm of it.	Understand	The learner to **Recall** Image Morphology and prepare algorithms and **Understand** Image Morphology and basic algorithm.	CO 3
PART B-LONG ANSWER QUESTIONS THINKING				
1	Explain in detail about histogram processing.	Understand	The learner to **Recall** the probability of occurrence of gray levels and **Understand** the histogram processing.	CO 3
2	With the help of block diagram explain homomorphic filtering approach for image enhancement.	Understand	The learner to **Recall** filtering techniques and **Apply** the homomorphic Filtering	CO 3

3	Describe various types of mean filters for image enhancement.	Understand	The learner to **Recall** filter functions and **Understand** the various types of mean filters.	CO 3
4	Demonstrate enhancement of monochrome image by histogram	Understand	The learner to **Recall** the monochrome technique and **Understand** the monochrome image by Histogram	CO 3
5	Discuss the procedure involved in Histogram matching.	Understand	The learner to **Recall** the operation of pixels and gray levels and **Understand** the histogram equalization and matching.	CO 3
6	Explain the steps in histogram equalization.	Understand	The learner to **Recall** the operation of pixels and gray levels and **Understand** the histogram equalization .	CO 3
7	Classify restoration models and list out its applications4)	Understand	The learner to **Recall** morphology and Binary morphology and **Understand** in image processing for image enhancement	CO 3
8	List out the various of gray level transformation used for image enhancement.	Understand	The learner to **Recall** the operation of pixels and gray levels **Understand** the gray level transformation for image enhancement	CO 3
9	Classify the Feature selection Techniques, along with texture and boundary representation	Understand	The learner to **Recall** Feature selection Techniques and **Understand** butterworth and aussian for image enhancement	CO 3
10	Describe Butterworth low pass and Butterworth high pass filters.	Understand	The learner to **Recall** low pass and high pass filters and **Understand** the Butterworth filter .	CO 3
11	List the salient features of image histogram.	Understand	——	CO 3
12	Discuss the following spatial enhancement techniques. iii) Spatial averaging. (ii)Median filtering.	Understand	The learner to **Recall** the spatial filters and **Understand** the enhancement techniques.	CO 3

13 1 1	Prepare the linear spatial sharpening filtering for image enhancement.	Understand	The learner to **Recall** the spatial filters and **Understand** the linear spatial sharpening filters.	CO 3
14	Explain linear spatial smoothing filtering.	Understand	The learner to **Recall** the spatial filters and **Understand** the linear spatial smoothing filters.	CO 3
15	Interpret image processing transforms using point processing method for iii) Negative image. ii)Thresholding iii)Log Transformation	Understand	The learner to **Recall** concept of point processing and **Understand** the various techniques for point processing.	CO 3
16	Interpret image processing transform nusing point processing method for power law transformation.	Understand	The learner to **Recall** concept of point processing and **Understand** the various techniques for point processing.	CO 3
17	Explain smoothing of images in frequency domain using region based segmentation.	Understand	The learner to **Recall**, region based segmentation. **Understand** in smoothing in frequency domain.	CO 3
18	What is meant by the Feature extraction and representation? Discuss their role in image enhancement.	Understand	The learner to **Recall** operation of pixels and gray level and **Understand** the concept of feature extraction and the representation.	CO 3
19	Sketch perspective plot of an histogram process by smoothing and sharpening function of filter cross section and explain its usefulness in Image enhancement.	Understand	The learner to **Recall** feature image classification and prepare algorithms and **Understand** transfer function for image enhancement.	CO 3
20	Explain the following operations: i) Binary morphology ii) Gray-level morphology	Understand	The learner to **Recall** point operations and **Understand** the concept of Gray-level morphology and Binary morphology.	CO 3
PART C -SHORT ANSWER QUESTIONS				
1	Specify the objective of image enhancement technique.	Remember	——	CO 3

2	Explain the 2 categories of image enhancement.	Remember	——	CO 3
3	What are the edge operations?	Remember	——	CO 3
4	What is morphology processing?	Understand	The learner to **Recall** the mask and **Understand** how the mask is operating on image.	CO 3
5	What is contrast stretching?	Remember	——	CO 3
6	What is thresholding?	Remember	——	CO 3
7	What is Binary morphology?	Remember	——	CO 3
8	What is image averaging? Give its application?	Remember	——	CO 3
9	Explain the purpose of image averaging?	Understand	This would require the learner to **Recall** the averaging mask and **Understand** the effect of mask on image.	CO 3
10	Give the formula for negative and log transformation.	Remember	——	CO 3
11	What is meant by bit gray level morphology?	Remember	——	CO 3
12	Define histogram.	Remember	——	CO 3
13	Discuss image negatives?	Understand	This would require the learner to **Recall** the image segmentation and **Understand** image negative.	CO 3
14	State the first order derivative filter or gradient filter.	Remember	——	CO 3
15	What is a Component Labeling ?	Remember	——	CO 3
16	Explain median filter?	Understand	The learner to **Recall** the image enhancement **Understand** median filter.	CO 3
17	What is a smoothing filter?	Remember	——	CO 3
18	What is a sharpening filter?	Remember	——	CO 3

19	Explain unsharp masking.	Understand	The learner to **Recall** the mask and **Understand** use of unsharp masking on image.	CO 3
20	What are the feature selection techniques ?	Remember	——	CO 3
MODULE III				
IMAGE SEGMENTATION AND MORPHOLOGY				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	Apply order Binary and Gray level morphology operations on the selected pixels in the image with suitable example.	Apply	The learner to **Recall** filter and **Understand** the various Binary and Gray level morphology operations.	CO 4
2	Justify the discussion "Morphological algorithms is an effective tool to minimize the salt and pepper noise through simple illustaration.	Apply	The learner to **Recall** salt and pepper noise and **Understand** median filter and **apply** on image segment.	CO 4
3	Compute the Erosion and Dilation, value of the prepared based pixels with illustrations.	Apply	The learner to **Recall** grey level image and **Understand** median filter and **apply** on - Erosion, Dilation,s.	CO 4
4	Compare image enhancement and image restoration .	Understand	The learner to **Recall** digital image and **Understand** image enhancement and restoration.	CO 4
5	Show effect of Closing Operations and Distance Transforms with example image.	Apply	The learner to **Recall** grey level image and **Understand** Closing Operations Distance Transforms and **apply** .	CO 4
CIE-II				

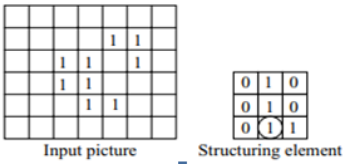
6	Analyse effect of max, min filter for the given image and interpret the results. $f(x,y)=\begin{bmatrix}30 & 10 & 20\\ 10 & 250 & 25\\ 20 & 25 & 30\end{bmatrix}$ image.	Analyze	The learner to **Recall** grey level image and **Understand** min, max filters and **apply** on image segment 3x3 and analyze the resulting images .	CO 4
7	Describe image segmentation technique for image restoration and write active contour models in details.	Understand	The learner to **Recall** the image segmentation and **Understand** transfer function of constrained least square function.	CO 4
8	Derive transfer function of regional descriptors approach for image restoration	Understand	The learner to **Recall** the filter and **Understand** transfer function of weiner filter	CO 4
9	Summarize the drawback image representation and analysis with suitable examples	Understand	The learner to **Recall** the filter and **Understand** image representation and analysis with suitable examples	CO 4
PART B-LONG ANSWER QUESTIONS				
1	Illustrate the different causes of image degradation	Understand	The learner to **Recall** the noise sources and **Understand** the causes for image degradation.	CO6
2	Summarize the power density function of uniform noise, salt & pepper noise and Gaussian noise and sketch it.	Understand	The learner to **Recall** the noise sources and **Understand** the power density function of noise.	CO6
3	Explain mean and geometric mean filter for image restoration.	Understand	The learner to **Recall** filter and **Understand** the transfer function of mean and geometric mean filer.	CO4
4	Explain erosion and dilation for image restoration.	Understand	The learner to **Recall** filter and **Understand** the transfer function of statistical image.	CO6

5	Demonstrate the most commonly used noise probability density functions in image processing applications and explain with its plot.	Understand	The learner to **Recall** the noise sources and **Understand** the most commonly used noise sources .	CO6
6	Explain the process of restoration in the presence of noise only using spatial filters for various mean filters?	Understand	The learner to **Recall** filter, noise and **Understand** image restoration by elastic deformation.	CO6
7	Discuss the three principal ways to estimate the degradation function for use in image restoration and explain it.	Understand	The learner to **Recall** image restoration and **Understand** image degradation function.	CO6
8	Explain regid body visualization used for restoring images	Understand	The learner to **Recall** visualization, noise and **Understand** image restoration by order statistics filters.	CO6
9	Explain how degradation is estimated using i)observation ii)mathematical modeling	Understand	The learner to **Recall** image restoration and **Understand** estimation of image degradation function.	CO6
10	Summarize Image degradation and restoration process? Explain various Noise filters in detail.	Understand	The learner to **Recall** image restoration and **Understand** image degradation function.	CO6
		CIE-II		
11	Explain alpha trimmed filters for image restoration.	Understand	The learner to **Recall** image restoration and **Understand** image degradation function.	CO6
12	Discuss inverse filtering for image restoration.	Understand	The learner to **Recall** the filter and **Understand** transfer function of inverse filtering.	CO6
13	Demonstrate the model for image degradation.	Understand	The learner to **Recall** the image restoration and **Understand** image degradation model.	CO6

14	Discuss constrained least square filtering method for restoration in details	Understand	The learner to **Recall** the filter and **Understand** transfer function of constrained least square function.	CO 4
15	Discuss about exponential, ayleigh noise and how it can be removed.	Understand	The learner to **Recall** the noise models and **Understand** the removal of noise.	CO 4
16	Describe inverse filtering for removal of blur caused by any motion and describe how it restore the image	Understand	The learner to **Recall** concept of blur **Understand** the blur removal by inverse filtering.	CO 4
17	Explain the following filtering techniques (1) Noise models by mean of filter (2) Constrained models by mean of filter (3) Homomorphic filter	Understand	The learner to **Recall** spatial filter for restoration and **Understand** the concept of various filters.	CO 4
18	Summarize minimum mean square error filtering for image restoration.	Understand	The learner to **Recall** the filter and **Understand** transfer function of minimum mean square filter function.	CO 4
19	Discuss about erlang noise and how it can be removed.	**Understand**	The learner to **Recall** the noise sources and **Understand** the power density function of noise.	CO 4
20	What is Image restoration? Draw and explain the basic block diagram of the restoration process. Give two areas where restoration process can be applied	**Understand**	The learner to **Recall** image restoration and **Understand** image degradation function.	CO 4

PART C- SHORT ANSWER QUESTIONS				
1	What is meant by Image Restoration?	Remember	——-	CO 4
2	How a degradation process is modeled?	Remember	——-	CO 4
3	Differentiate image enhancement and image restoration	Remember	——-	CO 4
4	What are the two methods of algebraic image restoration approach?	Remember	——-	CO 4
5	What is inverse filtering?	Remember	——-	CO 4
6	What is pseudo inverse filter?	Remember	——-	CO 4
7	Explain the causes of degradation in an image.	Understand	The learner to **Recall** image restoration and **Understand** causes for image degradation.	CO 4
8	What are the two methods of algebraic image restoration approach?	Remember	——-	CO 4
9	What is dynamic (or) Adaptive thresholding?	Remember	——-	CO 4
10	Explore the restoration is called unconstrained restoration?	Remember	——-	CO 4
CIE-II				
11	Write notes on Least square error filter	Remember	——-	CO 4
12	Describe constrained least square filtering for image restoration and derive its transfer function.	Remember	——-	CO 4
13	What is inverse filtering?	Remember	——-	CO 4
14	What is pseudo inverse filter?	Remember	——-	CO 4
15	What is a adaptive median filter?	Remember	——-	CO 4
16	Define arithmetic mean filter .	Remember	——-	CO 4
17	Define geometric mean filter .	Remember	——-	CO 4
18	Explain spatial filtering.	Remember	——-	CO 4

19	What is a median filter?	Remember	——-	CO 4
20	What is harmonic mean filter?	Remember	——-	CO 4
MODULE IV				
IMAGE ANALYSIS AND CLASSIFICATION				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	Consider an image segment of size 5x5 and explain the magnitude and direction of the gradient of the pixel.	Understand	The learner to **Recall** the image into segments of its constituents and **Understand** the magnitude and direction of the gradient of the pixel.	CO 5
2	Explain image segmentation for detecting pixel- based ,edge- based ,region-based	Understand	The learner to **Recall** image segmentation and **Understand** the image segmentation	CO 5
3	Illustrate medical image segmentation for detecting pixel- based ,edge- based ,region-based	Understand	The learner to **Recall** gradient operator and **Understand** the medical image segmentation.	CO 5
4	Explain statistical image representation for detecting edges and its response	Understand	The learner to **Recall** gradient operator and **Understand** the statistical image representation.	CO 5
5	Apply pixel based and edge based procedural stepts to segment any image with suitable illustrations.	Apply	The learner to **Recall** the image into segments of its constituents and **Understand** the information contained and **apply** pixel based and edge based	CO 5
6	Show that a invariant feature transformation separable while the whole-image features object is need to be seperable.	Understand	The learner to **Recall** separable property and **Understand** the invariant feature transformation.	CO 5
7	Prepare the active contour models and Level sets for medical image segmentation	Apply	The learner to **Recall** segment of an image and **Understand** Active contour model of an image and **apply** to c Level sets by structuring element B.	CO 5

8	Discuss the binary image statistical image classification are exstended with suitable industrial applications	Apply	The learner to **Recall** the image into segments of its constituents and **Understand** the structuring element and **apply** tatistical image classification	CO 5
9	The input picture and structuring elements are shown below. Perform the erosion and dila-tion of the given below table. 	Apply	The learner to **Recall** binary image representation and **Understand** the structuring element and **apply** the input image is eroded and dilation by structuring element B.	CO 5
10	The Feature extraction and representation of an image. Perform the industrial applications.	Apply	The learner to **Recall** binary image representation and **Understand** the structuring element and **apply** the Feature extraction and representation.	CO 5

PART B-LONG ANSWER QUESTIONS				
1	How do you perform edge detection? Give suitable algorithm and discuss how the edge points are linked.	Understand	The learner to **Recall** the image into segments of its constituents and **Understand** smaller entities for region based segmentation.	CO 5
2	Discuss how region Growing approach are used for image 3segmentation.	Understand	The learner to **Recall** the image into segments of its constituents and **Understand** smaller entities for Edge linking based segmentation.	CO 5
3	Discuss how region splitting and merging approach are used for image segmentation.	Understand	The learner to **Recall** the image into segments of its constituents and **Understand** smaller entities for global thresholding.	CO 5
4	What is edge detection? Describe in detail about the types of edge detection operations.	Understand	The learner to **Recall** the image into segments of its constituents and **Understand** smaller entities for region based segmentation.	CO5
5	Illustrate Image visualization on rigid body visualization.	Understand	The learner to **Recall** the Image visualization and **Understand** smaller entities for Image visualization.	CO5
6	Explain global processing using Hough transform	Understand	The learner to **Recall** the image into segments of its constituents and **Understand** the closing operation in image morphology segmentation.	CO 5
7	What do you **Understand** by dilation and erosion in morphological operation? Explain in detail.	Remember	——-	CO 5
8	How do you link edge pixels through global processing?	Remember	——-	CO 5

9	Explain region based segmentation and region growing with an example.	Remember	——-	CO 5
10	Discuss image segmentation based on various thresholding techniques.	Understand	The learner to **Recall** the image into segments and **Understand** in to morphing for dilation and erosion.	CO 5
11	Describe gradient operators based edge detection method with necessary masks and equations.	Understand	The learner to **Recall** the image into segments and **Understand** the thresholding process.	CO 5
12	Explain gradient operators based edge detection method with necessary masks and equations.	Understand	The learner to **Recall** the image into segments and **Understand** the boundary characteristics.	CO 5
13	Explain edge linking using Hough transform.	Understand	The learner to **Recall** the image into segments and **Understand** the image segmentation.	CO 5
14	Explain the following morphological algorithms i) Boundary extraction ii) Hole filling.	Understand	The learner to **Recall** the image into segments and **Understand** the Hough transform for edge linking image segmentation.	CO 5
15	Explain the following morphological algorithms. i) Thinning ii) Thickening	Understand	The learner to **Recall** the image into segments and **Understand** the edge linking in image segmentation.	CO 5
16	With necessary figures, explain the opening and closing operations.	Understand	The learner to **Recall** the image into segments of its constituents and **Understand** smaller entities for region splitting and merging based on segmentation.	CO 5
17	How can you control Over segmentation problem? Explain it.	Understand	The learner to **Recall** the image into segments and **Understand** the of Hit-or-Miss morphological transformation	CO 5

18	Explain the detection of isolated points in an image.	Understand	The learner to **Recall** the image into segments and **Understand** in to morphing image processing	CO 5
19	Explain about morphological hit-or-miss transform.	Understand	The learner to **Recall** the image into segments and **Understand** in to morphing for dilation and erosion of image processing.	CO 5
20	Explain watershed transformation and discuss about its advantages and disadvantages.	Understand	The learner to **Recall** the image into segments and **Understand** the of Hit-or-Miss morphological transformation.	CO 5
PART C-SHORT ANSWER QUESTIONS				
1	What is segmentation?	Remember	——-	CO 5
2	Write the applications of segmentation	Remember	——-	CO 5
3	What are the three types of discontinuity in digital image?	Remember	——-	CO 5
4	How the derivatives are obtained in edge detection during formulation?	Remember	——-	CO 5
5	What are the two properties used for establishing similarity of edge pixels?	Remember	——-	CO 5
6	Give the properties of the second derivative around an edge?˙	Remember	——-	CO 5
7	Define Gradient Operator.	Remember	——-	CO 5
8	What is meant by zero crossing property of second order derivative?	Remember	——-	CO 5
9	What are the disadvantages of Laplacian operator?	Remember	——-	CO 5
10	What are the various techniques that can be used for edge linking?	Remember	——-	CO 5
11	What is object point and background point?	Remember	——-	CO 5
12	What is thresholding? What are its types?	Remember	——-	CO 5

13	What is Global Thresholding?	Remember	——-	CO 5
14	What is variable Thresholding?	Remember	——-	CO 5
15	What are the disadvantages of thresholding?	Remember	——-	CO 5
16	What are the disadvantages of thresholding?	Remember	——-	CO 5
17	Define region growing?.	Remember	——-	CO 5
18	Specify the steps involved in splitting and merging.	Understand	The learner to **Recall** the image into segments and **Understand** in to smaller entities for image segmentation	CO 5
19	Define morphological operations.	Remember	——-	CO 5
20	Define statistical image classification.	Remember	——-	CO 5
MODULE V				
IMAGE REGISTRATION AND VISUALIZATION				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	Determine the interactive principle access registration with suitable example.	Analyze	The learner to **Recall** the interactive principle access registration **Understand** the encoding process then **apply** Huffman code for given source and **analyze** average length of the code and its	CO 6
2	Explore A source rigid body visualization from any method of 2D or 3D display with any examples.	Analyze	The learner to **Recall** average method of 2D and 3D display **Understand** the encoding process then **apply** method of 2D or 3D display for given source and **analyze** method of 2D or 3D display	CO 6

3	For the image shown below compute the elastic deformation- based registration that can be Interactive principal axis registration in digital image analytical.	Apply	The learner to **Recall Understand** the principal axis registration **apply** elastic deformation for given image.	CO 6
4	Explore the feature based registration which source from rigid body visualization with examples,	Apply	The learner to **Recall** Rigid body visualization, **Understand**s the feature based registration then **apply** .	CO 6
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	The learner to **Recall** the codeword and **Understand** the procedure for arithmetic coding and **apply** it to find the word length and code length	CO 6
6	Perform steps of algorithm for the following Descriptors, Whole-image Features object and Scale for the industrial applications	Analyze	The learner to **Recall** the alogrithm efficiency and **Understand** the intensity distribution and **apply** algorithm and compare with that of uniform length code.	CO 6
7	List out the steps of algorithm of Invariant Feature Transform (SIFT) and its importance with suitable example.	Apply	The learner to **Recall** the codeword and **Understand** the procedure for uffman coding and **apply** it to find the average length of the code and its redundancy.	CO 6
8	Compute from S={S0 ,S1, S2, S3,S4} with corresponding probabilities P= {0.4 ,0.2,0.2,0.1,0.1} of principal axis registration.	Understand	The learner to **Recall** the encoding techniques and **Understand** the uffman coding for source symbols and probabilities.	CO 6
9	Outline about principal axis registration.	Understand	The learner to **Recall** the principal axis registration and **Understand** the principal axis registration and probabilities.	CO 6

10	Why elastic deformation-based registration is better than a interactive principal axis registration? Summarize the merits and de-merits.	Understand	The learner to **Recall** the cinteractive principal axis registration and **Understand** the elastic deformation-based registration better than a interactive principal axis registration.	CO 6
PART B-LONG ANSWER QUESTIONS				
1	Differentiate elastic deformation-based registration and interactive principal axis registration.	Understand	The learner to **Recall** the techniques and **Understand** the redundancies in a digital image	CO 6
2	Demonstrate feature based registration with example.	Understand	The learner to **Recall** the techniques and **Understand** the feature based registration in digital image	CO 6
3	Explain the need for image visualization and image visualization encoding approach is used for virtual reality based image visualization.	Understand	The learner to **Recall** the need for image visualization and **Understand** the image visualization	CO 6
4	Demonstrate arithmetic coding with example.	Understand	The learner to **Recall** the need for image compression and **Understand** the arithmetic Coding.	CO 6
5	Explain the average length of the code. Is Huffman code uniquely decodable? If so , Justify your answer.	Understand	The learner to **Recall** average length of the code and **Understand** uffman code.	CO 6
6	How an image is pixel based JPEG in image segmentation?	Understand	the learner to **Recall** the compression standard and **Understand** the JPEG image.	CO 6
7	Explain in detail about the arithmetic coding	Understand	the learner to **Recall** the compression techniques and **Understand** the arithmetic coding in a digital image	CO 6

8	Describe run length encoding with examples	Understand	the learner to **Recall** the compression techniques and **Understand** the run length encoding in a digital image	CO 6
9	What is mean by Virtual reality interactive visualization and write the applications of it	Understand	the learner to **Recall** the image to take number of bits and **Understand** bVirtual reality interactive visualization	CO 6
10	List out and explain in detail about the Virtual reality interactive visualization	Understand	——	CO 6
11	Relate the statistical shape standard and the steps involved in statistical image classification.	Understand	——	CO 6
12	Which type of method to generating variable length codes with an example.	Understand	the learner to **Recall** the compression techniques and **Understand** the variable length encoding in a digital image	CO 6
13	Show whole-image features object along with an examples.	Understand	the learner to **Recall** the whole-image features and prepare algorithms and **Understand** the arithmetic encoding	CO 6
14	Why whole-image features and prepare the need for image relates with an example.	Understand	The learner to **Recall** the compression techniques and **Understand** the whole-image features in a digital image	CO 6
15	Relate the medical image segmentation and the steps involved in image representation.	Understand	The learner to **Recall** the image segmentation techniques and **Understand** the medical image segmentation in a digital image	CO 6
16	Select and match the image visualization and their display methods with examples	Understand	The learner to **Recall** the image visualization methods and **Understand** the removal methods in a digital image	CO 6

17	Demonstrate with example level sets for medical image segmentation	Understand	The learner to **Recall** the prepare algorithms and **Understand** the coding for binary arithmetic process for medical image segmentation.	CO 6
18	Compare Feature and Elastic deformation based registration	Understand	The learner to **Recall** the Elastic deformation based registration and **Understand** to active contour models	CO 6
19	Relate Image Visualization with merits and demerits	Understand	The learner to **Recall** the compression techniques and **Understand** the JPEG compression in a digital image	CO 6
20	Draw the suitable diagrams of registration of system and relate with image compression.	Understand	The learner to **Recall** the compression techniques and **Understand** the transform coding compression in a digital image	CO 6
PART C-SHORT ANSWER QUESTIONS				
1	What is image classification and its importance?	Remember	——-	CO 6
2	Which is the need for Compression?	Remember	——-	CO 6
3	What are the types of redundancy?	Remember	——-	CO 6
4	Define coding redundancy.	Remember	——-	CO 6
5	What are the pixel and edge of images.	Remember	——-	CO 6
6	Define Psychovisual redundancy.	Remember	——-	CO 6
7	What is Image representation and analysis?	Remember	——-	CO 6
8	Construct the rigid body visualization.	Remember	——-	CO 6
9	State the feature based registration.	Remember	——-	CO 6
10	Prepare the statistical Text.	Remember	——-	CO 6
11	What are the operations performed by descriptors?	Remember	——-	CO 6

12	What is Variable image visualization?	Remember	——-	CO 6
13	List out the advantages of image registration?	Remember	——-	CO 6
14	What are the coding systems in JPEG?	Remember	——-	CO 6
15	What are the basic steps in image registration?	Remember	——-	CO 6
16	State whether the following image visualization methods: 2D and 3D display methods	Remember	——-	CO 6
17	Match the feature based registration with example.	Remember	——-	CO 6
18	Explain the Image visualization and Data Redundancy.	Understand	The learner to **Recall** the Virtual Reality and prepare the relative algorithms and **Understand** to image intensity levels for feature based registration.	CO 6
19	Draw and relate diagram of Interactive principal axis registration.	Remember	——-	CO 6
20	Prepare the importance of Virtual Reality based interactive visualization	Remember	—-	CO 6

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