



INSTITUTE OF AERONAUTICAL ENGINEERING

(AUTONOMOUS)

Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING

TUTORIAL QUESTION BANK

Course Title	IMAGE PROCESSING				
Course Code	ACS511				
Programme	B.Tech				
Semester	V	CSE			
Course Type	Elective				
Regulation	IARE - R16				
Course Structure	Theory			Practical	
	Lectures	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Chief Coordinator	Ms. S J Sowjanya, Assistant Professor				
Course Faculty	Ms. B Tejaswi, Assistant Professor				

COURSE OBJECTIVES:

The course should enable the students to:	
I	Understand the concepts of digital image processing methods and techniques.
II	Study the image enhancement techniques in spatial and frequency domain for image quality improvement
III	Learn the image restoration and compression techniques for optimization.
IV	Explore on color image features and transformation techniques.
V	Illustrate the techniques of image segmentation to identify the objects in the image.

COURSE OUTCOMES (COs):

CO 1	To Understand the need for image transforms different types of image transforms and their properties.
CO 2	Learn different techniques employed for the enhancement of images.
CO 3	Learn different causes for image degradation and overview of image restoration techniques.
CO 4	Understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.
CO 5	Learn different morphological algorithms for image analysis and recognition.

COURSE LEARNING OUTCOMES (CLOs):

ACS511.01	Understand the key concepts of Image Processing.
ACS511.02	Identify the origins of the Digital image processing
ACS511.03	Demonstrate the scope of the digital image processing in multiple fields
ACS511.04	Explore on overview of the components contained in the general purpose image processing system and its use in real time applications
ACS511.05	Describe the concept of elements of visual perception.
ACS511.06	Use the concept of sampling and quantization in generating digital images
ACS511.07	Explore on the basic relationships existed between the pixels in the image
ACS511.08	Illustrate different mathematical tools used in image intensity transformations for quality enhancement
ACS511.09	Use histogram processing techniques in image enhancement and noise reduction
ACS511.10	Understand the impact of smoothing and sharpening filters in spatial domain.
ACS511.11	Apply the Fourier transform concepts on image function in frequency domain filters(low pass/high pass).
ACS511.12	Describe the concept of image degradation or restoration of images.
ACS511.13	Understand the various kind of noise present in the image and how to restore the noisy image.
ACS511.14	Understand the differences of inverse, least square and Wiener filtering in restoration process of images
ACS511.15	Understand the color fundamentals and models in image processing
ACS511.16	Memorize the transformation techniques in pseudo color image processing.
ACS511.17	Use wavelet concepts in multi-resolution processing.
ACS511.18	Understand the basic multi-resolution techniques and segmentation methods
ACS511.19	Explore on lossy/lossless compression models using wavelets
ACS511.20	Use morphological operations like dilation and erosion to represent and describe regions, boundaries etc. in identification of the components in images.

TUTORIAL QUESTION BANK

UNIT- I				
INTRODUCTION TO DIGITAL IMAGE PROCESSING				
Part - A (Short Answer Questions)				
S. No	Question	Blooms Taxonomy level	Course Outcomes	Course Learning Outcomes (CLOs)
1	Define digital image processing	Understand	CO 1	ACS511.01
2	Write any two origins of image processing?	Understand	CO 1	ACS511.02
3	Mention different types of digital images	Remember	CO 1	ACS511.03
4	Mention different bands in electromagnetic spectrum	Remember	CO 1	ACS511.04
5	Which step is the objective of digital image processing	Understand	CO 1	ACS511.05
6	Write one example of hardware of image processing components	Understand	CO 1	ACS511.01
7	What is meant by pel?	Understand	CO 1	ACS511.02
8	What are the different fields in which Digital Image Processing is used?	Understand	CO 1	ACS511.03
9	What is the need of image processing?	Understand	CO 1	ACS511.04
10	Define connectivity and path in relationship between pixels	Understand	CO 1	ACS511.05
11	Define N_4, N_8, N_D	Understand	CO 1	ACS511.01
12	Define region and boundary in the image	Understand	CO 1	ACS511.02
13	Observe the changes in sizes of different resolution images	Remember	CO 1	ACS511.03
14	What is meant by illumination and reflectance in image function?	Understand	CO 1	ACS511.04
15	What are the applications of image processing?	Understand	CO 1	ACS511.05
16	List the different components in a simple Image formation model	Remember	CO 1	ACS511.01
17	Write about sampling role in digitization process	Understand	CO 1	ACS511.02
18	Write about quantization in digitization process	Understand	CO 1	ACS511.03
19	List the basic steps involved in image processing	Remember	CO 1	ACS511.04
20	Define distance measure and Give the different distance measures	Remember	CO 1	ACS511.05
21	Define resolution of image	Understand	CO 1	ACS511.01
Part – B (Long Answer Questions)				
1	Explain the steps involved in digital image processing with neat diagram	Understand	CO 1	ACS511.01
2	Discuss about image sensing and acquisition process in detail	Understand	CO 1	ACS511.02
3	To create a digital image, describe the steps involved converting continuous sensed data into digital form?	Remember	CO 1	ACS511.03
4	Write the basic relationships among the pixels in the image a) Neighbor of a pixel b)Adjacency	Understand	CO 1	ACS511.04
5	Illustrate the process of image sampling and quantization and discuss about spatial and gray-level resolution in image sampling.	Remember	CO 1	ACS511.05
6	What are the elements required for visual perception and explain how image can be formed in human eye	Understand	CO 1	ACS511.01
7	Discuss about zooming and shrinking of digital images with examples	Understand	CO 1	ACS511.01
8	Define digital image. Discuss how digital images are represented with neat diagrams	Understand	CO 1	ACS511.01
9	List and explain applications of image processing	Remember	CO 1	ACS511.02

10	List different components present in image processing and explain each component in detail with diagram	Remember	CO 1	ACS511.03
Part – C (Problem Solving and Critical Thinking Questions)				
1	Compare the linear and nonlinear operations with the help of mathematical tools	Understand	CO 1	ACS511.05
2	Find the relation among p and q in the given image segment and $V=\{1,2,3\}$	Remember	CO 1	ACS511.01
UNIT-II				
IMAGE ENHANCEMENT IN THE SPATIAL AND FREQUENCY DOMAIN				
Part - A (Short Answer Questions)				
1	Define image enhancement	Understand	CO 2	ACS511.01
2	How to get an image negative?	Understand	CO 2	ACS511.02
3	Describe about contrast stretching?	Understand	CO 2	ACS511.03
4	Give the Bit-Plane slicing representation	Remember	CO 2	ACS511.04
5	How to construct a histogram?	Remember	CO 2	ACS511.05
6	List the uses histogram for the image enhancement	Remember	CO 2	ACS511.01
7	Define the mask mode radiography	Understand	CO 2	ACS511.02
8	Mention any two basics of spatial filtering	Remember	CO 2	ACS511.03
9	List the different types of spatial filters.	remember	CO 2	ACS511.04
10	Write the uses of the order-statistics filters	Remember	CO 2	ACS511.05
11	Define the frequency domain	Understand	CO 2	ACS511.01
12	Write any two steps of filtering in the frequency domain	Remember	CO 2	ACS511.02
13	What is the difference between spatial and frequency domains in filtering.	Understand	CO 2	ACS511.03
14	Define the ideal low pass filter.	Understand	CO 2	ACS511.04
15	GLPF stands for	Remember	CO 2	ACS511.05
16	BLPF stands for	Remember	CO 2	ACS511.01
Part – B (Long Answer Questions)				
1	What is image enhancement? List and explain the advantages of image enhancement	Remember	CO 2	ACS511.01
2	Discuss about the basic intensity transformation functions and plot the intensity transformations i) Linear ii) log iii) power- law	Understand	CO 2	ACS511.02
3	Explain about image histogram matching specification method.	Understand	CO 2	ACS511.03
4	What is the importance of image enhancement and explain with arithmetic/logic operations.	Understand	CO 2	ACS511.04
5	What are smoothing spatial filters and explain in detailed	Understand	CO 2	ACS511.05
6	Discuss about the filtering in the frequency domain with properties of frequency and filters	Understand	CO 2	ACS511.01
7	Write the smoothing frequency-domain filters of Butter worth low pass and Gaussian low pass filters.	Understand	CO 2	ACS511.02
8	What are sharpening frequency domain filters and explain with Gaussian High pass filters and Laplacian in the frequency domain.	Understand	CO 2	ACS511.03
9	Discuss about Homomorphic filtering with implementation	Understand	CO 2	ACS511.01
10	What is meant by Gradient and Lapacian? Discuss these in image enhancement	Understand	CO 2	ACS511.02
11	Explain the method of using second derivative for image sharpening by using Laplacian operator	Understand	CO 2	ACS511.03
12	What is meant by image enhancement using point processing? Discuss any two methods in it.	Remember	CO 2	ACS511.04
13	What is high boost filtering? Compare it with high pass filtering	Understand	CO 2	ACS511.05
Part – C (Problem Solving and Critical Thinking Questions)				
1	Describe the correlation and convolution process with an example.	Remember	CO 2	ACS511.05
2	Apply the low pass filters to perform the smoothing.	Remember	CO 2	ACS511.05

3	Apply full correlation image data and using the specified weighted filter for contrast enhancement.	Remember	CO 2	ACS511.05
UNIT-III				
IMAGE RESTORATION AND FILTERING				
Part - A (Short Answer Questions)				
1	Compare image enhancement and restoration techniques?	Understand	CO 3	ACS511.05
2	Give the probability density functions for Rayleigh noise models	Remember	CO 3	ACS511.05
3	Give the probability density functions for the Erlang noise models	Remember	CO 3	ACS511.05
4	Give the probability density functions for Gaussian noise models	Remember	CO 3	ACS511.05
5	Give the probability density functions for Salt and Pepper noise models	Remember	CO 3	ACS511.05
6	Explain adaptive median filter and its advantages.	Understand	CO 3	ACS511.05
7	How do you reduce the periodic noise using frequency domain Filters?	Understand	CO 3	ACS511.05
8	What is image restoration?	Remember	CO 3	ACS511.05
9	Image restoration and image enhancement differences	Understand	CO 3	ACS511.05
10	List out the all Image observation models.	Remember	CO 3	ACS511.05
11	Explain Noise models	Understand	CO 3	ACS511.05
12	Explain A general model of a simplified digital image degradation process	Understand	CO 3	ACS511.05
13	Mention the Possible classification of restoration methods	Remember	CO 3	ACS511.05
14	What are band reject filters?	Remember	CO 3	ACS511.05
15	What is the difference between notch filters and band pass filters?	Understand	CO 3	ACS511.05
Part – B (Long Answer Questions)				
1	Discuss about periodic noise reduction by frequency domain filtering	Understand	CO 3	ACS511.05
2	Explain model of image degradation/restoration process with a block diagram	Remember	CO 3	ACS511.05
3	Discuss about image restoration in the presence of noise reduction using spatial filtering	Understand	CO 3	ACS511.05
4	Explain three principle ways to estimate the degradation function for use in image restoration	Understand	CO 3	ACS511.05
5	Discuss different types of filters used to restore an image	Understand	CO 3	ACS511.05
6	Write about Noise Probability Density Functions for all noise models	Understand	CO 3	ACS511.05
7	Specify any four important noise probability density functions.	Remember	CO 3	ACS511.05
8	Discuss the importance of adaptive filters in image restoration system. Highlight the working of adaptive median filters.	Understand	CO 3	ACS511.05
9	Compare wiener filter with inverse filtering and constrained least square filtering	Remember	CO 3	ACS511.05
10	What is image filtering process? List out various image filtering techniques	Remember	CO 3	ACS511.05
11	Explain notch reject filters. How can we obtain the notch filter that pass rather than suppressing the frequency in notch area?	Understand	CO 3	ACS511.05
12	Compare different filters in the frequency domain for noise reduction	Remember	CO 3	ACS511.05
13	Discuss about linear and position-invariant degradations	Understand	CO 3	ACS511.05
Part – C (Problem Solving and Critical Thinking Questions)				
1	Apply Arithmetic, geometric, median filters of various sizes on image. Analyze the result.	Remember	CO 3	ACS511.05
2	Obtain equations for butter worth, gaussian band reject filters	Understand	CO 3	ACS511.05

3	Obtain equations for butter worth, Gaussian band pass filters	Understand	CO 3	ACS511.05
4	Explain Iterative deterministic approaches to restoration Constrained least squares iteration and Least squares iteration.	Remember	CO 3	ACS511.05
5	Derive the expression for observed image when the degradations are linear position invariant.	Remember	CO 3	ACS511.05

UNIT-IV

COLOR IMAGE PROCESSING

Part - A (Short Answer Questions)

1	Define color image. Explain the need of color image processing.	Understand	CO 4	ACS511.05
2	Distinguish between different color models	Understand	CO 4	ACS511.05
3	Mention the process of transforming gray-level image to color image	Remember	CO 4	ACS511.05
4	List out different color models in color image processing and discuss about pseudo color image processing	Remember	CO 4	ACS511.05
5	Give the names of different color transformations	Remember	CO 4	ACS511.05
6	What is color image smoothing and sharpening?	Understand	CO 4	ACS511.05
7	What is color segmentation? Explain how segmentation done in HSB color space	Understand	CO 4	ACS511.05
8	Define noise in color images. What is color image compression	Understand	CO 4	ACS511.05
9	List out different multi resolution expansions in wavelets and Multi resolution processing	Understand	CO 4	ACS511.05
10	Compare image pyramids and sub band coding techniques	Remember	CO 4	ACS511.05
11	Discuss about Haar transform in wavelets and multiresolution processing	Understand	CO 4	ACS511.05
12	Give some applications of color image processing	Remember	CO 4	ACS511.05
13	Distinguish between wavelet transforms in one and two dimensions	Understand	CO 4	ACS511.05
14	What is wavelet packet and fast wavelet transform?	Understand	CO 4	ACS511.05
15	What is the difference between encoder and decoder? Give the names of different encoders and decoders	Understand	CO 4	ACS511.05
16	List out the types of encoders. What are the three operations performed by source encoder	Remember	CO 4	ACS511.05
17	What is the need for Compression? What are different Compression Methods?	Understand	CO 4	ACS511.05
18	Discuss about i)Bit-plane coding ii)Lossless predictive coding	Understand	CO 4	ACS511.05
19	Write short notes on i)Variable-length coding ii)LZW coding	Understand	CO 4	ACS511.05
20	What are the differences between error-free compression and lossy compression?	Understand	CO 4	ACS511.05
21	Expand JPEG. What are the basic steps in JPEG?	Remember	CO 4	ACS511.05
22	Define coding redundancy and inter pixel redundancy	Understand	CO 4	ACS511.05
23	What are the operations performed by error free compression?	Understand	CO 4	ACS511.05

Part – B (Long Answer Questions)

1	Discuss about fundamentals required for color image processing	Understand	CO 4	ACS511.05
2	Write short notes on i)RGB color model ii)HSI and CMYK color models	Understand	CO 4	ACS511.05
3	Compare pseudo color and full-color image processing techniques.	Remember	CO 4	ACS511.05
4	What is the need of color transformation? Explain different color transformation techniques.	Understand	CO 4	ACS511.05
5	What is multiresolution expansion? Discuss about series expansions and scaling functions.	Understand	CO 4	ACS511.05

6	Define smoothing and sharpening process. Explain the process in color images.	Understand	CO 4	ACS511.05
7	Explain how noise can be reduced in color images.	Understand	CO 4	ACS511.05
8	Compare segmentation in HIS color space and RGB vector space	Remember	CO 4	ACS511.05
9	Give the summary on wavelets and multiresolution processing	Remember	CO 4	ACS511.05
10	Describe the process involved in discrete and continuous wavelet transform	Understand	CO 4	ACS511.05
11	Explain in detail about image compression models.	Understand	CO 4	ACS511.05
12	Specify the characteristics of lossless and lossy compression.	Remember	CO 4	ACS511.05
13	Determine the method of generating variable length codes with an example	Understand	CO 4	ACS511.05
14	Describe the following related to lossy compression i) Transform coding ii) Wavelet coding	Understand	CO 4	ACS511.05
15	Discuss about wavelet transforms in one and two dimensions	Understand	CO 4	ACS511.05

Part – C (Problem Solving and Critical Thinking Questions)

1	The color intensity of each pixel in the image depends on the spectral properties of two components except for the object. What are these?	Remember	CO 4	ACS511.05
2	What are the applications of wavelet transforms in image processing? Discuss.	Understand	CO 4	ACS511.05
3	On which type of images can we expect that run-length coding gives high compression. Discuss the degree of compression when using JPEG.	Remember	CO 4	ACS511.05
4	Explain about JPEG compression standard and the steps involved in JPEG compression	Understand	CO 4	ACS511.05

UNIT-V

MORPHOLOGICAL IMAGE PROCESSING

Part - A (Short Answer Questions)

1	What is morphological image processing?	Understand	CO 5	ACS511.05
2	Describe dilation morphological transformations on a binary image.	Understand	CO 5	ACS511.05
3	Describe erosion morphological transformations on a binary image .	Understand	CO 5	ACS511.05
4	Write short notes on Structuring elements in image morphological transformations.	Understand	CO 5	ACS511.05
5	Write short notes on Digital image water marking.	Understand	CO 5	ACS511.05
6	List out the Applications of morphology.	Remember	CO 5	ACS511.05
7	Give the Applications of digital water marking?	Remember	CO 5	ACS511.05
8	What is encoding technique in digital water marking	Understand	CO 5	ACS511.05
9	What is decoding technique in digital water marking	Understand	CO 5	ACS511.05
10	What is “bridging gap”, how it is achieved with the help of dilation?	Understand	CO 5	ACS511.05
11	What is Hit-or-Miss Transformation?	Understand	CO 5	ACS511.05
12	Mention some basic morphological algorithms	Remember	CO 5	ACS511.05
13	Give the summary of morphological operations on binary images	Remember	CO 5	ACS511.05
14	Write the differences between any two morphological algorithms	Understand	CO 5	ACS511.05
15	Write algorithm for i) Convex Hull ii) Thinning	Understand	CO 5	ACS511.05
16	Explain how to detect discontinuities in image segmentation?	Understand	CO 5	ACS511.05
17	Differentiate between optimal and Global thresholding.	Remember	CO 5	ACS511.05
18	What are the things included in Region Based segmentation?	Understand	CO 5	ACS511.05

19	What is the use of boundary characteristics in image segmentation?	Understand	CO 5	ACS511.05
20	List out the differences between point, edge and line detection in image segmentation.	Remember	CO 5	ACS511.05
21	Define thresholding. What is the role of illumination in thresholding?	Understand	CO 5	ACS511.05
22	Discuss about thresholds based on several variables	Understand	CO 5	ACS511.05
23	What is edge linking and boundary detection in image segmentation?	Understand	CO 5	ACS511.05
Part – B (Long Answer Questions)				
1	What is the need of morphological image processing? Mention and explain applications of morphological image processing	Understand	CO 5	ACS511.05
2	Discuss about different morphological algorithms	Understand	CO 5	ACS511.05
3	Determine the importance of Hit-or-Miss morphological transformation operation on a digital binary image	Remember	CO 5	ACS511.05
4	Explain the opening operation in image morphology with examples?	Understand	CO 5	ACS511.05
5	Explain the closing operation in image morphology with examples?	Understand	CO 5	ACS511.05
6	Mention algorithms for i)Extraction of connected components ii)skeleton iii)pruning	Remember	CO 5	ACS511.05
7	What are the preliminaries for morphological image processing? Explain.	Understand	CO 5	ACS511.05
8	Write short notes on image segmentation and edge detection.	Understand	CO 5	ACS511.05
9	Discuss region oriented segmentation in detail.	Understand	CO 5	ACS511.05
10	What are the derivative operators useful in image segmentation? Explain their role in segmentation	Understand	CO 5	ACS511.05
11	What is thresholding? Explain about global thresholding	Understand	CO 5	ACS511.05
12	Explain about the Global processing via the Hough Transform for Edge linking	Understand	CO 5	ACS511.05
13	Write in detail about the Global processing via graph-theoretic techniques for edge linking	Understand	CO 5	ACS511.05
14	Discuss in detail the threshold selection based on boundary characteristics	Understand	CO 5	ACS511.05
Part – C (Problem Solving and Critical Thinking Questions)				
1	Describe at least three different morphological set operations (except erosion and dilation). What in the image disappears when it is eroded and dilated, respectively	Understand	CO 5	ACS511.05
2	Consider two structuring elements s_1 and s_2 , where s_1 is a disc of radius r and s_2 is a circle with radius r . The center of the disc and circle respectively is the origin. Will dilation and erosion using s_1 or s_2 yield the same results with any set? Justify your answers.	Analyze	CO 5	ACS511.05
3	One category of image segmentation is referred to as edge-based segmentation. Describe how the first and second order derivatives can be used to detect edges, how they differ from each other, how they are affected by noise, and which filter masks can be used.	Remember	CO 5	ACS511.05
4	Explain region growing by pixel aggregation for image segmentation.	Remember	CO 5	ACS511.05