INSTITUTE OF AERONAUTICAL ENGINEERING

(AUTONOMOUS)

Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

TUTORIAL QUESTION BANK

Course Name	**:**	**DIGITAL IMAGE PROCESSING**
Course Code	**:**	**A70436-R15**
Class	**:**	**IV B. Tech I Semester**
Branch	**:**	**Electronics and Communication Engineering**
Year	**:**	**2018 – 2019**
Course Coordinator	**:**	**Dr .S. China Venkateswarlu, Professor-ECE**
Team of Instructors	**:**	**Dr. V. Padmanabha Reddy, Professor-ECE**

COURSE OBJECTIVE

This course gives the students the fundamentals of digital image processing, linear filtering, linear transforms, image enhancement in both spatial and frequency domain;; image reconstruction; inverse problems in imaging; edge detection; feature extraction; compression; wavelet based imaging and mathematical morphology

UNIT – I DIGITAL IMAGE FUNDAMENTALS & IMAGE T RANSFORMS			
S. No	**Question**	**Blooms Taxonomy level**	**Course Outcomes**
Group - A (Short Answer Questions)			
1	List the steps involved in digital image processing	Understand	1
2	How do you represent the digital images?	Remember	1
3	Explain about sampling and quantization of an image.	Understand	1
4	Explain a simple Image formation model	Understand	1
5	Name various arithmetic and logical operations that can be done on Images	Understand	1
6	What are the different fields in which Digital Image Processing is used?	Remember	1
7	Explain about some of the geometrical operations that can be done on images	Understand	1
8	Distinguish between Fourier Magnitude Spectrum, Fourier Phase Spectrum and Power spectrum.	Remember	1
9	Define discrete cosine transform	Understand	1
10	Define an Image.	Understand	1
11	What is meant by pixel?	Understand	1
12	Define Resolutions.	Remember	1
13	What is Dynamic Range?	Understand	1
14	What is meant by illumination and reflectance?	Remember	1
15	Find the number of bits required to store a 256 X 256 image with 32 gray levels	Remember	1
16	Write the expression to find the number of bits to store a digital image?	Understand	1
17	What is the need for transform?	Understand	1
18	What is Image Transform?	Understand	1
19	What are the applications of transform?	Understand	1
20	What are the properties of unitary transform?	Understand	1

Group – B (Long Answer Questions)			
1	Explain the steps involved in digital image processing	Understand	1
2	Discuss about the following relationships between pixels with neat diagrams i) Neighbours of a pixel ii) Connectivity iii) Distance measures iv) Path	Remember	1
3	Write the expressions for Walsh transform kernel and Walsh transform (1D &2D).	Remember	1
4	Briefly explain the forward and inverse transformation kernels of image transforms	Understand	1
5	Name and explain some important properties of 2-D DFT	Understand	1
6	Discuss in detail about the Slant transform (1-D & 2-D) in Image processing.	Remember	1
7	Determined the Hadamard transforms (1-D & 2-D) in Image processing.	Remember	1
8	Staten and explain about the Haar transform (1-D & 2-D) in Image processing.	Remember	1
9	Discuss about the Hotelling transforms (1-D & 2-D)	Remember	1
10	State and prove separability property of 2D-DFT.	Understand	1
11	State and prove the translation property with example.	Remember	1
12	State distributivity and scaling property with example.	Remember	1
Group – C (Analytical Questions)			
1	Calculate DCT matrix of order 8?	Remember	2
2	Calculate Haar Transform matrix of order 8?	Remember	2
3	Write Hadamard matrix of order 3?	Understand	1
4	Compare different Transform Techniques.	Understand	1
5	Obtain K L Transform for X=[1 2 1 0]	Understand	2
UNIT – II IMAGE ENHANCEMENT (SPATIAL DOMAIN & FREQUENCY DOMAIN)			
S. No	**Question**	**Blooms taxonomy level**	**Course Outcomes**
Group - A (Short Answer Questions)			
1.	Narrate the concept of derivative filters.	Understand	3
2.	Discuss how the derivative filters are used in Digital Image Enhancement?	Remember	3
3.	Describe Histogram Specification	Understand	3
4	Explain Gray level transformation functions for contrast enhancement	Remember	3
5	Discuss the Image negatives transformations	Understand	3
6	Discuss the Contrast stretching transformations	Understand	3
7	Explain the Local enhancement	Understand	3
8	Explain the Image subtraction	Understand	3
9	Explain the Image averaging	Understand	3
10	What is the objective of image enhancement? Define spatial domain. Define point processing	Remember	3
11	Explain on procedure to derive frequency domain filtering from spatial domain..	Remember	3
12	Explain the method to set the cut off frequencies in ILPF?	Understand	3
13	Correspondence between filtering in the spatial & frequency domains	Understand	3
14	Explanation on the basic steps for filtering used to enhance an image in frequency domain	Understand	3

15	Explain the concept of homomorphism filtering	Understand	3
Group – B (Long Answer Questions)			
1.	Explain smoothing spatial filters and nonlinear order statistic spatial filters.	Understand	3
2.	Explain about Prewitt and Sobel edge detectors	Remember	3
3.	Describe image Histogram equalization	Remember	3
4.	Explain the method of using the second derivate for Image sharpening by Laplacian Operator	Remember	3
5.	What is high boost spatial filtering? Compare it with high pass spatial filtering?	Understand	3
6.	Discuss how the Bit Plane Slicing is useful in image processing	Understand	3
7.	Discuss the importance of a kernel or mask or window in spatial filtering used for enhancement of a digital image	Remember	3
8.	How does the spatial filter with name Order static filter (non_ linear filter) or median filter work?	Evaluate	3
9.	What is meant by image enhancement by point processing? Discuss any two methods in it.	Remember	3
10	Define histogram of a digital image. Explain how histogram is useful in image enhancement?	Understand	3
11	Write about Smoothing Spatial filters	Understand	3
12	What is meant by the Gradiant and the Laplacian? Discuss their role in image enhancement.	Remember	3
13	Description of Homo-morphic filtering	Remember	3
14	Expression for 2-D IHPF, Expression for BHPF, Expression for GHPF with sketches. Explain their usefulness in Image enhancement	Understand	3
15	Give the expression for 2-D ILPF, BLPF & GLPF functions and sketch them. Explain their usefulness in Image enhancement	Understand	3
16	Expression for Butterworth Low Pass Filter in frequency domain and discuss	Remember	3
17	Compare the characteristics of Low pass, High pass and Homo-morphic filters in image enhancement in frequency domain.	Remember	3
18	Discuss about Ideal High Pass Filter and Butterworth High Pass filter	Remember	3
19	Discuss about Gaussian High Pass and Gaussian Low Pass Filter	Remember	3
20	Explain how Laplacian is implemented in frequency domain	Remember	3
21	Write about high boost and high frequency filtering	Understand	3
Group – C (Analytical Questions)			
1	Compare Butterworth, Gaussian and ideal filter responses.	Remember	3
2	Explain how median filter eliminates Salt & Pepper noise.	Remember	3
3	Explain need for image padding when filtering in frequency domain.	Remember	3
4	Explain Local Histogram equalization	Understand	3
UNIT – III IMAGE RESTORATION			
Group - A (Short Answer Questions)			
1	Compare image enhancement and restoration techniques?	Understand	4
2	Give the probability density functions for Rayleigh noise models	Remember	4
3	Give the probability density functions for the Erlang noise models	Remember	4
4	Give the probability density functions for Gaussian noise models	Remember	4

5	Give the probability density functions for Salt and Pepper noise models	Remember	4
6	Explain adaptive median filter and its advantages.	Understand	4
7	How do you reduce the periodic noise using frequency domain filters?	Understand	4
8	What is image restoration?	Remember	4
9	Image restoration and image enhancement differences	Understand	4
10	List out the all Image observation models.	Remember	4
11	Explain Noise models	Understand	4
12	Explain A general model of a simplified digital image degradation process	Understand	4
13	Mention the Possible classification of restoration methods	Remember	4
14	Give the Linear position invariant degradation models	Remember	4
15	Write Typical linear position invariant degradation models	Understand	4
MID-II			
16	Give Some characteristic metrics for degradation models	Understand	4
17	Explain in detail about the One dimensional discrete degradation model. Circular convolution.	Understand	4
18	Explain Two dimensional discrete degradation model. Circular convolution	Understand	4
19	Give Direct deterministic approaches to restoration: Inverse filtering,	Remember	4
20	Determined Computational issues concerning inverse filtering	Understand	4
21	Give Constrained least squares (CLS) restoration	Understand	4
22	Explain Computational issues concerning the CLS method	Understand	4
23	Give Projection onto convex sets (POCS)	Remember	4
24	Explain in detail about the Spatially adaptive iteration	Understand	4
25	Determined about the model for image distortion	Remember	4
26	Give assumptions for the distortion model and common noise models	Understand	4
27	Give noise-reduction filters with Examples	Remember	4
28	Explain pseudo-inverse filtering	Remember	4
29	What are the observations about Wiener filter	Understand	4
30	How to improve Wiener filters	Understand	4
31	Give some geometric distortions	Understand	4
Group – B (Long Answer Questions)			
1	Explain the method of Least Mean Squares Filtering (Wiener) for image restoration	Understand	4
2	Explain model of image degradation/restoration process with a block diagram	Remember	4
3	Explain the method of Constrained Least Squares Filtering for image restoration	Understand	4
4	Explain three principle ways to estimate the degradation function for use in image restoration	Understand	4
5	Discuss the process of image restoration by direct inverse filtering?	Understand	4
6	Write about Noise Probability Density Functions for all noise models	Understand	4
MID-II			
7	Explain about iterative nonlinear restoration using the Lucy–Richardson algorithm.	Understand	4
8	Computational issues concerning iterative techniques	Understand	4

9	Stochastic approaches to restoration	Remember	4
10	Wiener smoothing filter , Relation with inverse filtering and Iterative Wiener filters	Understand	4
11	Explain the importance process in image restoration process in image processing.	Remember	4
12	Explain any four important noise probability density functions.	Remember	4
13	Discuss the importance of adaptive filters in image restoration system. Highlight the working of adaptive median filters.	Remember	4
Group – C (Analytical Questions)			
1	Apply Arithmetic, geometric, median filters of various sizes on image.Analyze the result.	Remember	4
2	Obtain equations for butterworth,gaussian band reject filters	Understand	4
3	Obtain equations for butterworth,gaussian band pass filters	Understand	4
4	Explain Iterative deterministic approaches to restoration Constrained least squares iteration and Least squares iteration	Remember	4
5	Derive the expression for observed image when the degradations are linear position invariant.	Remember	4
MID-II			
6	With a block diagram, briefly explain the image model of degradation- restoration process.	Understand	4
7	Explain notch reject filters. How can we obtain the notch filter that pass rather than suppressing the frequency in notch area?	Understand	4
8	Explain the Weiner filtering method of restoring images.	Remember	4
9	Discuss and Explain the method of Least Mean Squares Filtering for image restoration	Understand	4
10	Explain Computational issues concerning the CLS method	Understand	4
UNIT – IV IMAGE SEGMENTATION & MORPHOLOGICAL IMAGE PROCESSING			
Group - A (Short Answer Questions)			
1.	Write about edge detection.	Remember	5
2.	Explain about the Local processing for edge linking.	Understand	5
3.	Write short note on Region Growing.	Remember	5
4.	Determined the mask for prewitt operator .	Remember	5
5.	Write the mask for sobel operator.	Remember	5
6.	Define mask for laplacian operator .	Remember	5
7.	Define segmentation.	Remember	5
8.	Describe dilation morphological transformations on a binary image.	Remember	7
9.	Describe erosion morphological transformations on a binary image .	Remember	7
10.	Write short notes on Structuring elements in image morphological transformations.	Understand	7
11.	Write short notes on Digital image water marking.	Remember	7
12.	List out the Applications of morphology.	Remember	7
13.	What are the Applications of digital water marking.	Remember	7
14.	What is encoding technique in digital water marking	Remember	7
15.	What is decoding technique in digital water marking	Remember	7
Group – B (Long Answer Questions)			
1.	What are the derivative operators useful in image segmentation? Explain their role in segmentation	Understand	5
2.	What is thresholding? Explain about global thresholding	Remember	5

3.	Determined the basic adaptive thresholding process used in image segmentation	Understand	5
4.	Discuss in detail the threshold selection based on boundary characteristics	Understand	5
5.	Determined the region based segmentation in image processing.	Understand	5
6.	What are the derivative operators useful in image segmentation? Explain their role in segmentation.	Remember	5
7.	Explain about the Global processing via the Hough Transform for edge linking	Remember	5
8.	Discuss in detail about the Global processing via graph-theoretic techniques for edge linking	Understand	5
9.	Explain about Region Splitting and Merging with an example	Remember	5
10	Determined the importance of Hit-or-Miss morphological transformation operation on a digital binary image	Understand	6
11	Explain the opening operation in image morphology with examples?	Remember	6
12	Explain the closing operation in image morphology with examples?	Understand	7
13	Discuss the main steps involved in Continuous Wavelet Transform	Understand	7
Group – C (Analytical Questions)			
1.	Write short notes on Hit-miss Transformation	Understand	7
2.	Write short notes on dilation or erosion	Understand	7
3.	Explain region growing by pixel aggregation for image segmentation.	Remember	7
UNIT – V IMAGE COMPRESSION			
Group - A (Short Answer Questions)			
1	How to calculate the memory required to store an image.	Understand	6
2	Define image compression.	Remember	6
3	What is image compression.	Remember	6
4	Define Coding Redundancy.	Understand	6
5	What is mean by Interpixel Redundancy .	Understand	6
6	Write about Psychovisual Redundancy.	Understand	5
7	What are the characteristics of lossy compression .	Remember	5
8	What are the characteristics of lossless compression.	Remember	5
Group - B (Long Answer Questions)			
1	Discuss in detail about the fidelity criterion.	Understand	5
2	Explain in detail about image compression models .	Understand	5
3	Determined method of generating variable length codes with an example .	Understand	5
4	Discuss in detail about the arithmetic encoding process with an example	Remember	6
5	Explain LZW coding with an example.	Remember	6
6	Explain in detail about the concept of bit plane coding method	Understand	6
7	Discuss in detail about the lossless predictive coding	Understand	6
8	Explain about lossy predictive coding	Understand	6
9	Explain with a block diagram about transform coding system	Understand	5

<table>
<tr><td colspan="5">Group – C (Analytical Questions)</td></tr>
<tr><td>1</td><td colspan="2">How to find Huffman coding for the given data<table><tr><td>Original source symbol</td><td>a2</td><td>a6</td><td>a1</td><td>a4</td><td>a3</td><td>a5</td></tr><tr><td>Probability</td><td>0.4</td><td>0.3</td><td>0.1</td><td>0.1</td><td>0.06</td><td>0.04</td></tr></table></td><td>Remember</td><td>7</td></tr>
<tr><td>2</td><td colspan="2">An 8 level image has the gray level distribution as given in the table. Compute the average pixel length for each code, compression ratio and Relative redundancy .<table><tr><td>r_k</td><td>$P_r(r_k)$</td><td>Code 1</td><td>$L_1(r_k)$</td><td>Code 2</td><td>$L_2(r_k)$</td></tr><tr><td>r_{87}</td><td>0.25</td><td>01010111</td><td>8</td><td>01</td><td>2</td></tr><tr><td>r_{128}</td><td>0.47</td><td>10000000</td><td>8</td><td>1</td><td>1</td></tr><tr><td>r_{186}</td><td>0.25</td><td>11000100</td><td>8</td><td>000</td><td>3</td></tr><tr><td>r_{255}</td><td>0.03</td><td>11111111</td><td>8</td><td>001</td><td>3</td></tr></table></td><td>Remember</td><td>7</td></tr>
<tr><td>3</td><td colspan="2">Explain about JPEG compression standard and the steps involved in JPEG compression</td><td>Understand</td><td>7</td></tr>
</table>

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