SCAD ENGINEERING COLLEGE
Department of Electronics and Communication Engineering
Question Bank
EC2029 - DIGITAL IMAGE PROCESSING
UNIT I

Part A

1. What are the fundamental steps in Image processing?
2. What are the elements of Digital Image Processing?
3. List the membranes in a Human eye?
4. What is fovea?
5. What is Photopic (or) Bright light vision?
6. What is sampling and quantization?
7. What is brightness adaptation?
8. What is subjective brightness?
9. What is Mach band effect?
10. Define Translation, Scaling and Rotation?
11. List out the properties of 2D Fourier transform.
12. Write the properties of cosine transform
13. Write the properties of KL transform
14. What are the properties of the optimum mean square quantizer?
15. What do you mean by gray level?
16. Give the Conditions for perfect transform?
17. What are the properties of unitary transform?
18. Define direct product (or) Kronecker product?
19. Give two properties of SVD transform?
20. Define 4-connectivity, 8-connectivity, m-connectivity?

PART B

1. (i)Explain any four basic relationships between pixels. (8 marks)
   (ii)What are the different transforms used in DIP? Explain the most advantageous one in detail. (8 marks)
2. (i)What is a frame buffer? Discuss the categories of digital storage for image processing applications.(8 marks)
   (ii)Describe in detail about the elements of digital image processing system.(8 marks)
3. Describe the elements of visual perception. (16)
4. Write short notes on sampling and quantization (16)
5. (i)Explain and the properties of 2D Fourier Transform. (8)
   (ii)Explain singular value decomposition and specify its properties. (8)
6. (i) Explain K-L transform in detail. (8)
   (ii) Explain Optimum mean square quantizer?(8 marks)
7. Explain discrete cosine transform and specify its properties. (16)
8. Explain in detail about vidicon camera tube. (16)
9. (i) Write the convolution of two sequences {1,2,3,4} and {-1,2,-1} as a toeplitz matrix on a 3 x 1vector
   (ii) Write the convolution of two periodic sequences {1,2,3,4, …} and {-1,2,-1,0…}, each of period 4, as a circulant matrix operating on a 4 x 1vector that represents the first sequence.
10. Explain RGB and HSI models. (16 marks)
11. Explain in detail about vidicon camera tube.
12. Describe the function of elements of digital image processing system with a diagram.

UNIT II

Part A

1. What is spatial domain method?
2. What is frequency domain method?
3. Explain the 2 categories of image enhancement.
4. Define Histogram?
5. What is histogram Equalization (or) histogram Linearization?
6. What are drawbacks of histogram equalization?
7. What is intensity level slicing/ Gray level slicing?
8. What is image averaging?
9. What is spatial filtering?
10. What is the difference between Linear and Non Linear filters?
11. Give some examples for linear and nonlinear filters?
12. What is band pass filtering?
13. What is the use of masking?
14. Specify the objective of image enhancement technique.
15. What is a Median filter?
16. Name the different types of derivative filters?
17. Define and give the transfer function of contra harmonic filter.
18. Give the PDF of Gaussian noise and plot it.
19. What do you infer from multimodal histogram?
20. Why noise is always considered to be additive in images?

PART B

1. Write in detail about histogram processing.
2. How do you enhance a monochrome image by histogram?
   (i) Equalization
   (ii) Specification technique how do you assess the qualities of enhancement?
3. (i)Give an algorithm for obtaining the average of four images of same size and explain.
   (ii)What are the important noise probability density functions?
4. What is directional smoothing? Explain how this is done. Where it is requires?
5. Discuss the procedure for color image enhancement.
6. Describe histogram equalization. Obtain Histogram equalization for the following image segment of size 5 x 5? Write the inference on image segment before and after equalization.

20	20	20	18	16
15	15	16	18	15
15	15	19	15	17
16	17	19	18	16
20	18	17	20	15

(5 x 5 matrix)

7. Obtain Histogram and Histogram equalization for a given image (4 x 4) – 4 bit per pixel is given by

10	12	8	9
10	12	12	14
12	13	10	9
14	12	10	12

8. (i)Describe how homo morphic filtering is used to separate illumination and reflectance component?
   (ii)How mean filters are used for image enhancement
9. Specify the expression for the following filters.
   (i) Geometric mean filter
   (ii) Harmonic mean filter
   (iii) Contra harmonic mean filter
10. Write notes on Homo morphic filtering.
11. Describe in detail about various types of mean filters.
12. Explain in detail about spatial averaging.

UNIT III

Part A

1. Explain additivity property in Linear Operator?
2. Define Gray-level interpolation?
3. What is meant by Noise probability density function?
4. Why the restoration is called as unconstrained restoration?
5. Which is the most frequent method to overcome the difficulty to formulate the spatial relocation of pixels?
6. What are the three methods of estimating the degradation function?
7. Give the difference between Enhancement and Restoration?
8. What are the forms of degradation?
9. Draw the model of image degradation process.
10. List the properties involved in Degradation model?
11. Give the relation for degradation model for continuous function?
12. Give the relation for 2-D discrete degradation model?
13. List the algebraic approach in Image restoration?
14. What is inverse filtering?
15. Define Blind Image restoration.
16. What are the properties of median filters?
17. Write any two differences between unconstraint and constraint restoration.
18. Define spatial transformation.
19. Define rubber sheet transformation
20. What is geometric transformation?

PART B

1. Describe, with mathematical model, both constrained and unconstrained restoration.
2. Explain Weiner filtering approach for image restoration.
3. What is gray level interpolation? Explain the schemes involved it.
4. Differentiate constrained and unconstrained restoration.
5. Write notes on Inverse Filtering.
6. Write notes on least square error filter.
7. Elaborate constrained and unconstrained restoration.
8. What is rubber sheet transformation? Describe the basic operations involved in it.
9. Write short notes on minimum square error filtering.
10. Describe constrained least square filtering for image restoration and derive its transfer function.
11. Explain the concept of geometric transformation for image restoration?
12. How wiener filtering is helpful to reduce the mean square error?

UNIT IV

Part A

1. What is segmentation?
2. How the derivatives are obtained in edge detection during formulation?
3. What are the two properties used for establishing similarity of edge pixels?
4. Give the properties of the second derivative around an edge?
5. Define Gradient Operator?
6. What is meant by object point and background point?
7. What is global, Local and dynamic or adaptive threshold?
8. Define region growing?
9. What are the 2 principles steps involved in marker selection?
10. What are the various methods of thresholding in image segmentation?
11. What is Hough transform?
12. Give any two applications of Hough transform.
13. Define catchment basin.
14. What is Marker? Mention its types
15. Write sobel horizontal and vertical edge detection masks (or) Define sobel operator
16. Mention the procedure involved in marker selection.
17. How do you know that an image is getting over segmented?
18. State the condition to be met by the partitions in region based segmentation.
19. What is the principle of region growing based image segmentation?
20. What is thinning or skeletonizing algorithm?

PART B

1. How do you link edge pixels through global processing?
2. Explain global processing using Hough transform
3. Describe Watershed segmentation algorithm
4. Explain region based segmentation and region growing with an example.
5. Discuss how to construct dams using morphological operations?
6. What do you understand by dilation and erosion in morphological operation. Explain in detail
7. Discuss in detail about the threshold selection based on boundary characteristics.
8. Elaborate the process of dam construction along with the watershed segmentation algorithm.
9. How do you perform edge defection? Give suitable algorithm and discuss how the edge points are linked?
10. Discuss how
    (i) Region growing
    (ii) Region splitting and merging approaches are used for image segmentation
11. What is edge detection? Describe in detail about the types of edge detection operation.
12. Describe in detail about segmentation by morphological watersheds.

UNIT V

Part A

1. Define is coding redundancy?
2. Define interpixel redundancy?
3. What are the components of Encoder?
4. What are operations composed in Error-Free Compression
5. What are variable-Length coding and name the types of variable-Length coding
6. What is the limitation of Huffman coding?
7. Define bit plane coding?
8. State the disadvantage in bit plane coding?

9. Give the formula to find the run-length entropy?
10. What are the operations performed by error free compression?
11. Coding the representation to eliminate coding redundancy
12. Define the procedure for Huffman shift
13. What is bit plane Decomposition?
14. How effectiveness of quantization can be improved?
15. What are the basic steps in JPEG?
16. What is zig zag sequence?
17. Define I-frame
18. Define P-frame
19. What is the use of MPEG standard?
20. What are performance metrics for evaluating image compression?

PART B

1. With neat block diagram, explain two dimensional transform coding.
2. Write short notes on Run length encoding and Shift codes.
3. Explain in detail about continuous tone still image compression standard.
4. Decode the message 0.23355 given the coding model.
   a-0.2, e-0.3, i-0.1, o-0.2, u-0.1,!-0.1
5. Determine the Huffman code assignment procedure for the following data. Compute the average length of the code and the entropy of the source. Is Huffman code uniquely decodable? If so, justify our answer.
6. Discuss the methods of constructing the masking function based on maximum variance and maximum magnitude.
7. Draw and explain the block diagram of MPEG encoder. (8 marks)
8. Explain the need for image compression. How run length encoding approach is used for compression? Is it lossy? Justify.
9. Write short notes on:
   (i) Arithmetic coding.
   (ii) Vector quantization.
   (iii) JPEG standards.
10. Briefly explain transform coding with neat sketch.
11. 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
   (i) Find a Huffman code for this source?
   (ii) Find the average length of the code and its redundancy?
12. Generate the tag for the sequence 1 3 2 1 for the probabilities P(1)=0.8, P(2)=0.02, P(3)=0.1813. How an image is compressed using JPEG Image compression standard?