UNIT I DIGITAL IMAGE FUNDAMENTALS

PART A

Elements of Digital Image processing (DIP) systems

1. What is a pixel?

2. Define–Digital Image

3. What are the steps involved in DIP?

4. List the categories of digital storage.

5. What is dynamic range?

6. Define – Digital Image Processing

7. What are the types of connectivity?

8. Write the formula for calculating D_4 and D_8 distance.

9. What is geometric transformation?

Elements of visual perception, brightness, contrast, hue, saturation, machband effect

1. Define – Brightness

2. Define – Luminance

3. What are the types of light receptors?

4. How cones and rods are distributed in retina?

5. Define – Subjective Brightness and Brightness Adaptation

6. What is meant by machband effect?

7. What are hue and saturation?

8. Define – 4 and 8 Neighbors of a Pixel

Color Image Fundamentals- RGB, HSI models

1. What is meant by colour model?

2. List the hardware oriented colour models.

Image Sampling, Quantization, dither

1. Define – Sampling and Quantization

2. Write the expression for finding the number of bits required to store a digital image.

3. Define –Tapered Quantization

2-D mathematical preliminaries, 2-D Transform -DFT,DCT,KLT,SVD

1. List the properties of 2D Fourier transform.

2. List the properties of forward transformation kernel.

3. KLT is an optimum transform - Justify.

4. What is separable image transform?

5. List the properties of Singular Value Decomposition (SVD).

6. What is the need for a transform?

7. What are the applications of transform?

8. List the properties of two-dimensional DFT.

9. What is image translation and scaling?

PART B

Elements of Digital Image processing (DIP) systems

1. What are the elements of image processing system? Describe its working.

   (M/J –12), (N/D–12), (N/D–08)

2. Whatis a frame buffer? Write the categories of digital storage for image processing applications.   (8)

Elements of visual perception, brightness, contrast, hue, saturation, machband effect

1. Explain with neat diagram,the elements of visual perception.

2. Explain any four basic relationships between pixels.   (8)

Color Image Fundamentals- RGB, HSI models

1. How an RGB model is represented using HSI format? Describe the transformation.

2. Write in detail,the RGB colour model.

Image Sampling, Quantization, dither

1. Explain the principle of sampling and quantization. Discuss the effect of increasing the

   a) Sampling frequency

   b) Quantization levels on image

2-D mathematical preliminaries, 2-D Transform -DFT,DCT,KLT,SVD

2. Explain the computation of DFT for a given 2D image.

3. Explain the different transforms in DIP and explain any one in detail.

4. Explain the following separable transforms

   a) Hadamard transform

   b) DCT transform

   c) Karhunen - Loeve transform

UNIT II- IMAGE ENHANCEMENT

PART A

Histogram Equalization and Specification

   1. List the categories of image enhancement.

   2. What is meant by bit plane slicing?

   3. Define – Histogram

   4. What is a multimodal histogram?

   5. List the types of image enhancement.

   6. Write the objectives of image enhancement technique.

Noise Distributions

   1. Why does the noise always considered to be additive in images?

Spatial Averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contraharmonic mean filters, Homomorphic filtering

   1. List the different types of derivative filters.

   2. State the principle of directional smoothing.

   3. Define – Geometric Mean Filtering

   4. Compare spatial and frequency domain methods.

   5. What are the effects of applying Butterworth low pass filter to the noisy image?

   6. Define–Contrast Stretching

   7. What is gray level slicing?

   8. What is the purpose of image averaging?

   9. What is meant by masking?

   10. Write the steps involved in frequency domain filtering.

   11. What is image negative?

12. Define–Spatial Filtering

13. What is meant by median filter?

14. What are maximum filter and minimum filter?

15. Write the applications of sharpening filters.

PART B

Histogram Equalization and Specification

1. Howis a monochrome image enhanced by histogram equalization?

2. Explain histogram processing.

3. Write an algorithm for obtaining the average of four images of same size .

4. Explainhomomorphic filtering.

5. How are image subtraction and image averaging is used to enhance the image?

6. Explain the various sharpening filters used in spatial domain.

7. Explain the spatial domain methods for image enhancement.

8. Explain image enhancement in frequency domain using

   a) Low Pass Filter

   b) High Pass Filter

Color Image Enhancement

9. Explaincolour image enhancement.

UNIT III - IMAGE RESTORATION AND SEGMENTATION

PART A

Image Restoration - degradation model

1. What is meant by image restoration?

2. Differentiate enhancement from restoration.

3. How a degradation process is is modeled?

4. What are the types of noise models?

5. Write the expression for gamma noise.

6. Write the expression for uniform noise.

7. Write the expression for Impulse noise.

Unconstrained restoration - Lagrange multiplier and constrained restoration, Inverse Filtering

8. Define–Geometric Transformation

9. Define –Averaging Filters

10. Write the condition to be met by the partitions in region based segmentation.

11. What is inverse filtering?

12. Why the restoration is called an unconstrained restoration?

13. What are the three methods of estimating the degradation function?

14. What is pseudo inverse filter?

15. What is least mean square filter?

16. What is blind image restoration?

Removal of blur caused by linear motion, Wiener filtering

17. What are the two approaches for blind image restoration?

Geometric Transformations - spatial transformations

18. Define –Gray Level Interpolation

19. What is rubber sheet transformation?

Edge Detection

20. Define –Texture

21. How is edge detection used for detecting discontinuities in a digital image?

22. What is directional derivative? Where is it used?

23. Define – Sobel Operator

24. What are the three types of discontinuity in digital image?

25. How are the derivatives obtained in edge detection during formulation?

26. What are the two properties used for establishing similarity of edge pixels?

27. What is an edge?

28. List out the properties of the second derivative around an edge.

29. Define –Gradient Operator **Edge**

Linking via Hough Transform

30. List out the steps involved in splitting and merging.

Thresholding

31. What is a global, local and dynamic or adaptive threshold?

32. Define – Chain Code Derivative in 4 and 8 connectivity

Region based growing,Region splitting and Merging

33. How is an image identified as an over segmented?   (M/J −12)

34. What is the principle of region growing based image segmentation?

Segmentation by Morphological watersheds ,watershed algorithm

35. What is segmentation?

36. List the applications of segmentation.

37. What are the uses of markers?

38. What is the condition to be met by the partitions in region based segmentation?

PART B

Image Restoration - degradation model,Unconstrained restoration - Lagrange multiplier and constrained restoration, Inverse Filtering

1. Explain the following

    a) Inverse filtering

    b) Least square error filtering

2. What is image restoration? Explain the degradation model for continuous function.

3. Explain mean filters.

4. Explain the constrained least square restoration.

5. Explain the digital image restoration system and the image observation models.

Removal of blur caused by linear motion, Wiener filtering, Geometric Transformations -

spatial transformations

6. Explain theWiener filtering approach for image restoration.

7. What is gray level interpolation? Explain the schemes involved in it.(N/D −12)

8. What is rubber sheet transformation? Explain the basic operations involved in it.

9. Explain the blind image restoration.

Edge Detection

10. How is edge detection performed? Write a suitable algorithm and explain the edge point linking.

11. What is edge detection? Describe the types of edge detection operations.

Edge Linking via Hough Transform

12. Explain global processing using Hough Transform.

Thresholding

13. Explain the concept of thresholding in image segmentation and write its merits and demerits.

Region based growing,Region splitting and Merging

14. How are region growing ,region splitting and merging approaches used for image segmentation.

Segmentation by Morphological watersheds ,watershed algorithm

15. Explain segmentation by morphological watersheds.

16. Explain the watershed segmentation algorithm.

UNIT IV–WAVELETS AND IMAGE COMPRESSION

PART A

Need for data compression

1. What is the need for compression?

2. Define –Compression Ratio.

3.   What is image compression?

4. What is data compression?

5. What are the types of data compression?

Codings

6. What are the coding systems in JPEG?

7. How shift codes are generated?

8. Write the Hadamard transform matrix H_n for n=3.

9. What is interpixel redundancy?

10. Define –Coding Redundancy

11. Define – Interpixel Redundancy

12. What is run length coding?

13. Define –Psycho Visual Redundancy

14. Define –Encoder

15. Define –Source Encoder

16. Define –Channel Encoder

17. What are the types of decoder?

18. What are the operations performed by error free compression?

19. What is Variable Length Coding?

20. Define – Huffman Coding

21. Define –I frame

22. Define–P frame

JPEG and MPEG standards

23. What is JPEG?

24. What are the basic steps used in JPEG?

25. What is MPEG?

PART B

Need for data compression

1. Explain the image compression model with a neat diagram.

2. Explain the need for image compression. How run length encoding approach is used for compression?   (N/D –12)

3. Differentiate lossless compression from lossy compression and explain transform   coding system.

4. Explain in detail, the Huffman coding procedure with an example.

Codings

5. Explain the wavelet coding of images.

6. Explain in detail, the method of zonal and threshold coding.

7. Explain the following lossless compression coding.

     i. LZW coding

     ii. Predictive coding

8. Explain the lossy compression wavelet coding.

9. Explain the two dimensional transform coding.

10. Explain the lossless predictive coding.

11. Explain the block diagram of the lossy predictive coding with delta modulation technique.

JPEG and MPEG standards

1. Explain the MPEG encoder.

2. Explain the methods of constructing the masking function based on maximum variance and maximum magnitude.

3. Explain the image compression standards.

UNIT V – IMAGE REPRESENTATION AND RECOGNITION

PART A

1. What is pattern?

2. What is pattern class?

3. What is pattern recognition?

4. What are the three principle pattern arrangements?

5. Define –Chaincode

6. What are the demerits of chain code?

7. What is polygonal approximation method?

8. Specify the various polygonal approximation methods.

9. Name few boundary descriptors.

10. Define length of a boundary.

11. Define shape numbers

12. Name few measures used as simple descriptors in region descriptors.

13. Define texture.

14. Define compactness.

15. List the approaches to describe texture of a region.

16. What is global, local and dynamic or adaptive threshold?

PART B

1. Explain the boundary descriptors in image representation.

2. Explain the regional descriptors in image representation.

3. Explain the pattern and pattern classes in object recognition.

4. Explain the different object recognition methods.

5. Explain the structural methods in object recognition.