Code No: **R204105O** **R20** Set No. 1

IV B.Tech I Semester Regular Examinations, January – 2024
IMAGE PROCESSING
(OE-III: CE, EEE, ME, ECE, AME, MM, AGE, CSE-CS, CSE-IOTCSIBCT, CSE- IOT, FE, PHARM & CS)

Time: 3 hours   Max. Marks: 70

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks
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UNIT - I

1 a) What are the fundamental steps in an image processing system, and how do they differ from the steps in traditional photography. [7]

   b) List and describe various types of connectivity between pixels with an example of each. [7]

(OR)

2 a) Explain the concepts of image sampling and quantization. Why are these steps essential in the digitization of continuous analog images, and how do they affect image quality. [7]

   b) Discuss the hardware components of an image processing system, such as cameras and sensors. How do these components impact the quality of acquired images? [7]

UNIT - II

3 a) How does image enhancement differ from image restoration? Provide examples of image enhancement techniques and their applications. [7]

   b) What are the practical applications of image averaging in noise reduction and improving image quality? [7]

(OR)

4   Define histogram equalization and how does it enhance the contrast of an image? Explain the algorithm and its mathematical principles. [14]

UNIT - III

5   Explain the concept of redundancy in image data. How do coding redundancies, inter-pixel redundancies and psychovisual redundancies affect image compression techniques? [14]

(OR)

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6   a)   Describe the principles of run-length coding and its application in image compression. How does it exploit redundancies in binary or continuous-tone images?   [7]

    b)   Define lossless and lossy compression. What are the key differences between these two compression approaches?   [7]

UNIT - IV

7   a)   Explain the concept of expanding functions in wavelet-based image compression. How does the expansion of functions relate to signal representation?   [7]

    b)   Define scaling functions and their importance in wavelet-based image compression.   [7]

(OR)

8   a)   Provide a detailed mathematical explanation of the MRA refinement equation and its role in the wavelet transform.   [7]

    b)   Define wavelet series expansion and its use in image compression. How does it differ from other signal representation techniques like Fourier series?   [7]

UNIT - V

9   a)   What is image segmentation and explain how is image segmentation used to partition an image into meaningful regions.   [7]

    b)   Define feature extraction in the context of image analysis. What are the key characteristics or attributes extracted from images?   [7]

(OR)

10   Discuss the concept of digital image watermarking. Why is digital image watermarking needed and what are its applications in various fields.   [14]

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UNIT - I
1 a) Discuss the importance of image pre-processing in image processing. What are the common pre-processing techniques and their applications?   [7]
   b) Describe the role of memory and storage devices in image processing. What are the considerations for choosing suitable storage solutions for images?   [7]
(OR)
2 a) Explain the concept of attention in visual perception. How can image processing algorithms be designed to capture and utilize attention cues for object recognition and tracking?   [7]
   b) How do input and output devices contribute to the image processing system? Provide examples of input and output devices used in image processing.   [7]

UNIT - II
3 a) What is a basic grey level transformation in image processing, and how does it alter the appearance of an image? Provide examples of commonly used transformation functions.   [7]
   b) Discuss the advantages and limitations of histogram equalization. When is it most effective and when might it produce undesirable results.   [7]
(OR)
4 a) Describe the differences between arithmetic mean and geometric mean image averaging methods.   [7]
   b) What are smoothing filters in image processing and how do they reduce noise and enhance the overall image quality?   [7]

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UNIT - III

5   a)   Discuss the role of inter-pixel redundancies in image compression.   [7]

    b)   Provide examples of lossless compression techniques commonly used in image compression such as run-length coding.   [7]

(OR)

6   a)   Explain the concept of differential encoding and its role in encoding the difference between adjacent pixel values.   [7]

    b)   Provide an overview of the JPEG compression standard. What are its key features?   [7]

UNIT - IV

7   a)   Describe the mathematical properties of expansion functions, and provide examples of commonly used expansion functions in wavelet analysis.   [7]

    b)   Explain how scaling functions are used to generate a multi resolution representation of an image.   [7]

(OR)

8   a)   Discuss the advantages of wavelet series expansion in representing images with sharp transitions and localized features.   [7]

    b)   Explain the discrete wavelet transform (DWT) and its role in image compression.   [7]

UNIT - V

9   a)   Discuss the concept of discontinuities in image segmentation. How can abrupt changes in pixel intensity be used to detect edges and boundaries in an image.   [7]

    b)   Explain the role of texture features in image analysis. How can texture be quantified and used as a feature for classification and object recognition.   [7]

(OR)

10   a)   Describe the concept of feature-based object recognition. How are key features of objects used to identify and match them in images?   [7]

    b)   Why is there a need for digital image watermarking? Explain the primary reasons and challenges that make watermarking essential in the digital age for image protection and verification.   [7]

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UNIT - I

1 a) Explain the concept of image segmentation. How does it play a crucial role in image processing, and what are some common segmentation algorithms. [7]

   b) Discuss the importance of user interfaces in image processing systems. How can user interfaces be designed to facilitate efficient image processing tasks. [7]

(OR)

2 a) Discuss the concept of color perception and its role in image processing. How are color spaces like RGB and CMYK used to represent and manipulate color in images. [7]

   b) Describe the different types of image sensors and their working principles, including CCD and CMOS sensors. What are the advantages and disadvantages of each type? [7]

UNIT - II

3 a) Explain the concept of contrast stretching. How does it affect the dynamic range of pixel values in an image? [7]

   b) Describe the Laplacian filter and its applications in edge enhancement. What is the role of the Laplacian of Gaussian (LoG) filter in image sharpening? [7]

(OR)

4 Explain the concept of adaptive histogram equalization and its application in medical image processing. How does it differ from standard histogram equalization? [14]

UNIT - III

5 a) Explain psychovisual redundancies and their significance in image compression. [7]

   b) Discuss the trade-offs involved in lossy compression and how compression ratios impact the quality of the decompressed image. [7]

(OR)

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6   Discuss the basics of the Discrete Cosine Transform (DCT) and its use in image compression. How does the DCT convert image data from the spatial domain to the frequency domain?   [14]

UNIT - IV

7   a)   Define MRA in the context of wavelet-based image compression. How does MRA allow for the analysis of images at different scales?   [7]

   b)   Discuss the characteristics and properties of scaling functions such as orthogonality and compact support.   [7]

(OR)

8   a)   Describe the process of down-sampling in the DWT and its impact on image resolution and data reduction.   [7]

   b)   Compare and contrast the discrete wavelet transform (DWT) and the continuous wavelet transform (CWT) in the context of image compression.   [7]

UNIT - V

9   a)   Explain the process of edge linking and boundary detection in image segmentation.   [7]

   b)   Explain the concept of shape features in feature extraction. How are geometric properties used to distinguish objects in images?   [7]

(OR)

10   a)   Discuss the techniques for template matching in object recognition. How does template matching work and what are its limitations.   [7]

   b)   What are the potential risks and threats to digital images that necessitate the use of watermarking techniques? How can watermarking address these risks.   [7]

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UNIT - I

1 a) Describe the process of image restoration. What are the challenges in restoring images, and how can they be addressed. [7]

   b) Explain the process of image digitization in image sensing and acquisition. What factors affect the choice of resolution and bit depth during digitization. [7]

(OR)

2 a) How does the human visual system perceive and process motion in images and videos? Describe the applications of motion perception in image processing. [7]

   b) Compare the various image acquisition techniques such as radiographic imaging and satellite imaging. [7]

UNIT - II

3 a) Discuss the significance of image negation as a grey level transformation. [7]

   b) What are the challenges and limitations associated with sharpening filters? How can over-sharpening be avoided? [7]

(OR)

4 Discuss the challenges and techniques associated with image registration before performing image subtraction. [14]

UNIT - III

5 a) Define fidelity in the context of image compression. How is it related to the quality of the decompressed image? [7]

   b) Describe the JPEG 2000 compression standard and its improvements over the original JPEG standard. What advantages does it offer in terms of image quality and compression efficiency? [7]

(OR)