Code No: **R204104B** **R20** **Set No. 1**

IV B.Tech I Semester Regular Examinations, January – 2024

DIGITAL IMAGE PROCESSING

(Electronics and Communication Engineering)

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) Calculate the Radon Transform for a given image and describe its applications in medical imaging, specifically in computed tomography (CT) scans. [7]

b) Describe the components of an image processing system and their functions. How do these components work together to enhance or manipulate digital images? [7]

(OR)

2 a) Perform a Haar Transform on a grayscale image. Show the transformation process and the resulting Haar coefficients. [7]

b) Explain the concept of mathematical tools used in digital image processing. How do these mathematical tools contribute to image enhancement and analysis? [7]

UNIT - II

3 a) Explain how different intensity transformation functions are used to enhance or modify images. [5]

b) Apply a frequency domain filter to smooth a noisy image. Provide the calculations for the filter's frequency response and the transformed image. Discuss how this approach differs from spatial domain filtering. [9]

(OR)

4 a) Explore the fundamental concepts of spatial filtering in image processing. Discuss the differences between smoothing and sharpening spatial filters, and provide real-world examples where each type of filter is applied. [9]

b) Describe the differences between smoothing and sharpening spatial filters. [5]

UNIT - III

5 a) Discuss strategies for restoring images in the presence of noise, focusing on spatial filtering techniques. [7]

b) Include all the calculations and steps necessary to reconstruct the image using an appropriate method. [7]

(OR)

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6 a) Discuss the importance of understanding the image degradation and restoration process in digital image processing. [7]

b) Explain the role of each block and the mathematical formulation involved in Constrained Least Squares filter process. [7]

UNIT - IV

7 a) Provide a step-by-step explanation of how LZW coding works and discuss its applications and limitations in image compression. [7]

b) Explain the concept of Run-Length coding and Symbol-Based coding in image compression. [7]

(OR)

8 a) Discuss the fundamentals of image compression & Discuss Bit-Plane coding as a method of image compression. [7]

b) Explain the principles of Huffman coding and highlight strengths and weaknesses. [7]

UNIT - V

9 a) Explain its significance and provide real-world scenarios where thresholding is an effective technique for separating objects from the background. [7]

b) Numerically demonstrate the application of morphological operations (erosion and dilation) to a binary image. Provide the original image, the structuring element, and the results of the operations. [7]

(OR)

10 a) Describe the process of thresholding in image segmentation and Discuss the fundamental concepts of image segmentation. [7]

b) Perform a color-based segmentation on a full-color image. Choose a suitable color space model, apply relevant transformations, and describe how the segmentation process can separate objects based on color information. [7]

Code No: **R204104B** **R20** **Set No. 2**

IV B.Tech I Semester Regular Examinations, January – 2024

DIGITAL IMAGE PROCESSING

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

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ONE Question from Each unit
All Questions Carry Equal Marks

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UNIT - I

1 a) Perform Hadamard Transform on a grayscale image and explain its significance in pattern recognition and image encryption. [7]

b) Discuss the fundamental steps in digital image processing. Explain how image sensing and acquisition play a crucial role in this process. [7]

(OR)

2 a) Apply the Discrete Cosine Transform (DCT) to compress an image. Discuss the principles of image compression using DCT. [7]

b) Compare and contrast the Discrete Fourier Transform (DFT) of one variable with the extension to functions of two variables. What are the practical implications of these transforms in image processing? [7]

UNIT - II

3 a) Given a blurred image and the corresponding point spread function (PSF), perform image restoration using spatial filtering. Explain the deconvolution process and its impact on the restored image. [9]

b) Enlist the fundamentals of Spatial Enhancement methods with examples. [5]

(OR)

4 a) Discuss the advantages and challenges of applying spatial enhancement methods in image processing. Provide a detailed analysis of techniques that combine multiple spatial enhancement methods for superior image quality. [9]

b) Describe the advantages of analyzing and processing images in the frequency domain. [5]

UNIT - III

5 a) Noise can significantly affect the quality of digital images. Describe various noise models that are commonly encountered. [7]

b) You have an image corrupted by noise. Apply the Minimum Mean Square Error (Wiener) filtering technique to restore the image. [7]

(OR)

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Code No: **R204104B** **R20** **Set No. 2**

6	a)	Explain the concept of periodic noise in digital images.	[7]
	b)	Explain the role of each block and the mathematical formulation involved of the image restoration process using the Constrained Least Squares filter.	[7]

UNIT - IV

7	a)	Compare and contrast the basic compression methods such as Golomb coding, and Arithmetic coding.	[7]
	b)	Design an image compression system using LZW coding. Apply LZW coding to a given image and decode it, demonstrating the compression and decompression processes.	[7]

(OR)

8	a)	Discuss the fundamentals of image compression & Describe the LZW coding algorithm in image compression.	[7]
	b)	Provide a numerical example of image compression using Wavelet coding. Use a 1D or 2D wavelet transform on a grayscale image	[7]

UNIT - V

9	a)	Explore region-based segmentation techniques in digital image processing.	[7]
	b)	Provide a practical example of edge detection in image segmentation.	[7]

(OR)

10	a)	Discuss the fundamental concepts of image segmentation. Explain various methods such as point, and line, detection	[7]
	b)	Explore the concept of color image compression.	[7]

Code No: **R204104B** **R20** **Set No. 3**

IV B.Tech I Semester Regular Examinations, January – 2024

DIGITAL IMAGE PROCESSING

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

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UNIT - I

1 a) Analyze the phase components of a 2-D image's Discrete Fourier Transform (DFT) and explain their impact on the image's visual features. [7]

b) The 2-D Discrete Fourier Transform is a key concept in image processing. Explain its properties and significance in the context of image analysis and manipulation. [7]

(OR)

2 a) Explain the concept of Nyquist theorem and aliasing in image sampling. Describe advanced techniques used to address aliasing in high-frequency image components. [7]

b) Discuss the need for image transforms in digital image processing. Provide examples of situations where various image transforms, such as the Discrete Fourier Transform and Discrete Cosine Transform, are applied. [7]

UNIT - II

3 a) Describe the process of restoring a degraded image using spatial filters. Explain the role of the point spread function (PSF) in this context and the challenges associated with it. [9]

b) Describe frequency domain filters are more effective than spatial domain filters with real world examples. [5]

(OR)

4 a) Design a spatial filter for edge detection and sharpening in a digital photograph. Explain the mathematical formulation of the filter and demonstrate its effectiveness through image examples. [9]

b) Explain the concepts of histogram equalization and contrast stretching. [5]

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UNIT - III

5 a) Explain the concept of periodic noise in digital images. How does periodic noise impact image quality. [7]

b) Provide a numerical example of image restoration from projections using an appropriate method. [7]

(OR)

6 a) Apply the Minimum Mean Square Error (Wiener) filtering technique to restore the image. Explain the steps of this method and the rationale behind using it. [7]

b) Create a block diagram representing the image restoration process using the Constrained Least Squares filter. [7]

UNIT - IV

7 a) Compare and contrast the basic compression methods such as Huffman coding, and Arithmetic coding. [7]

b) Discuss Bit-Plane coding as a method of image compression. [7]

(OR)

8 a) Given a grayscale image, perform Huffman coding to compress it. Include the construction of the Huffman tree, encoding, and decoding steps. Provide an example with calculations. [7]

b) Explain the principles of Golomb coding and highlight strengths and weaknesses. [7]

UNIT - V

9 a) Discuss the fundamental concepts of image segmentation. Explain various methods such as line, and edge detection. [7]

b) Explain any two morphological algorithms for boundary extraction in Morphological Image Processing. [7]

(OR)

10 a) Discuss the principles and advantages of region-based segmentation and provide examples of when and how it is used. [7]

b) Explain the fundamentals of color image processing, including color models and transformations. [7]

Code No: **R204104B** **R20** **Set No. 4**

IV B.Tech I Semester Regular Examinations, January – 2024

DIGITAL IMAGE PROCESSING

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

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ONE Question from Each unit
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UNIT - I

1 a) Implement advanced filtering techniques, such as anisotropic diffusion or nonlinear diffusion, for image enhancement. Explain the principles of these filters and their effect on image features. [7]

b) Discuss the importance of phase in image transforms. How does phase information impact the interpretation and manipulation of digital images? [7]

(OR)

2 a) Discuss the trade-offs between image quantization levels and image quality. How do quantization errors affect the perceptual quality of the image, and what strategies are used to mitigate these errors? [7]

b) Explain the concept of Nyquist theorem and aliasing in image sampling. Describe advanced techniques used to address aliasing in high-frequency image components. [7]

UNIT - II

3 a) Given a low-contrast image, perform histogram equalization to enhance its visibility and dynamic range. Provide the step-by-step calculations and the resulting enhanced image. [9]

b) Discuss scenarios where frequency domain filtering may not be effective, especially when dealing with complex noise patterns and non-uniform illumination. [5]

(OR)

4 a) Implement a spatial filter to reduce noise in a grayscale image. Discuss the choice of filter type and parameters, and provide before-and-after images to demonstrate the noise reduction. [9]

b) Discuss the advantages of frequency domain filtering over spatial domain filtering in this context. [5]

Code No: **R204104B** **R20** **Set No. 4**

UNIT - III

5 a) Design a constrained least squares filtering process to restore an image affected by linear, position-invariant degradation. [7]

b) Create a block diagram illustrating the steps involved in the image restoration process using the Geometric Mean filter. [7]

(OR)

6 a) Given a set of image projections, perform image reconstruction using an appropriate technique, and explain the mathematical principles behind this process. [7]

b) Provide detailed explanations for each block's function and the overall process of Geometric Mean filter. [7]

UNIT - IV

7 a) Explain the importance of image compression in digital image processing and provide an overview of any two image compression techniques covered. [7]

b) Explain the principles of Arithmetic coding and highlight strengths and weaknesses. [7]

(OR)

8 a) Compare and contrast the basic compression methods such as Huffman coding, Golomb coding. [7]

b) Explain the concept of Run-Length coding and Symbol-Based coding in image compression. [7]

UNIT - V

9 a) Discuss the fundamental concepts of image segmentation. Explain various methods such as point and edge detection. [7]

b) Explore the concept of color image compression. Discuss various compression methods and their effectiveness in reducing the size of color images while preserving quality. [7]

(OR)

10 a) Explain the basic principles of morphological image processing. [7]

b) Discuss the concept of morphological watersheds for image segmentation. [7]