

**R15**

Code No: 127CJ

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**B. Tech IV Year I Semester Examinations, July/August - 2023**

**DIGITAL IMAGE PROCESSING**

**(Electronics and Communication Engineering)**

**Time: 3 Hours**

**Max. Marks: 75**

- Note:** i) Question paper consists of Part A, Part B.  
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.  
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

**PART – A**

**(25 Marks)**

- 1.a) What property makes the Haar transform useful for image compression? [2]
- b) How does the number of bits used for quantization affect the quality of an image? [3]
- c) What are the advantages of frequency domain filtering over spatial domain filtering? [2]
- d) What is meant by Contrast stretching? [3]
- e) Name one application of LMS filters in image processing. [2]
- f) What is the purpose of incorporating constraints in the least squares restoration approach? [3]
- g) What is region-oriented segmentation? [2]
- h) What are the resulting operations when dilation is followed by erosion and when erosion is followed by dilation? [3]
- i) Define Fidelity criteria. [2]
- j) What is meant by Run length Coding? [3]

**PART – B**

**(50 Marks)**

- 2.a) Discuss the Nyquist-Shannon sampling theorem and its significance in digital image processing. Explain the conditions required for faithful representation of continuous images through discrete samples.
- b) Describe the Hadamard transform and its applications in signal and image processing. Discuss the advantages and limitations of using the Hadamard transform compared to other transform techniques. [5+5]

**OR**

- 3.a) Describe the key characteristics of digital images and explain how they differ from analog images. Provide examples to support your answer.
- b) Discuss the properties of the Slant transform, such as shift-invariance, sparsity, and directionality. Explain how these properties make the Slant transform suitable for applications such as edge detection and texture analysis. [5+5]

- 4.a) Explain how histogram equalization and histogram stretching techniques can be used to improve image contrast and dynamic range.
- b) Describe the concept of filtering in the frequency domain. Explain how frequency domain filters are used to process images and improve their quality. [5+5]

**OR**

- 5.a) Explain the different types of point operations used in image enhancement. Discuss the purpose and applications of each type of point processing operation.
- b) Describe the characteristics and properties of high-pass filters in the frequency domain. Discuss how high-pass filters are used for image sharpening and edge enhancement. [5+5]

- 6.a) Explain how the degradation model helps in formulating effective restoration techniques.
- b) Discuss the benefits of using constrained least squares restoration over other restoration techniques. Provide examples of constraints commonly used in this approach and their impact on restoration quality. [5+5]

**OR**

- 7.a) Describe the concept of interactive restoration in image processing. Discuss the role of human interaction and feedback in the restoration process.
- b) Discuss the challenges and limitations of inverse filtering. Explain how factors such as noise and ill-posedness affect the effectiveness of inverse filtering and suggest possible solution. [5+5]

- 8.a) Discuss the process of edge linking in image processing. Explain how edges are connected to form boundaries and contours.
- b) Describe the concept of structuring element decomposition in morphological image processing. Discuss how structuring elements are decomposed into basic shapes to achieve desired operations. [5+5]

**OR**

- 9.a) Describe the concept of detecting discontinuities in image processing. Discuss the importance of identifying and analyzing edges and boundaries in images.
- b) Explain the concept of opening and closing operations in morphological image processing. Discuss how these operations are performed using a combination of erosion and dilation. [5+5]

- 10.a) Discuss the criteria used to evaluate the performance of lossy and lossless predictive coding methods. Explain the metrics and measures used to assess compression efficiency and reconstruction quality.
- b) Given the code interval [0.35, 0.65) and the symbol probabilities: A (0.4), B (0.3), C (0.2), D (0.1), decode the binary string 0.101 using arithmetic coding. [5+5]

**OR**

- 11.a) Discuss the architecture of JPEG 2000. Explain the key components and processes involved in the compression and decompression of images using the JPEG 2000 standard.
- b) Given the following code words: A (00), B (01), C (10), D (11), decode the binary string 0011010110 using Huffman coding. [5+5]