



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech V SEMESTER END EXAMINATIONS (REGULAR/ SUPPLEMENTARY) - FEBRUARY 2024

Regulation: UG20

IMAGE PROCESSING

Time: 3 Hours

(COMMON TO CSE |CSIT)

Max Marks: 70

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

- (a) Explain about components of an image processing system with neat block diagram.
[BL: Understand| CO: 1|Marks: 7]
- (b) A common measure of transmission for digital data is the baud rate, defined as the number of bits transmitted per second. Generally, transmission is accomplished in packets consisting of a start bit, a byte (8 bits) of information and a stop bit. Using these facts, answer the following:
 - How many minutes would it take to transmit a 1024 x 1024 image with 256 intensity levels using a 56K baud modem?
 - What would the time be at 3000K baud, a representative medium speed of a phone DSL (digital subscriber line) connection?
[BL: Apply| CO: 1|Marks: 7]

MODULE – II

- (a) Which model is used to improving the quality of an image that has been acquired under poor illumination conditions? Discuss this briefly.
[BL: Understand| CO: 2|Marks: 7]
- (b) Apply the steps involved in histogram equalization on the image given in Figure 1.
[BL: Apply| CO: 2|Marks: 7]

$$\begin{bmatrix} 4 & 4 & 4 & 4 & 4 \\ 3 & 4 & 5 & 4 & 3 \\ 3 & 5 & 5 & 5 & 3 \\ 3 & 4 & 5 & 4 & 3 \\ 4 & 4 & 4 & 4 & 4 \end{bmatrix}$$

Figure 1

MODULE – III

- (a) What are the two popular metrics widely used in the image restoration field. Briefly explain the techniques.
[BL: Understand| CO: 3|Marks: 7]
- (b) Show effect of mean, geocentric mean, harmonic mean filter for the image shown in Figure 2.
[BL: Apply| CO: 3|Marks: 7]

$$f(x,y) = \begin{bmatrix} 128 & 128 & 128 & 128 & 128 \\ 128 & 255 & 128 & 255 & 128 \\ 128 & 128 & 255 & 128 & 128 \\ 128 & 255 & 128 & 0 & 128 \\ 128 & 128 & 128 & 128 & 128 \end{bmatrix}$$

Figure 2

4. (a) Describe image segmentation technique for image restoration and write active contour models in detail. [BL: Understand| CO: 4|Marks: 7]
- (b) Analyse effect of max, min filter for the image given in Figure 3 and interpret the results. [BL: Apply| CO: 4|Marks: 7]

$$f(x,y) = \begin{bmatrix} 30 & 10 & 20 \\ 10 & 250 & 25 \\ 20 & 25 & 30 \end{bmatrix}$$

Figure 3

MODULE – IV

5. (a) List different image compression models and explain each of them with suitable examples. [BL: Understand| CO: 5|Marks: 7]
- (b) A source emits letters from an alphabet $A = \{a_1, a_2, a_3, a_4, a_5\}$ with probabilities $P(a_1) = 0.3$, $P(a_2) = 0.4$, $P(a_3) = 0.15$, $P(a_4) = 0.05$ and $P(a_5) = 0.1$. Find for this source, average length of the code and its redundancy. [BL: Apply| CO: 5|Marks: 7].
6. (a) What is meant by redundancy in images? Explain the classification of redundancy with examples. [BL: Understand| CO: 5|Marks: 7]
- (b) Calculate the efficiency of Huffman code for the symbol whose probability of occurrence is given in Table 1. [BL: Apply| CO: 5|Marks: 7]

Table 1

Symbol	Probability
a_1	0.9
a_2	0.06
a_3	0.02
a_4	0.02

MODULE – V

7. (a) Explain in detail about region splitting and merging technique in image processing. [BL: Understand| CO: 6|Marks: 7]

- (b) Find the hit or miss transformation for the input image & structuring element shown in Figure 4. [BL: Apply| CO: 6|Marks: 7]

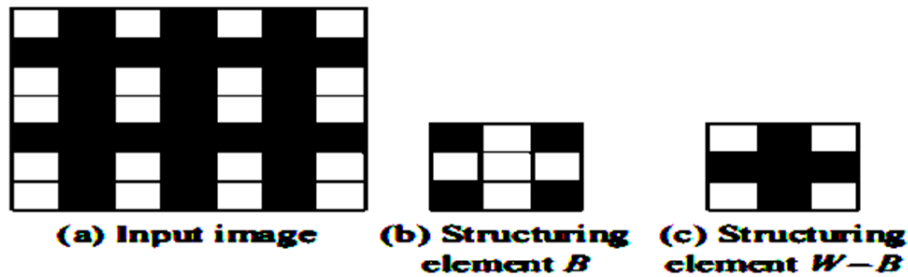


Figure 4

8. (a) Enlist five properties of opening and closing. Give few applications of morphological operations in the field of image processing. [BL: Understand| CO: 6|Marks: 7]
- (b) A person wishes to apply the Laplacian-of-a-Gaussian edge operator to an image $f(m, n)$ of size 256×256 . The size of the edge operator is 32×32 , and the origin is at its centre. Describe in words how to perform the operation in frequency domain? [BL: Apply| CO: 6|Marks: 7]

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