

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

CLASS: PG/Pre Ph.D
BRANCH: CSE

SEMESTER : I
SESSION : MO/2025

SUBJECT: CS532 IMAGE PROCESSING

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions in brief and concise answer. No additional sheet will be provided.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.

- | | Marks | CO | BL |
|---|-------|----|----|
| Q.1(a) What do you mean by brightness adaptation and brightness discrimination. Explain the role of Image sampling and quantization in the context of Image processing. | [5] | 1 | 2 |
| Q.1(b) What do you mean by Histogram Equalization? Perform histogram equalization for the 3-bit image (5×5) shown in figure A. | | | |

A =

1	2	1	1	1
2	5	3	5	2
2	5	5	5	2
2	5	3	5	2
1	1	1	1	1

[1+4] 1 2

- Q.2(a) Explain the Euclidean, City Block and Chessboard distance measures. For the following image consider $V = \{0,1\}$ and compute the lengths of the shortest 4-path, 8-path and m-path between p and q pixels.
- | | | | | |
|------|---|---|---|------|
| 5 | 4 | 3 | 1 | 1(q) |
| 5 | 4 | 0 | 2 | 0 |
| 3 | 2 | 0 | 2 | 4 |
| (p)1 | 3 | 5 | 1 | 3 |
- [3+2] 2 2,3

- Q.2(b) Find the first derivative and second derivative for the following image strip.

6	6	6	6	5	4	3	2	1	1	1	1	1	1	6	6	6	6	6
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

[2+3] 2 2,3

Also write the application of both in image processing.
Explain how Laplacian filter are derived using 2nd order derivative.

- Q.3(a) Derive the Fourier spectrum and Phase spectrum of 2D image $f(x,y)$ of spatial domain. [5] 3 6
- Q.3(b) What do you mean by Hadamard and Walsh transform. How they are related to each other. Explain. [5] 3 2,4

- Q.4(a) Explain the working principle of Block Transfer Coding algorithm with the help of suitable diagram. Using LZW encoding algorithm, encode the message: **wabbawabba** [3+2] 4 2
- Q.4(b) Construct Huffman code for the given frequency of the symbols and also calculate compression ratio and coding redundancy. [5] 4 3,6

a1	a2	a3	a4	a5	a6
10	40	6	10	4	30

- Q.5(a) Explain the conditions for image segmentation. What are the different approaches by which we can achieve image segmentation. Explain with suitable examples. [5] 5 2
- Q.5(b) Explain the procedure of Hough Transform using suitable example. [5] 5 3