

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

**CLASS: M.TECH
BRANCH: CS**

**SEMESTER :I
SESSION : MO/2023**

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.
 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.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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|--------|--|-------|----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|--|
| Q.1(a) | A square grayscale image has a total of 65536 pixels each of type uint8. If the resolution of the image is 300 pixels per inch in all directions what is the size of the image in inches and in bytes. | [5] 1 | 3 | | | | | | | | | | | | | | | | |
| Q.1(b) | What are the three different types of connectivity often used in image processing. | [5] 1 | 1 | | | | | | | | | | | | | | | | |
| Q.2(a) | Discuss three different point to point intensity transforms and suggest use cases for the use of all three of them. | [5] 2 | 2 | | | | | | | | | | | | | | | | |
| Q.2(b) | A 4x4 grayscale image using 3 bits per pixel is given in the figure below. What will be the output gray value (g_o) corresponding to input gray value (g_i) if the image is histogram equalized. | [5] 2 | 3 | | | | | | | | | | | | | | | | |
| | <table border="1" style="border-collapse: collapse; margin: auto;"><tr><td>0</td><td>1</td><td>3</td><td>5</td></tr><tr><td>1</td><td>2</td><td>5</td><td>6</td></tr><tr><td>3</td><td>3</td><td>4</td><td>7</td></tr><tr><td>2</td><td>4</td><td>5</td><td>5</td></tr></table> | 0 | 1 | 3 | 5 | 1 | 2 | 5 | 6 | 3 | 3 | 4 | 7 | 2 | 4 | 5 | 5 | | |
| 0 | 1 | 3 | 5 | | | | | | | | | | | | | | | | |
| 1 | 2 | 5 | 6 | | | | | | | | | | | | | | | | |
| 3 | 3 | 4 | 7 | | | | | | | | | | | | | | | | |
| 2 | 4 | 5 | 5 | | | | | | | | | | | | | | | | |
| Q.3(a) | Prove that the Fourier transform of a two dimensional image can be centered if the image is pre-multiplied by the term $(-1)^{(x+y)}$ before computing the Fourier Transform, where x and y is the row and column co-ordinate of a pixel and the multiplication is performed in a point to point manner. | [5] 3 | 2 | | | | | | | | | | | | | | | | |
| Q.3(b) | Describe the process of performing High Boost filtering of an image. | [5] 3 | 2 | | | | | | | | | | | | | | | | |
| Q.4(a) | Prove that the addition of two square matrix of the same size is a Linear operation. | [5] 4 | 2 | | | | | | | | | | | | | | | | |
| Q.4(b) | Refer to the image given in Q. [2b]. What is the entropy of the image? | [5] 4 | 3 | | | | | | | | | | | | | | | | |
| Q.5(a) | What is the number of bits required to encode the grayscale image G1, G2, G1, G2, G1, G1, G1, G2, G3 using the optimal Huffman code. If the original image had 8 bits per pixel, what was the redundancy of the image. | [5] 5 | 3 | | | | | | | | | | | | | | | | |
| Q.5(b) | With reference to a lossy algorithm what do you understand by the terms
(a) Quantization Table
(b) Zig zag encoding. | [5] 5 | 2 | | | | | | | | | | | | | | | | |

:23/11/2023 E: