

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: BTECH
BRANCH: AIML

SEMESTER : VII
SESSION : MO/2025

SUBJECT: AI425 COMPUTER VISION

TIME: 02 Hours

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
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|--------|--|-----|-----|
| Q.1(a) | How can an image histogram help analyze the contrast of the image? | [2] | 1 1 |
| Q.1(b) | For the given 3X3 image patch, compute the structure tensor for Harris corner detection. Based on the Harris response, classify the center pixel as corner or a flat region. | [3] | 2 3 |

$$I = \begin{bmatrix} 10 & 10 & 10 \\ 10 & 50 & 10 \\ 10 & 10 & 10 \end{bmatrix}$$

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|--------|---|-----|-----|
| Q.2(a) | What is periodic noise? How is it removed? | [2] | 1 1 |
| Q.2(b) | Consider the 2X2 image $f(x, y)$. Compute the power spectrum and the phase through the DFT of the image. | [3] | 1 2 |

$$f(x,y) = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

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| Q.3(a) | What is the role of order (n) in a Butterworth filter? | [2] | 1 1 |
| Q.3(b) | A binary edge image of size 5x5 has edge points at (1,1), (2,2), (3,3) and (4,1). Use Hough line detection with slope intercept form and consider slope $m \in \{0,1\}$ and $c \in \{0,1,2, 3, 4\}$. Construct the accumulator array and interpret what line it corresponds to in the image. | [3] | 2 3 |

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| Q.4(a) | Why is DCT preferred over other frequency transforms in JPEG compression? | [2] | 1 2 |
| Q.4(b) | A grayscale image has intensity values in the range [0, 255]. Design a piecewise linear transformation to enhance a specific range of intensities. The transformation is defined by two points on the intensity mapping curve $(r_1, s_1) = (50, 30)$, $(r_2, s_2) = (200,220)$. Assume a piecewise linear function connecting $(0,0) \rightarrow (r_1,s_1) \rightarrow (r_2,s_2) \rightarrow (255,255)$. What effect the transformation has on the image, explain briefly. | [3] | 1 3 |

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| Q.5(a) | What is the use of interest points in an image? | [2] | 2 1 |
| Q.5(b) | A 1D image $f(x) = [1,2,4,7,4,2,1]$ is given. Using $f(x+1) + f(x-1) - 2f(x)$ as an approximation of the LoG operator and $\sigma=1$, compute the scale normalized LoG used for SIFT keypoint detection and identify local extrema in a single scale ($\sigma=1$). | [3] | 2 4 |