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

CLASS: B.Tech. **SEMESTER : VII**
BRANCH: ECE **SESSION : MO/2025**

SUBJECT: EC431 DIGITAL IMAGE AND VIDEO 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.

			CO	BL
Q.1(a)	Explain the following point processing operations on images and derive the transformation matrix for each operation. i. Image scaling ii. Image rotation iii. Image skewing	[5]	1	III
Q.1(b)	Consider the 5x5 image matrix **I** and 3x3 kernel matrix **K** shown below. $I = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 3 & 1 & 1 \\ 1 & 2 & 0 & 2 & 1 \\ 1 & 1 & 3 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$ $K = \begin{bmatrix} 1 & -2 & 1 \\ -2 & 1 & -2 \\ 1 & -2 & 1 \end{bmatrix}$ Perform i) Convolution and ii) Correlation operations between I and K. (Do not zero pad the image I)	[5]	1	II
Q.2(a)	Derive a generalized 3×3 Laplacian filter kernel and mention its application in image processing. Also, 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	[6]	2	I
Q.2(b)	Explain homomorphic filtering and mention one of its applications.	[4]	2	I
Q.3(a)	Consider a matrix as shown below with 4 data points and 2 feature values each. Compute the principal components PC1 and PC2 of this feature matrix and project the features onto the principal components. **Feature** | **D1** | **D2** | **D3** | **D4** X1 | 2 | 3 | 4 | 5 X2 | 4 | 6 | 8 | 10	[5]	3	III
Q.3(b)	Describe the steps to segment an image into two classes of intensity values using Otsu's global thresholding method. Derive an optimum global threshold value, ***k*** to separate the two classes of pixels.	[5]	3	I

PTO

Q.4(a) Use arithmetic encoding to find the range of probabilities for transmitting the sequence 'IMAGE' from left to right. The probability of occurrence for each source symbol is given below. [5] 4 III

Symbol	**I**	**M**	**A**	**G**	**E**
Probability	0.3	0.2	0.2	0.2	0.1

Q.4(b) Find entropy of the image with pixel intensities shown below: [5] 4 I

21	21	21	95	169	243	243	243
21	21	21	95	169	243	243	243
21	21	21	95	169	243	243	243
21	21	21	95	169	243	243	243

For the same image, calculate the co-occurrence matrix based on the predicate Q= 'one pixel to the right'.

Q.5(a) Define motion vector and explain motion estimation using a block diagram. Also, mention how motion estimation contributes to improved video compression. [4] 5 I

Q.5(b) Explain various steps involved in H.261 standard for video compression. Also, mention the drawbacks of H.261 standard and how they are eliminated by H.263 compression standard. [6] 5 I

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