Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025

Date: 08-12- 2025 **Time:** 01:00pm – 04:00pm

School: SOCSE	**Program:** B.Tech	
Course Code: ISE2504	**Course Name:** Image Processing and Computer Vision	
Semester: V	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**26**	**26**	**24**	**24**	

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	Define digital image and mention the steps involved in image digitization.	2 Marks	L1	CO1
2.	Explain image sampling and quantization.	2 Marks	L	CO1
3.	State four sources of noise in digital images	2 Marks	L	CO1
4.	Define image segmentation.	2 Marks	L	CO2
5.	List morphological operations in image processing.	2 Marks	L	CO2
6.	List any four structuring elements used in morphological operations	2 Marks	L	CO2
7.	corner in the context of image features, and why is it important	2 Marks	L	CO3
8.	Define texture features and give two examples commonly used in image analysis.	2 Marks	L	CO3
9.	Define Optical flow in computer vision	2 Marks	L	CO4
10.	Define Histogram of Oriented Gradients (HOG). What primary information does it capture from an image?	2 Marks	L	CO4

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	**A 5×5 grayscale image is represented by the following pixel intensity matrix:** $$I = \begin{bmatrix} 10 & 12 & 15 & 14 & 10 \\ 18 & 20 & 22 & 21 & 17 \\ 25 & 27 & 30 & 28 & 24 \\ 20 & 22 & 24 & 23 & 19 \\ 15 & 17 & 18 & 16 & 14 \end{bmatrix}$$ **Apply a 3×3 kernel Mean Filter to compute the filtered value all pixel using symmetric-padding. Show all calculations step-by-step.**	**20 Marks**	**L3**	**CO 1**
		Or			
12.	**a.**	**Apply a 3×3 Median Filter to the following 5×5 grayscale image.** **Compute the filtered value for all *valid* interior pixels (symmetric padding).** **Show step-by-step calculation for each 3×3 neighborhood.** $$I = \begin{bmatrix} 12 & 18 & 25 & 30 & 22 \\ 10 & 20 & 28 & 32 & 24 \\ 15 & 22 & 30 & 35 & 26 \\ 17 & 25 & 33 & 40 & 28 \\ 19 & 27 & 34 & 42 & 30 \end{bmatrix}$$	**20 Marks**	**L3**	**CO 1**

13.	**a.**	**Given the following 5×5 grayscale image matrix I (pixel intensities 0–255):** $$I = \begin{bmatrix} 10 & 10 & 10 & 10 & 10 \\ 10 & 50 & 50 & 50 & 10 \\ 10 & 50 & 100 & 50 & 10 \\ 10 & 50 & 50 & 50 & 10 \\ 10 & 10 & 10 & 10 & 10 \end{bmatrix}$$	**20 Marks**	**L3**	**CO 2**

		Apply the 3×3 Laplacian kernel to the image using zero padding, and compute the filtered output matrix O. Show all convolution steps for the central 3×3 region (i.e., compute the output for every pixel— using 1-based indexing).			
Or					
14.	**a.**	**Consider the following 5×5 grayscale image matrix:** $I = \begin{bmatrix} 12 & 14 & 15 & 150 & 152 \\ 11 & 13 & 16 & 148 & 149 \\ 10 & 12 & 14 & 151 & 150 \\ 200 & 202 & 205 & 210 & 212 \\ 198 & 201 & 204 & 209 & 211 \end{bmatrix}$ **Apply Split-and-Merge segmentation using the following criteria: threshold T=7**	**20 Marks**	**L3**	**CO 2**

15.	**a.**	**An image pixel is represented in the HSI color model with the following values:** **Hue (H) = 120°, Saturation (S) = 0.75, Intensity (I) = 0.60** **Convert this HSI color to its corresponding RGB values using the standard HSI → RGB conversion formulas. Clearly show:** **1. The region in which the hue lies** **2. All intermediate calculations (R, G, B before normalization)** **3. Final R, G, B values in the range [0, 255]**	**20 Marks**	**L3**	**CO 3**
Or					
16.		**a) Explain the Laplacian filter used in image processing. Discuss its role in edge detection, the mathematical form of the Laplacian operator, and why it is considered a second-order derivative filter.** **b) Consider the following 2D grayscale image matrix:**	**20 Marks**	**L3**	**CO 3**

		$I = \begin{bmatrix} 3 & 3 & 4 \\ 2 & 3 & 5 \\ 1 & 2 & 4 \end{bmatrix}$ **Apply Laplacian filter of 3x3 size**			

17.	**a.**	**Compare YOLO-based real-time object detection with region-based methods (R-CNN family). Draw the architecture diagram of R-CNN model**	**20 Marks**	**L3**	**CO 4**
		Or			
18.	**a.**	**With Neat architecture diagram explain the workflow of Convolutional Neural Networks (CNNs) in image classification and detection.**	**20 Marks**	**L3**	**CO 4**