Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 6 – EXAMINATION – SUMMER 2026

Subject Code: 3164102 **Date: 22/05/2026**

Subject Name: Machine Vision System

Time: 10:30 AM TO 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

Q.1	**(a)**	Explain elements of visual perception.	**03**
	(b)	Define Machine vision system and list its components.	**04**
	(c)	Explain Gaussian optics and pinhole camera model with neat diagram.	**07**
Q.2	**(a)**	Explain image smoothing techniques.	**03**
	(b)	An image has gray levels ranging from 0 to 255. Perform negative transformation for following pixel values: [25, 60, 125, 180, 240]	**04**
	(c)	Explain image data structures used in vision systems.	**07**
		OR	
Q.2	**(c)**	Explain image segmentation techniques with applications.	**07**
Q.3	**(a)**	Discuss geometric transformations in image processing.	**03**
	(b)	Apply the following mask on center pixel: having Image Matrix and Mask: find the result. Image Matrix = $\begin{bmatrix} 2 & 4 & 6 \\ 1 & 3 & 5 \\ 7 & 9 & 2 \end{bmatrix}$ MASK = $\begin{bmatrix} -1 & 0 & 1 \\ -1 & 0 & 1 \\ -1 & 0 & 1 \end{bmatrix}$	**04**
	(c)	Define object recognition. Explain approaches to object recognition.	**07**
		OR	
Q.3	**(a)**	A camera with focal length 50 mm captures an object of height 100 mm placed at distance 1000 mm. Find image height formed on sensor .	**03**
	(b)	Define stereo reconstruction.	**04**
	(c)	Discuss recognition using single view and two views.	**07**
Q.4	**(a)**	Define K-means clustering and explain in brief	**03**
	(b)	Discuss Mapping Sonar Data in terms of Partitioning & Program Design for machine vision application.	**04**

(c) Perform one iteration of K-means clustering for points: **07**
(2,3), (3,4), (8,9), (9,10) having Initial centroids: C1=(2,2), C2=(8,8)

OR

Q.4 **(a)** Define video tracking **03**

(b) For the following binary image: Find: **04**
1. Total white pixels
2. Total black pixels
3 .White pixel percentage

$$\begin{bmatrix} 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$$

(c) Explain Partitioning ,Program Design and Analysis in EM Clustering. **07**

Q.5 **(a)** Define Robot Operating System (ROS). **03**

(b) Explain Open CV and OpenNI with applications. **04**

(c) Discuss applications of Robot vision in automation industries. **07**

OR

Q.5 **(a)** Define PCL and explain in brief. **03**

(b) Explain ROS to OpenCV conversion process. **04**

(c) Discuss ROS camera drivers and cv_bridge package. **07**

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