Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY 2025

Date: 24-05-2025 **Time:** 09:30 am – 12:30 pm

School: SOCSE	**Program:** B. Tech- CAI/CBC/CBD/CCS/CDV/CIT/COM/CSD/ CSE/CSG/ISE/IST	
Course Code: ECE3107	**Course Name:** Machine Vision for Robotics	
Semester: VI	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**34**	**34**	**32**	**--**	**--**

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.	The rays _____ after passing through a convex lens.	**2 Marks**	**L1**	**CO1**
2.	Monochromatic light is characterized by its _____.	**2 Marks**	**L1**	**CO1**
3.	Decreasing the focal length decreases the image _____.	**2 Marks**	**L1**	**CO1**
4.	Illumination of objects is the first step in performing machine vision tasks. List the different types of light sources used for this purpose.	**2 Marks**	**L1**	**CO1**
5.	Robotics industry employs machine vision systems. Shortly explain how.	**2 Marks**	**L1**	**CO1**
6.	Sound Navigation and Ranging (SONAR) is a method of _____, locating, and determining the speed of an object using the sound waves.	**2 Marks**	**L1**	**CO1**
7.	Learning is any process by a system improves performance from _____.	**2 Marks**	**L1**	**CO2**
8.	Mention two different types of classification algorithms.	**2 Marks**	**L1**	**CO3**

9.	What do we mean by latent variables in machine learning?	**2 Marks**	**L1**	**CO2**
10.	How do we calculate the range of an object using SONAR?	**2 Marks**	**L1**	**CO1**

Part B

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

11.	**a.**	Digital camera is a crucial element of a machine vision system. What are the advantages of a digital camera over an ordinary camera?	**5 Marks**	**L2**	**CO1**
	b.	Readings from the sensors need to be transformed in order that they can be utilized for some particular applications. What are the different steps of transforming the sensor readings. Describe briefly with block diagram.	**5 Marks**	**L2**	**CO2**
	c.	Support Vector Machine (SVM) is a classification algorithm. Describe it with diagrams for binary class and multi-class classification.	**10 Marks**	**L2**	**CO3**
		Or			
12.	**a.**	Camera calibration is the process of finding and correcting the quantities internal to the camera that affect the imaging process. Write a short note on those quantities.	**5 Marks**	**L2**	**CO1**
	b.	SONAR is an acronym for Sound Navigation and Ranging. Explain single-beam sonar in short.	**5 Marks**	**L2**	**CO2**
	c.	Reinforcement learning is an ML algorithm that achieves optimal results for decision-making tasks. Describe it with examples.	**10 Marks**	**L2**	**CO3**

13.	**a.**	An image can be processed after converting it to digital form. How can an image be converted into a digital image?	**5 Marks**	**L2**	**CO1**
	b.	The goal of multiscale image analysis is to define a representation in which image information is explicitly available. That is, it does not need to be computed when needed. Mention some of the applications of the multiscale image analysis.	**5 Marks**	**L2**	**CO2**
	c.	Write a short note on ROS and ROS equation.	**10 Marks**	**L3**	**CO3**
		Or			
14.	**a.**	An image is fundamental data structure in machine vision. Define the terms image, and color image in this context.	**5 Marks**	**L2**	**CO1**

	b.	Video tracking is a method of recording the movement of an object in a video clip. Write down the three key steps of video analysis, and two uses of object tracking.	**5 Marks**	**L2**	**CO2**
	c.	Write a short note on ROS filesystem.	**10 Marks**	**L3**	**CO3**

15.	**a.**	Deformable matching technique is used to identify objects having an unknown tilt. Describe the principle of this technique.	**5 Marks**	**L3**	**CO1**
	b.	How can we define machine learning?	**5 Marks**	**L1**	**CO2**
	c.	Give some examples where machine learning finds use. What are the different classes of machine learning algorithms? Explain briefly.	**10 Marks**	**L1**	**CO3**
		Or			
16.	**a.**	Template matching is a robust algorithm used to recognize the objects that change frequently. Explain it briefly.	**5 Marks**	**L3**	**CO1**
	b.	Curved mirrors are of two types: concave and convex. What are the differences between them?	**5 Marks**	**L1**	**CO2**
	c.	What do we mean by supervised learning algorithm, regression, and classification? How is classification different from regression?	**10 Marks**	**L1**	**CO3**

17.	**a.**	LEDs are currently the primary choice for illuminating the objects for performing the machine vision tasks. What are the advantages of using this illumination technology?	**5 Marks**	**L2**	**CO1**
	b.	Write a MATLAB code to a. Read an image file, peppers.png b. Show the image c. Convert this RGB image to gray image d. Perform image enhancement operation to obtain the negative of the image e. Enhance the contrast of the image	**5 Marks**	**L3**	**CO2**
	c.	Smoothing is a technique that is used to reduce noise in an image. Given below is a 6X6 image matrix and an average spatial filter of size 3X3, respectively. Calculate the smoothed values of the pixels marked *, using the filter.	**10 Marks**	**L3**	**CO2**

			2	9	4	2	7	4			
			4	2*	2	3	1*	6			
			3	0	3	4	1	9			
			1	0	1	4*	2	0			
			2	8*	9	5	6*	1			
			7	8	10	9	7	2			

1/9	1/9	1/9
1/9	1/9	1/9
1/9	1/9	1/9

Or

18.	**a.**	Illumination of objects is the first step in performing machine vision tasks. What is the goal of illumination, and how it helps in machine vision tasks?	**5 Marks**	**L2**	**CO1**
	b.	Segmentation subdivides an image into its constituent regions or objects based on line and edge detection. Describe mathematically the Sobel edge detector with its mask. Also, write a MATLAB code for Canny edge detection.	**5 Marks**	**L3**	**CO2**
	c.	Image segmentation methods are the ones in which the **inputs are images**, but the **outputs are attributes extracted** from those images. What are the three basic types of intensity discontinuities in a digital image. Mention the masks used for line detection: horizontal, vertical, and diagonal (+45° and -45°). What is the response of the point detection mask given below for the nine pixels marked *? If the threshold is 25, find out whether a point is detected or not.	**10 Marks**	**L3**	**CO2**

2	9	4	2	7	4
4	6	2	3	7	6
3	0	4*	5*	3*	9
1	0	8*	6*	4*	0
2	8	9*	2*	2*	1
7	8	10	9	7	2

-1	-1	-1
-1	8	-1
-1	-1	-1