PRESIDENCY UNIVERSITY
BENGALURU

SET B

SCHOOL OF ENGINEERING
END TERM EXAMINATION – MAY / JUNE 2024

Semester : Semester VIII - 2020
Course Code : ECE3107
Course Name : Machine Vision for Robotics
Program : B.Tech.

Date : May 31, 2024
Time : 01.00pm to 04.00pm
Max Marks : 100
Weightage : 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ANY FIVE QUESTIONS   **(5 Q X 2 M = 10 M)**

1. Robotics industry extensively employs the machine vision systems. Shortly explain how.

(CO1) [Knowledge]

2. A camera acquires the image data for machine vision tasks. In order to make the important features of the object/scene visible and to suppress the undesired features, we need to first _____ the object/scene.

(CO2) [Knowledge]

3. Gaussian optics is a technique in geometrical optics that uses the _____ approximation to describe the behavior of light rays in optical systems.

(CO2) [Knowledge]

4. The paraxial approximation only considers rays that make _____ angles with the optical axis of the system.

(CO2) [Knowledge]

5. Digital cameras can do what a normal camera cannot. Write down the advantages of using a digital camera.
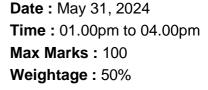
(CO2) [Knowledge]

6. Geometric transformation can be used to make an image smaller or larger. Find the output values of the coordinates (4,5) after the scaling operation if the scaling matrix is

4	0	0
0	2	0
0	0	1

(CO2) [Knowledge]

7. List two applications of k-means clustering algorithm.

(CO2) [Knowledge]

PART B

ANSWER ANY FIVE QUESTIONS **(5 Q X 10 M = 50 M)**

8. In the real world, a human eye captures images for further processing by the brain. Explain how image is formed in the eye, with diagram.

(CO1) [Comprehension]

9. Lenses are used in cameras for image formation. Describe the two important classes of lenses along with the diagrams showing the image formation process.

(CO2) [Comprehension]

10. Gray-level slicing is one of the image enhancement techniques. Explain two approaches of gray-level slicing with diagram.

(CO2) [Comprehension]

11. Spatial filtering is an image smoothing method that improves the quality of an image by removing noise. Using the simple averaging filter, find the values of the pixels of a 6X6 matrix, marked '*'.

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

(CO2) [Comprehension]

12. Sonar is a device that is used to detect underwater objects using sound waves. Explain how it can be used to find the range of an object. Also, write a short note on the three different types of sonars.

(CO2) [Comprehension]

13. Sonar data mapping involves using sonar technology to create maps or representations of underwater environments. Explain five different applications of sonar data mapping.

(CO2) [Comprehension]

14. Object tracking is an important task in the field of computer vision. Write a short note on video tracking.

(CO2) [Comprehension]

PART C

ANSWER ANY TWO QUESTIONS **(2Q X 20 M = 40 M)**

15. An image is subdivided into its constituent regions or objects using the image segmentation techniques. Mention the various masks used for line detection. What is the response of the point detection mask given below for all the nine pixels marked *? Find out whether a point is detected or not if the threshold is 19 for the pixel with intensity 10.

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

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

(CO2) [Application]

16. Describe
    (a) the ROS file system in detail, and
    (b) the ROS computation graph level (CGL) with the diagram.

(CO3) [Application]

17. Write down a MATLAB code for
    (a) Reading and showing the image named pout.tif
    (b) Obtaining the negative of the image pout.tif
    (c) Expanding the gray-scale of the image interval between 0.5 and 0.75 to the full range [0,1], from the image obtained in (a).
    (d) Increasing the contrast of the image in (a) automatically
    (e) Detecting the edges in the gray image in (a) using the Canny and Roberts detectors.

(CO2) [Application]