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PRESIDENCY UNIVERSITY BENGALURU

 SCHOOL OF ENGINEERING

 SUMMER TERM END TERM EXAMINATION - AUGUST 2024

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| **Semester : VIII** | **Date : 06-08-2024** |
| **Course Code : ECE3107** | **Time : 09:30 AM – 12:30 PM** |
| **Course Name : Machine Vision for Robotics** | **Max Marks : 100** |
| **Program : B.Tech** | **Weightage :50%** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

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| **PART A** |
|  **ANSWER ANY 5 QUESTIONS 5Q X 2M=10M** |
| 1 | Machine vision technology gives industrial equipment the ability to “see” what it is doing and make rapid decisions based on what it sees. List the two most common uses of machine vision. | (CO 1) | [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. | (CO 2) | [Knowledge] |
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| 3 | Gaussian optics is a technique in geometrical optics that uses the \_\_\_\_\_\_\_\_ approximation to describe the behavior of light rays in optical systems. | (CO 2) | [Knowledge] |
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| 4 | Image size increases with the increasing \_\_\_\_\_\_ length of the lens of a camera. | (CO 2) | [Knowledge] |
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| 5 | USB is the most commonly used and most user-friendly \_\_\_\_\_\_\_\_\_\_ interface. | (CO 2) | [Knowledge] |
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| 6 | Write the MATLAB function used for image enhancement. | (CO 2) | [Knowledge] |
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| 7 | List two applications of k-means clustering algorithm. | (CO 2) | [Knowledge] |
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| **PART B** |
|  **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** |
| 8 | Visual perception is at the core of machine vision technology. Explain the elements of both the direct as well as captured/mediated visual perception with proper diagrams. | (CO 1) | [Comprehension] |
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| 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. | (CO 2) | [Comprehension] |
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| 10 | Spatial filtering is an image smoothing technique that enhances an image by removing noise. Calculate the values of the pixels of a 6X6 matrix, marked ‘\*’, after filtering using the simple averaging filter.

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

 | (CO 2) | [Comprehension] |
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| 11 | Sensor data transformation is an important task to process the sensor readings. Explain the different stages of sensor data transformation with the help of a block diagram. | (CO 2) | [Comprehension] |
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| 12 | Sonar data mapping involves using sonar technology to create maps or representations of underwater environments. Explain five different applications of sonar data mapping. | (CO 2) | [Comprehension] |
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| 13 | Clustering is an unsupervised learning technique. What is a k-means clustering algorithm? Also, write down the steps of this algorithm with diagram. | (CO 2) | [Comprehension] |
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| 14 | Object tracking is an important task in the field of computer vision. Write a short note on video tracking. | (CO 2) | [Comprehension] |
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| **PART C** |
|  **ANSWER ANY 2 QUESTIONS 2Q X 20M=40M** |
| 14 | Image segmentation subdivides an image into its constituent regions or objects. Mention the 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 20 for the pixel with intensity 5.

|  |  |  |
| --- | --- | --- |
| -1 | -1 | -1 |
| -1 | 8 | -1 |
| -1 | -1 | -1 |

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

 | (CO 2) | [Application] |
|  |
| 15 | Explain the ROS file system as well as the ROS computation graph level using diagram. | (CO 3) | [Application] |
|  |
| 16 | Write down a MATLAB code for1. Reading and showing the image named pout.tif
2. Obtaining the negative of the image pout.tif
3. 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).
4. Increasing the contrast of the image in (a) automatically
5. Detecting the edges in the gray image in (a) using the Canny and Roberts detectors.
 | (CO 2) | [Application] |
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