

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Eighth Semester

Instrumentation and Control Engineering

(Common to Electronics and Instrumentation Engineering)

20ICEL804 - MACHINE VISION SYSTEMS

Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

- | | <i>Marks</i> | <i>K – Level</i> | <i>CO</i> |
|--|--------------|------------------|-----------|
| 1. Sensors that are used to measure the deflection to external forces and are mounted between the robot arm and end effectors are called as -----
(a) Joint Sensors (b) Wrist Sensors (c) Force Sensors (d) Torque Sensors | 1 | K1 | CO1 |
| 2. The most widely used Solid State Camera in robot vision system includes
(a) Charge Coupled Devices (b) Charge Injection Devices
(c) Silicon Bipolar Devices (d) Vidicon camera | 1 | K1 | CO1 |
| 3. The most popular image Enhancement technique used in Machine Vision System
(a) Gray Transformation (b) Histogram Equalization
(c) Local Enhancement (d) Histogram Specification | 1 | K1 | CO2 |
| 4. In Region based segmentation which method involves appending neighbouring pixels to seed point?
(a) Edge Detection (b) Region growing
(c) Region Growing with Pixel aggregation (d) Region merging | 1 | K1 | CO2 |
| 5. The Predominant use of decision functions in industrial vision systems is for
(a) Matching (b) Segmentation (c) object detection (d) Preprocessing | 1 | K1 | CO3 |
| 6. In structural methods of object recognition decomposition of objects is carried out as
(a) Pattern Primitives (b) Chain Codes (c) lines (d) Boundaries | 1 | K1 | CO3 |
| 7. Adaptive cruise control combined with lane keeping assistance is classified under ----- automation.
(a) Level 2 (b) Level 3 (c) Level 4 (d) Level 5 | 1 | K1 | CO4 |
| 8. Choose the component that is primarily used by automotive navigation systems to determine a vehicle's current location?
(a) Radar systems (b) Inertial navigation systems
(c) Global Positioning System (GPS) (d) Altimeters | 1 | K1 | CO4 |
| 9. The purpose of Cv Bridge library is to -----
(a) Allow Interoperability between ROS and Open CV
(b) Allow Flexibility between ROS and Open CV
(c) Allow image processing for Robotic applications
(d) Create ROS for Robotic Applications | 1 | K1 | CO5 |
| 10. The Robotic Operating System in robot vision typically uses a _____ structure to manage various tasks.
(a) Layered (b) Mesh (c) Linear (d) Star | 1 | K1 | CO5 |

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

- | | | | |
|---|---|----|-----|
| 11. Compare front lighting and Back Lighting techniques. | 2 | K2 | CO1 |
| 12. Draw a picture representation of range sensing by triangulation method. | 2 | K2 | CO1 |
| 13. Consider an industrial vision system having a pixel density of 350 pixels per line s and 280 lines and a 6- bit register for each picture element to represent various gray levels. Determine the total bits of data that can be stored in processor memory for each 1/30 secs. | 2 | K2 | CO1 |

- | | | | |
|---|---|----|-----|
| 14. Write the equation for inverse perspective transformation used to derive camera models. | 2 | K2 | CO2 |
| 15. Enumerate the purpose of Histogram Equalization to enhance the digital images in Machine Vision System. | 2 | K2 | CO2 |
| 16. Discuss the use of Perspective transformation in machine vision systems. | 2 | K2 | CO2 |
| 17. Does the number of objects in the model database increase the complexity of recognition systems? Justify. | 2 | K2 | CO3 |
| 18. Outline the use of String Grammars in object recognition used in machine vision systems. | 2 | K2 | CO3 |
| 19. Intelligent Vision Systems enhances vehicle navigation. Justify | 2 | K2 | CO4 |
| 20. Classify the overall Application categories of Intelligent Transportation Systems. | 2 | K2 | CO4 |
| 21. In the context of robotic vision, summarize the benefit of using simulated environments for initial algorithm testing. | 2 | K2 | CO5 |
| 22. OpenCV has packages that include numerous shared or static libraries. Summarize out the major modules available in the package. | 2 | K2 | CO5 |

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

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|------------|---|----|----|-----|
| 23. a) | Explain in detail four types of illumination techniques used in machine vision systems. | 11 | K2 | CO1 |
| OR | | | | |
| b) | Explain the operation of CCD as a solid state vision sensor used for image acquisition. | 11 | K2 | CO1 |
| 24. a) | Derive Camera model using perspective transformation technique. | 11 | K2 | CO2 |
| OR | | | | |
| b) | Explain Thresholding algorithms used for segmentation of objects in machine vision systems. | 11 | K2 | CO2 |
| 25. a) | Utilize Decision - Theoretic method for industrial object recognition and explain with an example. | 11 | K3 | CO3 |
| OR | | | | |
| b) | Make use of Multiple view representations and Sweep representations methods for object recognition and explain the technique applied to Machine vision systems. | 11 | K3 | CO3 |
| 26. a) | Develop various SAE levels of automation with features and examples for Bosch Automation company. | 11 | K3 | CO4 |
| OR | | | | |
| b) | V2V will be an integral part of V2X, delivering a far more intelligent environment on our roads identify the components and Explain. | 11 | K3 | CO4 |
| 27. a) | Build the concepts of cv_bridge for Converting between ROS images and OpenCV images (Python) with an example. | 11 | K3 | CO5 |
| OR | | | | |
| b) | Build a detailed report of working with cameras for using libuvc_camera package with a simple USB camera. | 11 | K3 | CO5 |
| 28. a) (i) | Summarize the problems encountered by Computer vision in Intelligent Transportation Systems. | 6 | K2 | CO4 |
| (ii) | Briefly explain ROS nodes and the associated client libraries. | 5 | K2 | CO5 |
| OR | | | | |
| b) (i) | Briefly explain the role of sensors and camera for Intelligent Transportation Systems. | 6 | K2 | CO4 |
| (ii) | Briefly explain ROS msg and srv used in Open Cv for Machine Vision Applications. | 5 | K2 | CO5 |