



B.E/B.TECH DEGREE EXAMINATIONS: NOV /DEC 2024

(Regulation 2018)

Sixth Semester

MECHATRONICS ENGINEERING

U18MCI6202: Robotics Engineering

COURSE OUTCOMES

- CO1:** Explain the robotic terminologies for various configurations
CO2: Select an appropriate gripper for a given application and use a gripper for pick and place application
CO3: Calculate the forward kinematics, inverse kinematics, and Jacobian for a serial robot
CO4: Apply Lagrangian and Newton-Euler methods to analyze dynamic characteristics of a robot
CO5: Describe various robot motion planning algorithm and robot interfaces
CO6: Explain and practice various programming techniques used in industrial robots

Time: Three Hours

Maximum Marks: 100

Answer all the Questions: -

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

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|---|-----|-------------------|
| 1. Compare the Resolution, Repeatability and Accuracy of a robot. | CO1 | [K ₂] |
| 2. Outline the importance of grippers. | CO2 | [K ₂] |
| 3. Name the parameters in the following equation.
$\xi_N = \mathcal{K}(q; \theta, d, a, \alpha, \sigma)$ | CO3 | [K ₂] |
| 4. Analyze the differences between spatial velocity and joint velocity. | CO4 | [K ₂] |
| 5. Compare any two communication protocols used in industrial robots. | CO5 | [K ₂] |
| 6. Describe the importance of simulation in industrial robotics. | CO6 | [K ₂] |
| 7. Evaluate the importance of the Session layer in the OSI model. | CO5 | [K ₂] |
| 8. Describe the two methods used to calculate robot dynamics. | CO4 | [K ₂] |
| 9. Explain the two ways to represent the right-handed coordinate frame with a neat sketch. | CO3 | [K ₂] |
| 10. List some examples of tools as robot end effectors. | CO2 | [K ₂] |

Answer any FIVE Questions: -

PART B (5 x 16 = 80 Marks)

(Answer not more than 400 words)

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|--|----|-----|-------------------|
| 11. a) Explain any two serial robot configurations with neat sketches. | 08 | CO1 | [K ₂] |
| b) Describe the types of robots based on applications | 08 | CO1 | [K ₂] |

12. a) Identify the suitable gripper to pick the Carton Boxes and explain the working of the gripper with a neat sketch. 08 CO2 [K₃]



- b) Explain the mechanical gripper mechanisms with neat sketches 08 CO2 [K₃]

13. a) Shown here is a picture of an actual robot manipulator. Draw a kinematic diagram and DH Parameter Table of this manipulator. Derive the homogeneous transformation matrix using the DH parameter table. 16 CO3 [K₃]



14. a) Employ the Lagrangian method to determine the torque of a two-link planar robot and appraise its effectiveness. 8 CO4 [K₃]
- b) Evaluate the importance of calculating the Jacobian inverse. Analyze the different steps required to calculate it. 8 CO4 [K₃]

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|-----|----|---|----|-----|-------------------|
| 15. | a) | Analyze the structure of the Robot Operating System (ROS) by decomposing its components and evaluate their functionalities. | 8 | CO5 | [K ₂] |
| | b) | Analyze the specific functions of the four lower layers of the OSI reference model. | 8 | CO5 | [K ₂] |
| 16. | a) | Explain the two types of Programming methods used in the industrial robot. | 16 | CO6 | [K ₃] |
