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Question Paper Code : 80929

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

Fifth/Sixth/Seventh/Eighth Semester

Industrial Engineering

CME 348 – MODERN ROBOTICS

(Common to : Industrial Engineering and Management/Mechanical Engineering/Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Name two key milestones in the history of robotics.
2. What are angular velocities and how are they used in robotics?
3. How do calculate the degrees of freedom of robot?
4. Compare first and second-order linear error dynamics in robot control.
5. Define kinematics of contact in robotic manipulation.
6. State the role of coulomb friction in the context of robotic grasping.
7. Differentiate between feedback and feed-forward control.
8. List the importance of reference trajectory in mobile robot control.
9. What is the role of robots in crop monitoring?
10. Define a medical robot and give two examples.

PART B — ($5 \times 13 = 65$ marks)

11. (a) Summarize about the anatomy of a robot and the role of its various components in performing tasks.

Or

- (b) Discuss the use of homogeneous transformation matrices to determine position and orientation of an end-effector.

12. (a) Explain the concept of robot kinematics and differentiate between forward and inverse kinematics for robotic manipulators.

Or

- (b) Elaborate about the Denavit-Hartenberg (D-H) convention and its use in transforming translation and rotation matrices for robot links.
13. (a) Analyze form-closure grasping of a given object and determine whether the grasp is stable under external forces.

Or

- (b) Develop steps in designing gripper and end-effector system for a robotic arm to manipulate objects of varying shapes and sizes.
14. (a) Explain the concept of mobile robots and distinguish them from stationary robots in industrial applications with suitable examples.

Or

- (b) Apply odometry data to estimate the position of a mobile robot and analyze errors in position estimation with an industrial case study.
15. (a) Illustrate the role of robots in inspection tasks and explain how automation improves accuracy and safety in modern industry 4.0 environment.

Or

- (b) Compare the applications of domestic robots versus service robots in household tasks with an aid of case study.

PART C — (1 × 15 = 15 marks)

16. (a) Design a workspace and task-space analysis for a given robot to ensure it meets all operational requirements for a specified task along with suitable case study.

Or

- (b) Develop steps in designing a military robot for surveillance or hazardous material handling, considering mobility and control.