Reg. No.												

Question Paper Code	12403

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023

Fifth Semester

Mechanical and Automation Engineering

20MUPC502 - MECHANICS AND CONTROL OF ROBOTIC MANIPULATORS

(Regulations 2020)

Duration: 3 Hours Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level, CO
1.	Define a 'Robot' according to the robotic terminologies.	*2,K1,CO1*
2.	How can we improve the safety and reliability of robots?	*2,K1,CO1*
3.	What is the difference between forward kinematics and inverse kinematics?	*2,K1,CO2*
4.	What is a SCARA robot?	*2,K1,CO2*
5.	What is the significance of 'Inverse Kinematics' in robot arm movement?	*2,K1,CO3*
6.	Define 'Precision' and 'Repeatability' in robotic systems.	*2,K1,CO3*
7.	Explain the concept of 'Roll, Pitch, and Yaw' angles in robotics.	*2,K2,CO4*
8.	Describe the role of Lagrange's equation in robot dynamics.	*2,K2,CO4*
9.	Describe the function of a 'Stepper Motor' in robotic joints.	*2,K2,CO5*
10.	What is PID control scheme and how is it applied in robotics?	*2,K1,CO5*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11.	a)	How do you specify a robot? Is robotics automation? Discuss the different classification systems of robots.	*13,K2,CO1*
		OR	
	b)	Sketch and explain the four basic robot configurations classified according to the coordinate system.	*13,K2,CO1*
12.	a)	Derive the forward kinematics of 3 dof 3R robot with steps.	*13,K2,CO2*
		OR	
	b)	Discuss in detail the Denavit–Hartenberg (DH) Convention for assigning frames to links for identifying the joint link parameters. Analyse in detail about the four DH parameters in Robot Kinematic Modeling.	*13,K2,CO2*
13.	a)	Explain briefly solvability and existence of solutions in inverse kinematics.	*13,K2,CO3*
		OR	

b) Elaborate on the 'Inverse Kinematics Computation' of a 6-axis robot with a neat diagram, emphasizing its application in complex tasks. *13,K2,CO3*

14. a) Describe with a neat sketch the process of deriving the 'Equations of Motion' for a simple 2 dof manipulator using Lagrange dynamic model. *13,K2,CO4*

OR

b) Describe using a neat sketch the Euler-Lagrange Equation in the context of robot dynamics and its application in state vector formulation. *13,K2,CO4*

15. a) Explain the static and dynamic characteristics of Sensors. *13,K2,CO5*

OR

b) Explain the robotic vision system and its components with a detailed diagram. *13,K2,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) Elaborate on the 'Law of Robotics' and various needs and applications of Robot in industrial scenario. *15,K2,CO1*

OR

b) Explain the main Robot anatomy with neat sketch. *15,K2,CO1*