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Question Paper Code	12868
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B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2024

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 the pitch, yaw and roll motion of the robot.	2	K1	CO1
2. Differentiate between accuracy and precision.	2	K2	CO1
3. List down the parameters influencing Robot design and control.	2	K1	CO2
4. List out the needs for a kinematic analysis.	2	K1	CO2
5. Define forward kinematics.	2	K1	CO3
6. Define inverse kinematics.	2	K1	CO3
7. Justify the need of Dynamics in manipulator control.	2	K2	CO4
8. Define potential energy with its terms.	2	K1	CO4
9. What is segmentation?	2	K1	CO5
10. Differentiate an open loop and closed loop control system.	2	K2	CO5

**PART - B (5 × 13 = 65 Marks)**

Answer ALL Questions

11. a) Explain the various types of controls adopted in robots.	13	K2	CO1
<b>OR</b>			
b) With a neat sketch explain the various configurations, its working, work volume, applications.	13	K2	CO1
12. a) Derive the forward kinematics of SCARA robot using DH convention.	13	K2	CO2
<b>OR</b>			
b) i) Narrate and explain the DH convention.	7	K2	CO2
ii) Compare and contrast Forward and inverse kinematics.	6	K2	CO2
13. a) Derive the inverse kinematics of 6 dof robot with steps.	13	K2	CO3
<b>OR</b>			
b) Derive the inverse kinematics of articulated arm robot with steps.	13	K2	CO3

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

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14. a) Derive the equations for velocity of n dof manipulator using Lagrange Euler formulation. 13 K2 CO4

**OR**

b) Frame the equations of motion by Lagrange Euler formulation for a 2 DOF planar manipulator. 13 K2 CO4

15. a) Derive the control equation for a linear second order control system. 13 K2 CO5

**OR**

b) Explain the static and dynamic characteristics of Sensors. 13 K2 CO5

**PART - C (1 × 15 = 15 Marks)**

16. a) Compare and contrast various joint actuators with its properties and characteristics. 15 K2 CO5

**OR**

b) Explain briefly about Machine vision system. 15 K2 CO5