Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (R,S) Exam April 2025 (2019 Scheme)

Course Code: MRT302

Course Name: ROBOTICS & AUTOMATION

Max. Marks: 100 **Duration: 3 Hours**

PART A

Answer all questions, each carries 3 marks. Marks

1		Explain the terms "roll," "pitch," and "yaw" as they relate to robotic motion.	(3)
2		Outline the main differences between hydraulic and electric drives in robotic systems.	(3)
3		Define an encoder and describe its role in measuring a robot's position or movement.	(3)
4		A part weighing 10lb is to be held by a gripper using friction against two opposing fingers. The coefficient of friction between the surfaces is 0.3. The orientation is such that the g factor for calculation is 3. Compute the required gripper force for the system	(3)
5		Explain the difference between position and orientation in robotic frames.	(3)
6		Write the equations for rotation about Y and X axis.	(3)
7		Define a Programmable Logic Controller (PLC) and briefly explain its purpose in industrial automation.	(3)
8		Differentiate between compact and modular types of PLCs	(3)
9		Define a counter in PLCs and provide an example of its application.	(3)
10		Explain the role of alarms in a PLC-based control system.	(3)

PART B

Answer any one full question from each module, each carries 14 marks.

Module I

11	a)	Illustrate and explain the basic structure of a robot with neat diagram. Describe the function of each main component, and how they work together in a robotic system.	(14)

OR

12	a)	Explain the principle of working of hydraulic actuator and state its advantages.	(7)
	b)	Explain the role of power transmission systems in robotic systems with examples of gears	(7)

Module II

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13 a) Explain the function of position sensors in robotics. Compare potentiometers, encoders, and LVDTs in terms of their working principles, applications, and limitations in robotic systems. (14)

OR

14 a) Describe the different types of end effectors used in robotics. Focus on the mechanical gripper and discuss various gripper mechanisms, Compare their advantages and limitations for handling different objects in industrial applications. (14)

Module III

15 a) Discuss about the mapping of description from one frame to another frame involving translated frames (7)

b) What are the methods of robot programming? Explain the offline programming method (7)

OR

16 a) Derive the expression for the forward and inverse kinematics for a 2 degree of freedom robotic arm (14)

Module IV

17 a) Explain the scan cycle of a PLC and describe why each step is important for the PLC's operation. (8)

b) Briefly describe how the PLC's communication interface is used. (6)

OR

18 a) With the help of a diagram, explain the wiring and installation process of a PLC and explain the various advantages and capabilities of using a PLC (14)

Module V

19 a) Explain about timers with example using ladder programming (7)

b) Write a ladder logic diagram for a basic process control application, such as controlling a motor with start/stop buttons explaining each step in detail. (7)

OR

20 a) What are the communication system in a PLC? Why is it required (7)

b) Explain about interlocks used in PLC. (7)

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