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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Eighth Semester, B.E. - Mechanical Engineering

Semester End Examination; July - 2023

Industrial Robotics

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Classify the robots based on geometrical configuration. Define work volume, resolution and accuracy of various configuration of robot.

CO2: Identify different types of drive system and sensor required for specific applications.

CO3: Explain the forward Kinematics of robots using DH method.

CO4: Develop robot task program using robot language.

CO5: Distinguish the requirements of robot systems for various industrial applications.

***Note**: I) **PART - A** is compulsory. **Two** marks for each question.*

*II) **PART - B**: Answer any **Two** sub questions (from a, b, c) for Maximum of **18 marks** from each unit.*

Q. No.		Questions	Marks	BLs	COs	POs
		I : PART - A	**10**			
1	a.	Define Robot work volume.	2	L1	CO1	PO1
	b.	Name the different drive systems powered by industrial robots.	2	L1	CO2	PO1
	c.	Write a rotational matrix about *x*-axis for direct kinematic robotics.	2	L1	CO3	PO1
	d.	List the methods of robot programming.	2	L1	CO4	PO1
	e.	Define forging operation.	2	L1	CO5	PO1
		II : PART - B	**90**			
		UNIT - I	**18**			
2	a.	With a neat sketch, explain any three robot configurations.	9	L1	CO1	PO1
	b.	Sketch and explain the following grippers used in robots: i) Mechanical gripper ii) Vaccum cups iii) Magnetic gripper	9	L2	CO1	PO1,2
	c.	With a neat diagram, explain accuracy, resolution and repeatability.	9	L2	CO1	PO1,2
		UNIT - II	**18**			
3	a.	With a neat circuit diagram, explain hydraulic drive system used in industrial robots.	9	L3	CO2	PO1,2
	b.	With a neat diagram, explain principle and working of torque-force sensor used in robotics.	9	L3	CO2	PO2
	c.	Explain principle and working of encoders.	9	L3	CO2	PO2

Contd... 2

	UNIT - III	**18**				
4 a.	With a neat sketch, explain the steps involved in implementation of Denavit-Hartenberg convention.	9	L2	CO3	PO1,2
b.	With the help of block diagram, explain the direct kinematics problem in robotics.	9	L2	CO3	PO2
c.	A point $P_{abc} = (2, 3, 4)^T$ has to be translated through distance of +4 units along OX-axis and −2 units along OZ-axis. Determine the coordinates of the new point P_{xyz} by homogeneous transformation.	9	L2	CO3	PO2
	UNIT - IV	**18**				
5 a.	Discuss first generation and future generation languages of robot programming.	9	L3	CO4	PO2
b.	With a neat sketch, explain teach pendant method of robot teaching.	9	L3	CO4	PO2
c.	Write a VAL program for the palletizing operations, the robot must pick up parts from an incoming chute and deposit them into a pallet. The pallet has three rows that are 40 mm apart and five columns that are 30 mm apart. The plane of the pallet is assumed to be parallel to the *xy* plane, the rows of the pallet are parallel to the axis and the columns of the pallets are parallel to the *y*-axis.	9	L3	CO4	PO1,2
	UNIT - V	**18**				
6 a.	List and explain key issues for locomotion.	9	L4	CO5	PO1
b.	Calculate and explain the number of possible gaits for a biped walker in autonomous mobile robots.	9	L4	CO5	PO1,2
c.	Explain how robots being utilized in the following production operations? i) Die casting ii) Plastic moulding iii) Stamping press operations	9	L4	CO5	PO1,2

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