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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth Semester B.Tech (Hons) Degree Examination July 2021 (2018 Admission)

Course Code: EC368
Course Name: ROBOTICS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks Marks

1 a) Explain cylindrical and spherical robot configurations. (6)

b) Explain the terms reach, precision, and repeatability of a robot. (9)

2 a) With neat diagram, explain working of LVDT. (5)

b) How torque is measured using strain gauge? (5)

c) How a variable reluctance type stepper motor is constructed? On what parameters step angle of a stepper motor is dependent on? (5)

3 a) What is a hydraulic actuator? List any 3 advantages and 3 disadvantages of hydraulic actuator. (5)

b) Explain working of a DC servo motor. (5)

c) How will you control speed and direction of DC motors? (5)

PART B

Answer any two full questions, each carries 15 marks

4 a) What are the main functions of robot vision system? (5)

b) With a neat block diagram, explain the components of a machine vision system (10)

5 a) A robot with 2 revolute joints (J1, J2) has 2 links (L1, L2) with length 1m each. Assume origin is at joint J1. Determine the end-effector coordinates if the joint rotations are 30 degrees at J1 and J2. (5)

b) Find a homogeneous transformation matrix T that represents a rotation of α angle about OX axis, followed by a translation of a units along the OX axis, followed by a translation of d units along the OZ axis, followed by a rotation of θ units along the OZ axis. (10)

6 a) Explain clearly the rules in DH representation. Define each parameter used. (6)

b) Derive the rotation matrix for a sequence of rotations: Ψ about OX axis, θ about OY axis, ϕ about OZ axis. (9)

PART C

Answer any two full questions, each carries 20 marks

7	a)	Derive manipulator Jacobian for a 2D planar 2 link manipulator.	(10)
	b)	What are the consequences of singularities in inverse kinematics?	(5)
	c)	What is PID control? What are the main advantages of PID control?	(5)
8	a)	Name the main categories of robot programming languages	(5)
	b)	List 3 typical commands in VAL II and explain the function performed by each of these commands	(10)
	c)	What is task level programming?	(5)
9	a)	Derive the kinetic and potential energies of a planar 2 link manipulator with link lengths l_1, l_2, joint angles θ_1, $\theta_1$and masses m_1, m_2.	(10)
	b)	Explain the use of robots in medical applications.	(5)
	c)	Explain the recent developments in robotics	(5)

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