

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER- V (New) EXAMINATION – WINTER 2019****Subject Code: 2154102****Date: 25/11/2019****Subject Name: Principles of Robotics****Time: 10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

		MARKS
Q.1	(a) Write the Asimov's laws of robotics.	03
	(b) Explain any two Robot specifications.	04
	(c) Demonstrate the robot cell construction and its working principle.	07
Q.2	(a) What is forward kinematics and where it can be applied?	03
	(b) Write the direct kinematic equation of a 3 DOF TRR configuration robot.	04
	(c) What is the inverse transformation and how should it be interpreted?	07
	OR	
	(c) Explain different kinematic pair used in robot.	07
Q.3	(a) Give the difference between the prismatic and rotary joints?	03
	(b) Define Linear and Angular velocity.	04
	(c) Derive the expression for the velocity of the tip of the two link, planar, RR manipulator arm.	07
	OR	
Q.3	(a) Draw the singular configuration of 2 link planner arm.	03
	(b) What is forward jacobian and Inverse jacobian?	04
	(c) Define Jacobian and Write the manipulator Jacobian matrix for the 3-DOF articulated arm with suitable example.	07
Q.4	(a) Analyse the suitable method for trajectory planning.	03
	(b) List out the advantages of recursive Newton Euler formulation.	04
	(c) Describe in detail about the control of robot manipulators in joint space trajectories.	07
	OR	
Q.4	(a) Define 'Lagrange function'.	03
	(b) Analyze the use of a p-degree polynomial as interpolation function	04
	(c) Discuss in detail about the position and orientation planning.	07
Q.5	(a) What are open and closed loop control?	03
	(b) Develop the block diagram of a manipulator control system.	04
	(c) List the pros and cons involved in linear and nonlinear control of robot manipulation.	07
	OR	
Q.5	(a) Analyze the PID control schemes.	03
	(b) Describe the schematic of robot control system.	04
	(c) Obtain the transfer function for position control, neglecting the armature inductance.	07
