

Enrollment No./Seat No.:

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**Bachelor of Engineering - SEMESTER - V EXAMINATION - WINTER 2025**

**Subject Code: 3154102**

**Date: 02-12-2025**

**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.**
- 4. Simple and non-programmable scientific calculators are allowed.**

	<b>Marks</b>
<b>Q.1 (a)</b> Define the term as per Japan industrial robot Association (JIRA). I) Manipulator, II) Playback robot, III) Intelligent robot.	<b>03</b>
<b>(b)</b> Describe the three guiding rules for robots as established by Asimov.	<b>04</b>
<b>(c)</b> What are the different types of robotic arm configurations? Draw and label any two in details.	<b>07</b>
<b>Q.2 (a)</b> Define the robot as per British Robot Association (BRA), Robotics Industries Association (RIA) and International Standard Organization (ISO).	<b>03</b>
<b>(b)</b> Describe progressive advancements in robots.	<b>04</b>
<b>(c)</b> Describe the wrist configuration and end-effector of a robotic arm in detail, with the help of a suitable diagram.	<b>07</b>
<b>OR</b>	
<b>(c)</b> Explain the various industrial application of robots.	<b>07</b>
<b>Q.3 (a)</b> Write about links, joints and joints scheme with suitable diagrams.	<b>03</b>
<b>(b)</b> Define linear and angular velocities in the context of robotic manipulators.	<b>04</b>
<b>(c)</b> Explain in detail about a manipulator control system with suitable diagram.	<b>07</b>
<b>OR</b>	
<b>(a)</b> Define DOF. Describe 2-DOF with 2-links and 2-joints with suitable diagram.	<b>03</b>
<b>(b)</b> What are the future prospects of robots?	<b>04</b>
<b>(c)</b> Discuss in details about manipulator workspace.	<b>07</b>
<b>Q.4 (a)</b> Define the term: I) Load carrying capacity, II) Work Volume.	<b>03</b>
<b>(b)</b> Give difference between Direct Kinematics and inverse kinematics.	<b>04</b>
<b>(c)</b> Describe in details about solvability of inverse kinematic model.	<b>07</b>
<b>OR</b>	
<b>(a)</b> Write three constraints on the planned trajectory.	<b>03</b>

- (b) Write the step in orientation planning. 04
- (c) Explain use of p-degree polynomial as interpolation function. 07
- Q.5** (a) What are the key parameters involved in joint space path planning? 03
- (b) What is the Jacobian matrix in robotics, and why is it important? 04
- (c) List the linear control schemes for manipulator. Discuss about open loop and closed loop manipulator control system with suitable diagram. 07

**OR**

- (a) What is the manipulator control problem? 03
- (b) Explain how cubic polynomials are used in joint space trajectory planning. 04
- (c) List the manipulator Jacobian. Explain in detail any one joint manipulator Jacobian. 07

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