

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 5 – EXAMINATION – SUMMER 2026

Subject Code: 3151110

Date: 21/05/2026

Subject Name: Robotics and Automation

Time: 02:30 PM TO 05:00 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.**

- Q.1**
- (a) Define "Robot" and list its three primary industrial applications. **03**
 - (b) State and briefly explain Isaac Asimov's three laws of robotics. **04**
 - (c) Draw a neat block diagram of a robotic system and explain the function of each core component. **07**

- Q.2**
- (a) What is an end-effector? Name three different types of grippers. **03**
 - (b) Differentiate between a microprocessor and a microcontroller, highlighting their respective roles in robotics. **04**
 - (c) Explain the working principle of an IR sensor and show how it can be interfaced with an Arduino controller with a neat diagram. **07**

OR

- Q.2**
- (c) Explain the concept of dynamic stabilization in robots and discuss why it is crucial for mobile robots. **07**
- Q.3**
- (a) Define 'Degrees of Freedom' (DOF) for a robot manipulator. **03**
 - (b) Briefly describe the working of a pneumatic actuator and list two of its advantages in robotic applications. **04**
 - (c) Describe the various generations of robots, highlighting the key technological advancements that defined each era. **07**

OR

- Q.3**
- (a) Explain the concept of accuracy and repeatability of a robot. **03**
 - (b) Explain the electrical actuators with its characteristics. **04**
 - (c) Compare and contrast forward kinematics and inverse kinematics. What are the essential inputs required for solving an inverse kinematics problem? **07**

- Q.4**
- (a) What is offline robot programming? List two significant advantages it offers. **03**
 - (b) Describe the role of the Robot Operating System (ROS). Why has it become a popular platform in robotics research? **04**
 - (c) Classify robots based on their coordinate systems (e.g., Cartesian, Cylindrical). Support your explanation with simple sketches of their work envelopes. **07**

OR

- Q.4**
- (a) List out basic modes of operation in Robot language structure. **03**
 - (b) List the type of robot joints along with notation, symbol and description. **04**

(c) Evaluate the online (teach pendant) method of robot programming. Discuss its main advantages and disadvantages. **07**

Q.5 (a) Differentiate between palletizing and depalletizing operations in material handling. **03**

(b) Define the following performance parameters for an industrial robot: 1. Accuracy 2. Repeatability 3. Payload 4. Speed. **04**

(c) Discuss and evaluate the key factors that must be considered while selecting a robot for an industrial application like arc welding. **07**

OR

Q.5 (a) What is machine interference? **03**

(b) List different types of material handling operation? **04**

(c) Design a simple robotic work cell for a pick-and-place operation. Justify your choice of robot type, gripper, and layout. **07**
