# GUJARAT TECHNOLOGICAL UNIVERSITY
**BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2022**

**Subject Code:3171717**                                **Date:16-01-2023**

**Subject Name:Robotic Engineering**

**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.**

|  |  |  | MARKS |
|---|---|---|---|
| **Q.1** | **(a)** | List and state three laws of robotics stated by Isaac Asimov. | **03** |
|  | **(b)** | List the type of robot joints along with notation, symbol and description. | **04** |
|  | **(c)** | How robots are classified based on coordinate system? Discuss any one of them with the help of neat sketches. | **07** |
| **Q.2** | **(a)** | List in detail specifications of an industrial robot. | **03** |
|  | **(b)** | Discuss any one of the types of gripper mechanism. | **04** |
|  | **(c)** | Describe the rotation matrix in detail. | **07** |

**OR**

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|---|---|---|---|
|  | **(c)** | Explain in detail history of robotics, along with various generations of robots that came into existence. | **07** |
| **Q.3** | **(a)** | Explain a robot cell and its use. | **03** |
|  | **(b)** | Explain how to decide the HP rating of a motor? | **04** |
|  | **(c)** | Explain in detail various types of grippers in robotics. | **07** |

**OR**

|  |  |  |  |
|---|---|---|---|
| **Q.3** | **(a)** | Explain in detail hydraulic actuator. | **03** |
|  | **(b)** | What points are considered while selecting HP rating of a motor? | **04** |
|  | **(c)** | What is robot programming? Explain in detail various types of robot programming. | **07** |
| **Q.4** | **(a)** | What is a Tactile Sensor? | **03** |
|  | **(b)** | Define degree of freedom, robot, repeatability and links. | **04** |
|  | **(c)** | The coordinates of a point Pabc=(4,3,2)T in the body coordinates frame oabc are rotated through 45° about OZ axis. Determine the coordinates of the vector Pxyz with respect to base reference coordinate frame. | **07** |

**OR**

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| **Q.4** | **(a)** | List any 3 types of arms used in industrial robot manipulators. | **03** |
|  | **(b)** | What are the uses of sensor in robotics? What are the types of sensors used in robotics? | **04** |
|  | **(c)** | Explain in detail Jacobian Transpose method for solving inverse kinematic problem. | **07** |
| **Q.5** | **(a)** | What is meant by pitch, yaw and roll? What is meant by a work envelope? | **03** |
|  | **(b)** | Differentiate between path planning and trajectory planning. | **04** |
|  | **(c)** | Discuss the performance characteristics of actuators. Compare electrical, pneumatic & hydraulic actuators for their characteristics. | **07** |

**OR**

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|---|---|---|---|
| **Q.5** | **(a)** | What is the workspace? Explain in detail. | **03** |
|  | **(b)** | Explain types of wrists of robots in robotics. | **04** |
|  | **(c)** | Explain the working of DC servo motors used in robotics. | **07** |

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