Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech. Summer 2018 - 19 Examination

Semester: 8 **Date:01/05/2019**
Subject Code: 03113451 **Time:10:30am to 01:00pm**
Subject Name: Robotics Engineering **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions (All are compulsory) (Each of one mark) **(15)**

1. A robot transformation may be in one of the following forms.
   (a) Pure translation (b) Pure rotation
   (c) Combination of a & b (d) None of these
2. What is the range of mechanical read switches?
   (a) 1 feet (b) 1 meter
   (c) 1 centimeter (d) None of these
3. Which type of robotic system having linear, linear, linear [LLL] type of coordinate system?
   (a) Cartesian coordinate system (b) Polar coordinate system
   (c) Jointed arm coordinate system (d) Cylindrical coordinate system
4. Which lower pair connectors having 3-degree of freedom?
   (a) Revolute pair (b) Prismatic pair
   (c) Cylindrical pair (d) Spherical pair
5. Industrial robots are generally designed to carry which of the following coordinate system(s).
   (a) Cartesian coordinate systems (b) Polar coordinate systems
   (c) Cylindrical coordinate system (d) All of the above
6. _____ is an internal type of robotic sensor.
7. For a manipulator, the joint angles and different configuration of the manipulator are derived from the position and orientation of the end effector, the scheme is called _____ problem.
8. ____ is ideal method of robot programming for welding & spray painting type of automated operations.
9. ____ is not a functionality of robot.
10. D-H representation method does not use a transformation along __ axis for robot joint.
11. For spray painting kind of continuous operation _____ programming system used.
12. Internal state sensors and external state sensors determine relationship of the robot and its environment and object handle it. (True/False)
13. Linear variable transformation is a kind of transducer. (True/False)
14. For commercially available robots straight line interpolation is the default procedure provided by manufacturer. (True/False)
15. Achieving the same target again and again by robotic arm is called accuracy. (True/False)

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) Compare hydraulics, pneumatics and electric drives of robot.
B) List down various types of grippers and explain any two in detail with neat sketch.
C) A point $p(7,3,1)^T$ is attached to a frame F_{noa} and is subjected to following transformations. Find the coordinators of the point relative to the reference frame at the conclusion of transformations.
   a) Rotation of 90^0 about z-axis
   b) Followed by a rotation of 90^0 about the y-axis.
   c) Followed by a translation of [4,-3,7].
D) Write a short note on harmonic drives used in robotics.

Q.3 A) Derive forwards and inverse kinematics equations for 2-degree of freedom manipulator having two rotational joints. **(07)**

B) Prepare D-H parameter table and matrix for each link and forward kinemics matrix for the given robotic arm. (Figure-1) **(08)**

OR

B) In detail explain the each steps of D-H parameter method and derive forward kinematics matrix. **(08)**

Q.4 A) Explain in detail leadthrough programming method with suitable example. **(07)**

OR

A) Explain three methods of defining robot position in space with suitable applications. **(07)**

B) Classify robot languages, briefly explain VAL programming structure and explain any four motion instruction of VAL programming method. **(08)**

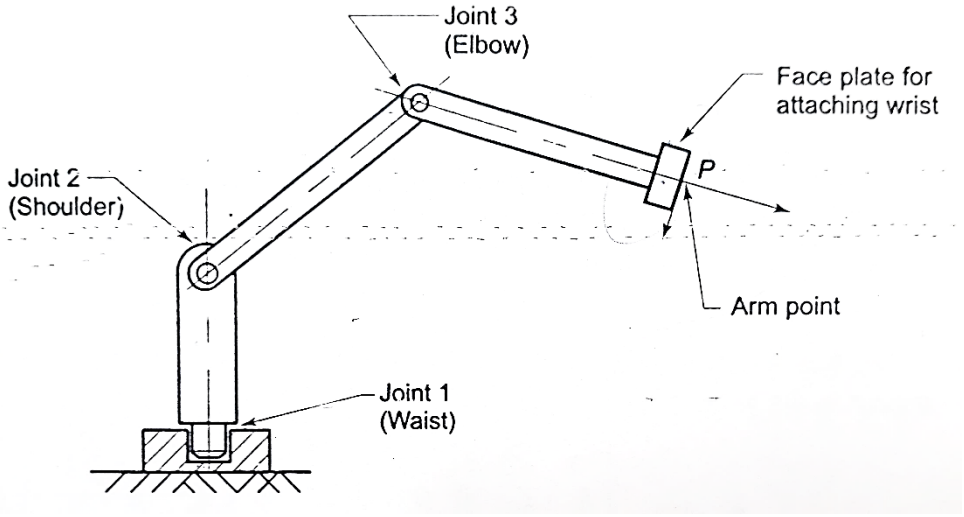

Figure-1: Robotic Manipulator