



### End Term Examination (December 2019)

School: School of Engineering

Program: B.Tech - Mechatronics

Course: Robotics

Course Code: MTE403

Semester: VII

Max Marks: 40

Duration (mins): 90

#### Q 1. Multiple Choice Questions (ANY EIGHT).

(Each question carries 1 marks)

[08]

- a) Which part of a robot provides motion to the manipulator and end-effectors?  
i. Controller    ii. Sensor    iii. Actuator    iv. All of the above
- b) Which of the following is not the type of actuator?  
i. Digital Actuator    ii. Pneumatic Actuator    iii. Hydraulic actuator    iv. None of the above
- c) In a robot the 'Translatory Joints' known as \_\_\_\_\_.  
i. Revolute    ii. Prismatic    iii. Cylindrical    iv. Spherical
- d) SCARA robot is very suitable in \_\_\_\_\_ operations.  
i. Single Operation    ii. Rotary Operation    iii. Assembly Operation    iv. Translatory Operation
- e) Which of the following is not the functionality of Robot?  
i. Reprogramability    ii. Multifunctionality    iii. Responsibility    iv. Efficient Performance
- f) The Robot designed with Cartesian coordinate systems has  
i. Three linear movements    ii. Three rotational movements  
iii. Two linear and one rotational movement    iv. Two rotational and one linear movement
- g) The following drive is used for lighter class of Robot.  
i. Pneumatic drive    ii. Hydraulic drive    iii. Electric drive    iv. All of the above
- h) Number degrees of freedom exhibited by robot wrist  
i. 1    ii. 2    iii. 3    iv. 4
- i) Preferred robot system for load carrying applications  
i. Hydraulic    ii. Pneumatic    iii. Electrical    iv. Mechanical
- j) Work volume of a Cartesian robot  
i. Cylinder    ii. Paraboloid    iii. Sphere    iv. Cube

**Q 2. Answer any TWO questions.**

**(Each question carries 6 marks)**

**[12]**

- a) Explain Polar and Cylindrical configuration system along with their applications.
- b) Give the classification of robots based on control system and describe their characteristic features.
- c) Describe the degrees of freedom of a robot wrist with the help of a neat sketch.
- d) Draw the following robotic configuration, state their Degree of freedom and also draw kinematic diagram of each: i) TRL ii) LOO iii) TLO

**Q.3 Answer any TWO questions.**

**(Each question carries 10 marks)**

**[20]**

- a) Determine the homogeneous transformation matrix to represent the following the sequence of operations:
  - (i) Rotation of  $45^\circ$  about x-axis
  - (ii) Translation of 6 units along x- axis
  - (iii) Translation of  $-3$  units along z-axis
  - (iv) rotation of  $30^\circ$  about y-axis
- b) Derive the forward kinematics equation using the DH convention for the two link planar manipulator.

- c) For three axis robot the following data is given:

Link	a	$\alpha$	$\theta$	d
1.	0	-90	30	1
2.	2	0	45	0
3.	0	+90	20	4

What are the coordinates of end-effector at the end of 3rd Link?

- d) Develop a robot for a car manufacturing company, where Robot has to pick windshield glass from an adjoining parallel premier applied glass carrying platforms. Platform 1 carries front glasses and platform 2 which is at the same level but next to platform 1 carries rear glasses platform 2 is farthest from car assembly line. Robot should fix the same on front and rear of a car module on car assembly line. Draw the Robot, specify and justify the use of joints and gripper. State its degree of freedom and explain its work envelope.

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