

(Following Paper ID and Roll No. to be filled in your Answer Books)

PAPER ID : ME29

Roll No.

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M. TECH. (Sem.II)

THEORY EXAMINATION 2015-16

ROBOTICS & CONTROL

Time : 3 Hours

Total Marks : 100

Note : Attempt all questions.

1. Answer any two parts : (10×2)
 - (a) Explain basic types of mechanical configuration of an industrial robot with suitable diagram.
 - (b) What is an industrial Robot? Define classification of Robots. Also discuss its industrial applications.
 - (c) Explain the various components of a robotic manipulator. Explain characteristics of Robot.

2. Answer any two parts : (10×2)
 - (a) What is the major type of drive systems used for industrial robot? Explain briefly.
 - (b) Derive the matrix that represents a pure rotation about the Y-axis of the reference frame.

- (c) What do you mean by 'degree of freedom'? Discuss with suitable diagram number of degrees of freedom a robot could have?

3. Answer any two parts : (10×2)

- (a) With the help of suitable sketch, show the PTP, linear and contouring control of robot.
- (b) A point $p(7,3,1)^T$ is attached to a frame F_{noa} and is subjected to the following transformation, but all relative to the current moving frame, as listed below. Find the coordinates of the point relative to the reference frame after transformations are completed.
- (i) Rotation of 90° about the a-axis,
 - (ii) Then a translation of $[4,-3,7]$ along n, o, a-axis,
 - (iii) Followed by a rotation of 90° about the o-axis.
- (c) What are the basic types of 'End Effectors'? What factors should be taken into consideration while designing end effectors?

4. Answer any two parts : (10×2)

- (a) Describe the following terms:
- (i) Accuracy
 - (ii) Precision
 - (iii) Resolution
 - (iv) Repeatability
 - (v) Work volume

- (b) Derive the matrix for Roll, Pitch; Yaw (RPY) angles Equations of Robot.
- (c) Discuss various technical features required of robot for spot welding and spray coating applications.

5. Answer any two parts : (10×2)

- (a) What is adaptive control? Explain Model Reference Adaptive Control (MRAC) with proper diagram.
- (b) What are the commonly used programming languages for robot programming? Differentiate between VAL and RAIL robot programming languages.
- (c) Write short notes on any two:
 - (i) SCARA robot
 - (ii) Actuators
 - (iii) Robot sensors
