

Dec.-22-0300

ME-701 (Industrial Automation and Robotics)

B.Tech. 7th (CBCS)

Time : 3 Hours

Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, selecting one question from each section A, B, C and D. Question no. 9 is compulsory.

**SECTION - A**

1. Write a short note:
  - (a) Reach and stroke
  - (b) Tool orientation
  - (c) Degree of freedom
  - (d) Singularity of mechanism
  - (e) Denavit-Hartenberg (DH) Representation (5×2=10)
2. Explain the different type of arm configurations with 3-DOF. (With neat diagrams). (10)

**SECTION - B**

3. What are the fundamental rotation matrices? Obtain the three fundamental rotation matrices for rotations about axes x, y, and z from the rotation matrix for rotation about an arbitrary axis k. (10)
4. (a) Explain all the elements of robot anatomy with neat sketch. (4)

- (b) Compute the arm matrix  $T_{tool}^{base}(q)$  for the four axis SCARA robot. (6)

**SECTION - C**

5. (a) Write homogenous transformation matrices for rotation in 3D. (5)  
(b) Explain the payback method for the economic analysis. (5)
6. (a) Differentiate between hydraulic and pneumatics manipulators. What are the advantages of hydraulic and pneumatics manipulators? (5)  
(b) What do you understand by screw transformations? Where these transformations can be useful? (5)

**SECTION - D**

7. (a) Discuss the concept of industrial automation and explain types of automations. (5)  
(b) Socio economic impacts of automation. (5)
8. (a) Name any two methods by which path is controlled by robot controller. Discuss various transfer mechanisms (5)  
(b) Draw and explain the various types of joints used in robotic manipulators. (5)

**SECTION - E**

9. Briefly explain.
  - (a) Differentiate between servo-controlled robot and non-servo-controlled robot.

[P.T.O.]

- (b) Explain the need of filter and lubricator in the pneumatic systems.
- (c) What is Coanda effect?
- (d) Robot vision.
- (e) Explain speed of motion in an industrial robot.
- (f) Repeatability of the manipulator.
- (g) Accuracy of the manipulator.
- (h) End-effectors.
- (i) Load carrying capacity.
- (j) SCARA Manipulator. (10×2=20)