Roll No. ☐☐☐☐☐☐☐☐☐☐☐   Total No. of Pages : 02

Total No. of Questions : 09

B.Tech (Automation & Robotics) (2012 & Onwards)   (Sem.-6)

ADVANCED ROBOTICS

Subject Code : BTAR-601

M.Code : 71065

Time : 3 Hrs.   Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. **Write briefly :**

   a. What are the factors to be considered while selecting the robot?

   b. Differentiate between forward kinematics and reverse kinematics.

   c. Define work envelope of the manipulator.

   d. Explain briefly why kinematic study of the robot is important.

   e. Differentiate between Lagrange Euler and Newton Euler Formulation.

   f. Differentiate joint coordinates and world coordinates.

   g. Define work volume and load carrying capacity with reference to robot.

   h. Define DH parameters.

   i. What do you mean by Jacobian matrix?

   j. What features are required for robot in spray painting?

SECTION-B

2. Explain about Newton - Euler formulations by considering an example.

3. Discuss in detail the architecture of robot system.

4. How velocity Jacobian matrix does come into picture in static analysis?

5. What are work place design considerations for safety of Robots?

6. What are the apparent advantages and disadvantages of the Euler-Lagrange and Newton-Euler formations?

SECTION-C

7. A single cubic trajectory given by $q(t) = 10 + 90t^2 - 60t^3$ is used for a period of 1 seconds. Determine starting and final position, velocity and acceleration of end effector.

8. Describe about Inverse and Backward analysis of serial SCARA (PRRRP) Robot.

9. For the four degree of freedom robot depicted in Figure 1:

    a. Assign appropriate frames for D-H representation.

    b. Fill out the parameter table containing θ, d, a, α

    c. Write an equation in terms of A matrices that show how $^U T_H$ can be calculated.
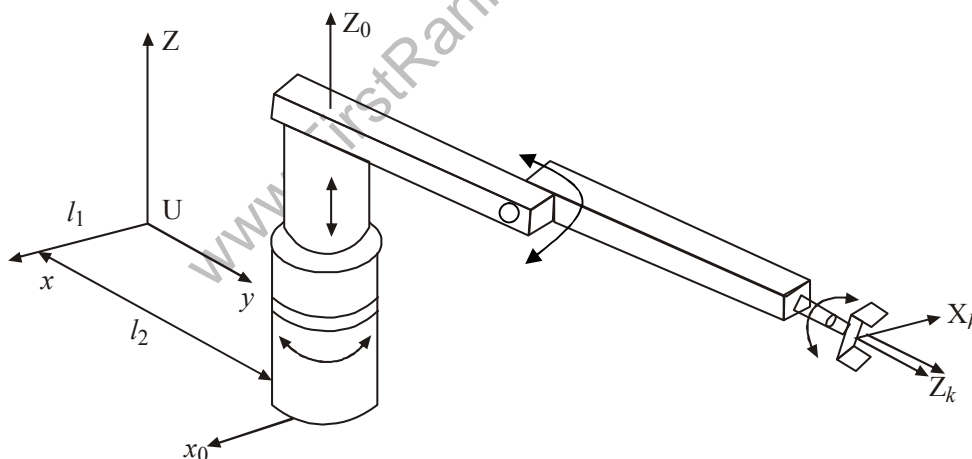

Figure 1

NOTE : Disclosure of identity by writing mobile number or making passing request on any page of Answer sheet will lead to UMC case against the Student.