JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2023

B.Tech-VII Semester (CSE/IT/ECE/CE/BT/BI)

COURSE CODE (CREDITS): 20B1WEC731 (3) MAX. MARKS: 35

COURSE NAME: AUTOMATION AND ROBOTICS

COURSE INSTRUCTORS: EMP, Mr. Mukund Mitra MAX. TIME: 2 Hours

Note: *(a)All questions are compulsory.*
(b)Marks are indicated against each question in square brackets.
(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

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Q1. Prove that $R_x(\theta_1)R_y(\theta_2) \neq R_y(\theta_2)R_x(\theta_1)$ [CO3, 2M]

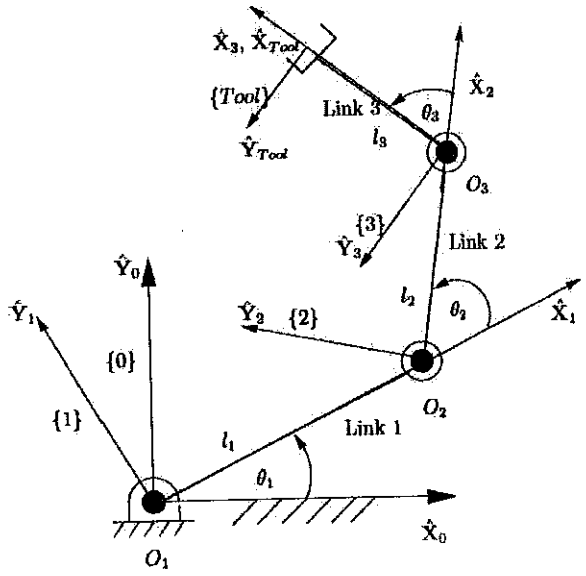
Q2. Explain the 4 DenavitHartenberg (DH) parameters $(\alpha_{i-1}, a_{i-1}, d_i, \theta_i, where\ i = links)$ with a schematic diagram. [CO3, 3M]

Q3. Find a trajectory $(\theta_1(t))$ with $\mathbb{C}^2$ for a robotic manipulator using joint space scheme given the following conditions:

$\theta_1(0) = 10^{\circ}; \theta_1(3) = 40^{\circ}; \dot{\theta}_1(0) = -20\ deg/sec\ ; \dot{\theta}_1(3) = 30\ deg/sec$

Draw the position, velocity and acceleration profiles for the trajectory obtained. [CO5, 5M]

Q4. Find the Inverse Kinematic solution for a 3R robotic manipulator as shown below. Comment on the uniqueness of Inverse Kinematic solution along with reason. [CO3, 5M]



Q5. Define motion planning. What are the various types of schemes used for motion planning of a robotic system? Define each scheme along with its importance. What is $\mathbb{C}^2$ continuity? Mention its importance in motion planning. [CO5, 5M]

Q6. A frame {C} is rotated by 20° to get frame {B}. Frame {B} is then rotated by 40° to get frame {A}. A point "P" in frame {C} is given by $[2\ 4\ 6]^T$. What is its position vector with respect to frame {A}? [CO3, 5M]

Q7. What are sensors and actuators? Highlight their significance in enabling intelligent and responsive behavior in automated systems. Discuss the various types of sensors used in automation. [CO4, 5M]

Q8. Examine the role of Programmable Logic Controllers (PLCs) in industrial automation, exploring their principles, applications, and impact on modern manufacturing processes. Describe how it functions as a versatile control system in diverse industrial settings. [CO2, 5M]