VIT

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

REG.NO:

SCHOOL OF MECHANICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST (CAT) -II
WINTER SEMESTER 2025-2026

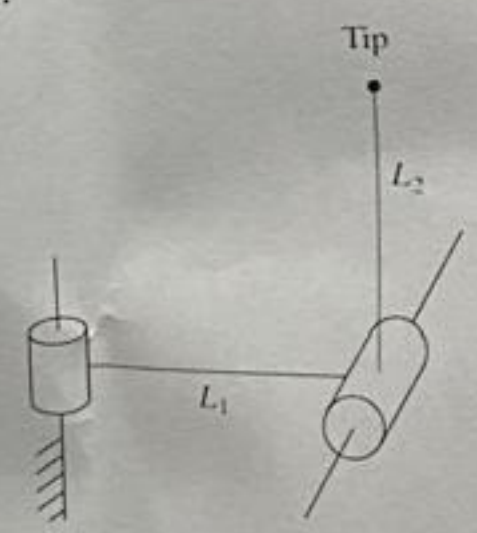
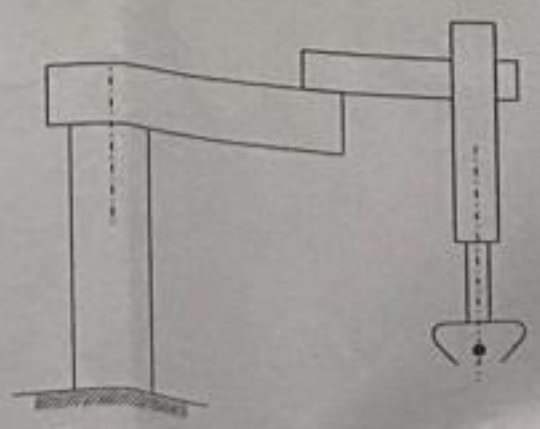
Programme Name & Branch	**: B.Tech Mechanical Engineering**
Course Code	**: BMEE316E**
Course Name	**: Industrial Robotics**
Faculty Name(s)	**: Kalaiyarasan G**
Class Number(s)	**: VL2025260503131**
Date of Examination	**: 22.03.2026**
Exam Duration	**: 90 minutes** **Maximum Marks: 50**

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes Statements.

CO. 3: Solve and model the kinematics equations of various manipulator configurations.

CO. 4: Compute the collision-free trajectory planning.

Q. No	Question	M	CO	BL
1.	Derive the transformation matrix for the given manipulator configuration as shown in the figure.1.  Figure.1 2-DOF Manipulator	10	03	03
2.	Affix the frames as per the procedure and fill the DH table for the given SCARA manipulator as shown in the figure.2  Figure.2 SCARA Manipulator	10	03	03
3.	Derive the invers kinematics equation for joint angle θ_1 , θ_2 and θ_3 for the given 3-link planar manipulator as shown in the figure.3.	10	03	03

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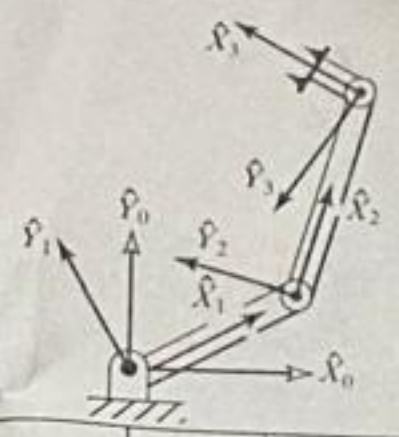

i	α_{i-1}	a_{i-1}	d_i	θ_i
1	0	0	0	θ_1
2	0	L_1	0	θ_2
3	0	L_2	0	θ_3

Figure.3 Three link planar

4.	A rotary joint move in two-segment cubic spline with the desired velocity of −20 degrees/second at its via point. Sketch the graphs of position, velocity, and acceleration for an initial position θ_o = 75 degree, via point θ_v = 60 degree, and a goal point of θ_g = 50 degree. The first and second segments last for 1 and 0.5 seconds, respectively. What are the accelerations right before and after the via point?	10	05	03
5.	The initial cartesian position of two link planar is *x=200 mm and y=200 mm* in lower elbow configuration. It is desired to move the robot arm from initial position to final position *x=0 and y=400 mm*. Calculate the cartesian trajectory planning *x(t) and y(t) and* using inverse kinematics of two link planar calculate the joint variable for the respective *x(t) and y(t).*	10	05	04

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