Name :.....
Roll No:.....

MAR ATHANASIUS COLLEGE OF ENGINEERING

(Government Aided Autonomous Institution)
Kothamangalam, Kerala - 686 666
DEPARTMENT OF MECHANICAL ENGINEERING

B24ME3T04 ROBOTICS AND AUTOMATION

First Sessional Examination August 2026

Duration: 1 hour and 30 minutes | S5 ME A & B BATCH | Max mark: 40

Part A

(1) What is meant by the Degree of Freedom (DOF)? Explain the DOF associated with any two types of joints commonly used in robotic manipulators.(CO1) **(3)**

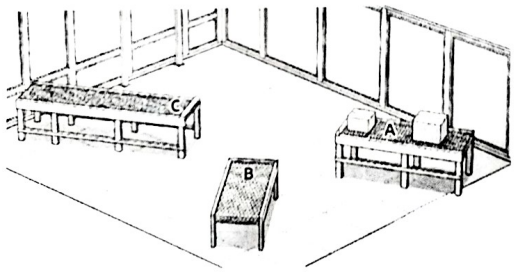
(2) Differentiate Incremental Position Encoders and Absolute Position Encoders.(CO1) **(3)**

(3) Define the Homogeneous Transformation Matrix. Explain its significance in robotic manipulator kinematics. (CO2) **(3)**

(4) What are the different rotation representation schemes used in robotics? (CO2) **(3)**

Part B

(1) a. Explain the common robot configurations with neat sketches. Based on the given layout, recommend a suitable robot configuration for transferring boxes from Station A to Stations B and C. (CO1) **(7)**



b. Discuss the applications of robots in manufacturing and service industries, giving suitable examples. (CO1) **(7)**

(2) a. Consider a 3-DOF planar robot with three revolute joints having $L_1 = 300\,\text{mm}$, $L_2 = 250\,\text{mm}$, $L_3 = 150\,\text{mm}$ and joint angles for Z axis rotation are $\theta_1 = 30°$, $\theta_2 = 45°$, and $\theta_3 = 15°$. Determine the overall transformation matrix ${}^0T_3$, the end-effector position and orientation. (CO2) **(7)**

b. Using a neat sketch of two consecutive links, explain the Denavit–Hartenberg (DH) convention. Define the four DH parameters and explain how the six relative spatial parameters are reduced to four DH parameters. (CO2) **(7)**

Vision

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Mission

1. To facilitate comprehensive and integrated development of students by providing quality education that encourages sustainable practices.
2. To mould disciplined and socially committed engineers capable of assuming professional leadership upholding national integrity.