

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(MID SEMESTER EXAMINATION)**

CLASS: BTECH  
BRANCH: CSE

SEMESTER: VII  
SESSION: MO/2022

SUBJECT: ME397 INDUSTRIAL ROBOTICS AND AUTOMATION

TIME: 2 HOURS

FULL MARKS: 25

**INSTRUCTIONS:**

1. The total marks of the questions are 25.
2. Candidates attempt for all 25 marks.
3. Before attempting the question paper, be sure that you have got the correct question paper.
4. The missing data, if any, may be assumed suitably.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

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|--|-----|----|----------|
| Q1 (a) Classify Robots based on coordinate systems.  | [2] | 1  | Classify |
| Q1 (b) What are the different subsystems of a robotic system   | [3] | 1  | What     |
| Q2 (a) Prove that the transpose of a rotational matrix is equal to the inverse of the same.  | [2] | 1  | Prove    |
| Q2 (b) A frame {B} is located initially coinciding with a frame {A}. If {B} is rotated $60^\circ$ about $\hat{Z}_B$ and then $90^\circ$ about the current $\hat{X}_B$ , find the rotation matrix that will describe a vector frame {B} in a frame {A}. | [3] | 1  | Find     |
| Q3 (a) Write the list of rules you obey to describe the parameters of a manipulator.   | [2] | 1  | Write    |
| Q3 (b) The arm with three degrees of freedom is shown in Fig. Q.3(b). Derive the kinematic equation for $\frac{B}{W}T$ .   | [3] | 1  | Derive   |

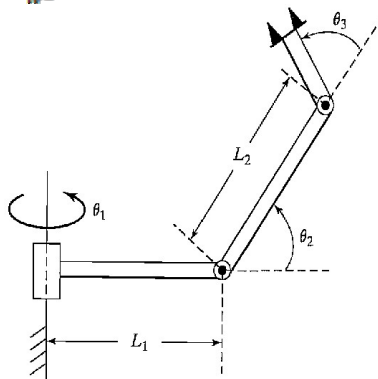


Fig. Q.3(b)

- |   |     |   |       |
|---|-----|---|-------|
| Q4 (a) What is an actuator?   | [2] | 2 | What  |
| Q4 (b) Write the list of different types of actuators in brief detail.      | [3] | 2 | Write |
| Q5 (a) Draw a typical speed-torque plot of a dc-motor.                      | [2] | 2 | Draw  |
| Q5 (b) List any three advantages and disadvantages of a pneumatic actuator. | [3] | 2 | List  |