

Sem VIII / IT / CBGS / Robotics / M-J-16

QP Code : 724200

Extry

(3 Hours)

[Total Marks : 80

- N.B. : (1) Questions No. 1 is **compulsory**.
 (2) Answer **any three** from the remaining quetions.

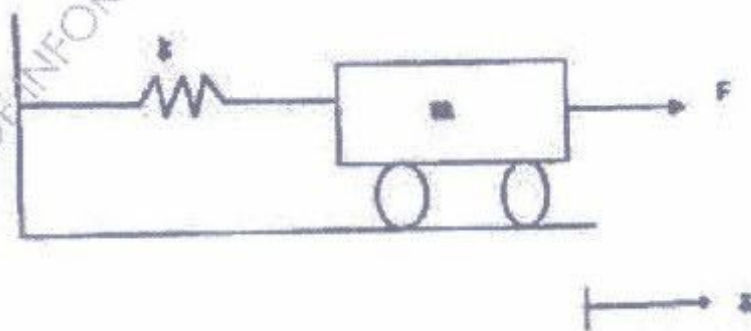
1. (a) Define Robot and how are Robot classified. 5
 (b) Define all kinematics parameter of robot with neat sketch. 5
 (c) Develop Screw transformation matrix. 5
 (d) Compare hard and soft automation. 5
2. (a) A frame F has been moved 5 units along the Y axis and 10 units along the z axis of the reference frame. Find the new location of the frame. 10

$$\begin{bmatrix} 0.527 & -0.574 & 0.628 & 5 \\ 0.369 & 0.819 & 0.439 & 3 \\ -0.766 & 0 & 0.643 & 8 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

- (b) Calculate the inverse of the given transformation matrix: 10

$$T = \begin{bmatrix} 0.5 & 0 & 0.866 & 3 \\ 0.866 & 0 & -0.5 & 2 \\ 0 & 1 & 0 & 5 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

3. Explain DH algorithm. Carry out the inverse Kinematics analysis of 4 axis SCARA robot. 20
- 4 (a) Derive the force-acceleration relationship for the 1-DOF system shown in figure using both the Lagrangian mechanics as well as the Newtonian mechanics. Assume the wheels have negligible inertia. 10



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- (b) Explain the term Work envelop & Work Volume for the following types of robot **10**
(i) Cartesian Robot (ii) Cylindrical Robot (iii) Spherical Robot
5. Define Direct Kinematics. Develop arm equation for 5-axis RHINO XR3 robot with the help of D-H Algorithm. **20**
6. Write short notes on any two **20**
(a) Robot motion planning Techniques
(b) Bug Algorithms
(c) Cell Decomposition

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