Duration: 2 hours   Total Marks: 30

1. For the two-degrees-of-freedom parallel manipulator, as shown in Fig. 1, derive the expressions for the inverse kinematics (positions only), i.e., for θ_1 and θ_2 in terms of x, y, and ϕ.

[10]

2. For the prismatic (P) and revolute (R) jointed manipulator shown in Fig. 2,
   a. Locate the DH-frames and tabulate the DH parameters
   b. Derive the dynamic equations of motion

[3+12]

3. Define the following with sketches: (i) Coriolis acceleration; and (ii) Chebyshev spacing

[5]

Fig. 1

m_1, m_2: masses of links 1 and 2

C_1, C_2: Location of mass center (assume at the middle of links)

g: Acceleration due to gravity

Fig. 2

-- END --