Question 1 ..... [3]

The mechanism, as shown in Figure 1, is an example of a block moving in a rectangular slot. If the slider velocity is 10 mm/sec and the tangential velocity of link 3 at point C is 35 mm/s, calculate the magnitude of Coriolis acceleration of the slider. Assume the length of line BC as 50 mm.

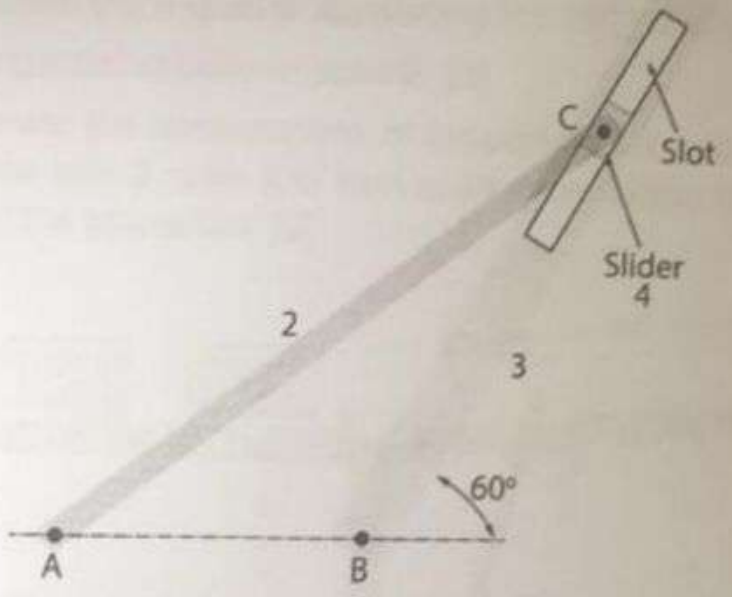

Figure 1: Moving block in a rectangular slot

Question 2 .....[17]

The conveyor belt mechanism, as shown in Figure 2, is used to transfer boxes to a shipping station. The kinematic parameters of transferring link 1 (DE) are important for the smooth operation. For the given configuration do the following:

a) Identify the mechanism type and draw its kinematic diagram. [1]

b) Analytically calculate the angles of supporting link (BC) and transferring link 1. [5]

c) Calculate the tangential velocity of point E. [2]

d) Graphically estimate the accelerations of supporting link and transferring link 1 if the link AB rotates with 3 rad/s and having an acceleration of 40 rad/s^2. Write all the main steps of the procedure. [9]

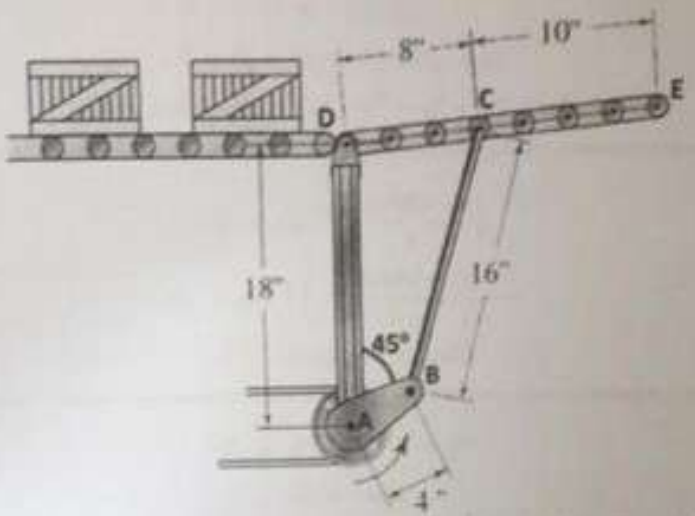

Figure 2: Box transfer mechanism. All length dimensions are in inches

Supplementary sheet

$$\theta_{4_{1,2}} = 2tan^{-1}\left(\frac{-B \pm \sqrt{B^2 - 4AC}}{2A}\right)$$

$$A = cos\theta_2 - K_1 - K_2 cos\theta_2 + K_3$$

$$B = -2sin\theta_2$$

$$C = K_1 - (K_2 + 1)cos\theta_2 + K_3$$

$$K_1 = d/a,\ K_2 = d/c,\ K_3 = (a^2 - b^2 + c^2 + d^2)/2ac$$

$$\theta_{3_{1,2}} = 2tan^{-1}\left(\frac{-E \pm \sqrt{E^2 - 4DF}}{2D}\right)$$

$$D = cos\theta_2 - K_1 - K_4 cos\theta_2 + K_5$$

$$E = -2sin\theta_2$$

$$F = K_1 + (K_4 - 1)cos\theta_2 + K_5$$

$$K_4 = d/b,\ K_5 = (c^2 - d^2 - a^2 - b^2)/2ab$$

$$\theta_{3_1} = sin^{-1}\left(\frac{a\,sin\theta 2 - c}{b}\right)$$

$$\theta_{3_2} = sin^{-1}\left(-\frac{a\,sin\theta 2 - c}{b}\right) + \pi$$

$$d = acos\theta 2 - bcos\theta 3$$

$$K_1 = a^2 - b^2 + c^2 + d^2$$

$$K_2 = -2ac$$

$$K_3 = -2ad$$

$$A = K_1 - K_3;\quad B = 2K_2;\quad C = K_1 + K_3$$

$$\theta_{2_{1,2}} = 2tan^{-1}\left(\frac{-B \pm \sqrt{B^2 - 4AC}}{2A}\right)$$

$$\theta_{3_1} = sin^{-1}\left(\frac{a\,sin\theta 2 - c}{b}\right)$$

$$\theta_{3_2} = sin^{-1}\left(-\frac{a\,sin\theta 2 - c}{b}\right) + \pi$$

$$\theta_{4_{1,2}} = 2tan^{-1}\left(\frac{-T \pm \sqrt{T^2 - 4SU}}{2S}\right)$$

$$P = asin\theta_2 siny + (acos\theta_2 - d)cosy$$

$$Q = -asin\theta_2 cosy + (acos\theta_2 - d)siny$$

$$R = -csiny$$

$$S = R - Q;\ T = 2P;\ U = Q + R$$

$$b = \frac{asin\theta_2 - csin\theta_4}{sin\theta_3}$$

$$\theta_3 = \theta_4 \pm \gamma$$