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Name of the Program - B.tech (IT & MI)

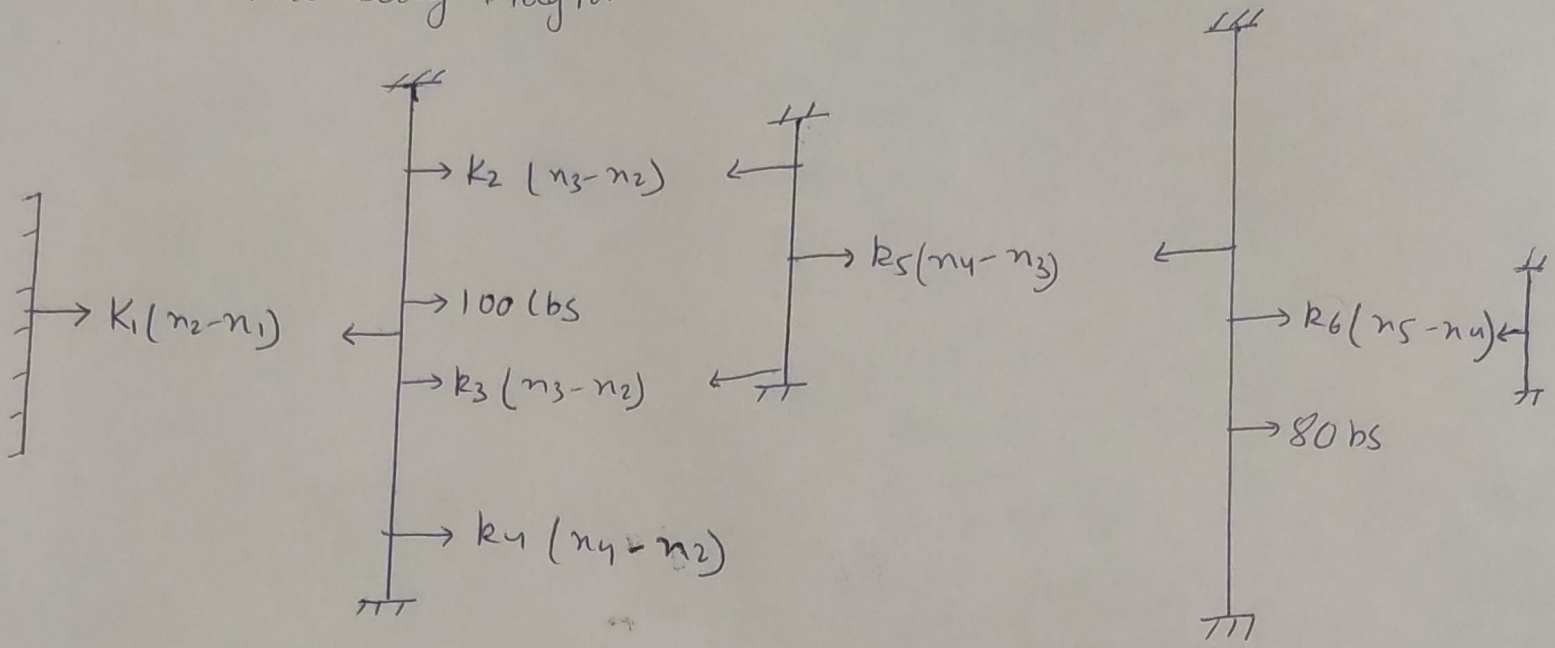
Semester / Year - VII Semester / IV year

Unique Paper Code - 911710

Title of Paper - Fluidity in Nature :
Computational Interpretations

Q.1

Free Body Diagram



Let x_1, x_2, x_3, x_4, x_5 be displacements

The Eqns of motion from its eqbm are

$$k_1 x_1 - k_1 x_2 = 0$$

and, $$(k_1 + k_2 + k_3) x_2 - k_1 x_1 - k_2 x_3 - k_3 x_3 + k_4 x_2 - k_4 x_4 = 100$$

and, $$(k_2 + k_3 + k_5) x_3 - (k_2 + k_3) x_2 - k_5 x_4 = 0$$

and, $$(k_5 + k_6 + k_4) x_4 - k_5 x_3 - k_6 x_5 - k_4 x_2 = 80$$

and, $$k_6 x_5 - k_6 x_4 = 0$$

Therefore in Matrix form

$$\begin{bmatrix} k_1 & -k_1 & 0 & 0 & 0 \\ -k_1 & (k_1+k_2+k_3+k_4) & -(k_2+k_3) & -k_4 & 0 \\ 0 & -(k_2+k_3) & (k_2+k_3+k_5) & -k_5 & 0 \\ 0 & -k_4 & (-k_5) & (k_5+k_6+k_4) & -k_6 \\ 0 & 0 & 0 & -k_6 & k_6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix}$$

$$= \begin{bmatrix} 0 \\ 100 \\ 0 \\ 80 \\ 0 \end{bmatrix}$$

Keeping the values Given, we get

$$\begin{bmatrix} +60 & -60 & 0 & 0 & 0 \\ -60 & 340 & -130 & -150 & 0 \\ 0 & -130 & 250 & -120 & 0 \\ 0 & -150 & -120 & 450 & -180 \\ 0 & 0 & 0 & -180 & 180 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = \begin{bmatrix} 0 \\ 100 \\ 0 \\ 80 \\ 0 \end{bmatrix}$$

Cancelling the 1st & 5th rows & columns as they are fixed

$$\begin{bmatrix} 340 & -130 & -150 \\ -130 & 250 & -120 \\ -150 & -120 & 450 \end{bmatrix} \begin{bmatrix} x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 100 \\ 0 \\ 80 \end{bmatrix}$$

Displacements one

$x_2 = 0.91$ in

$x_3 = 0.8077$ in

$x_4 = 0.6966$ in

$x_1 = 0$

$x_5 = 0$

Reactions forces

$$\begin{bmatrix} -60 & -60 & 0 & 0 & 0 \\ 0 & 0 & 0 & -180 & -180 \end{bmatrix} \begin{bmatrix} 0 \\ 0.91 \\ 0.8077 \\ 0.6966 \\ 0 \end{bmatrix} = \begin{bmatrix} R_1 \\ R_5 \end{bmatrix}$$

$R_1 = -54.6$ lbs

$R_5 = -125.388$ lbs