Yes, U can!

CV4101

1(a). 2 DOFs. u_4, v_4.

(b). $\frac{A_1E}{L_1} = \frac{2000 \times 2000}{1} = 400K = \frac{A_2E}{L_2}$ $\quad \frac{A_3E}{L_3} = \frac{2000 \times \sqrt{2} \times 200}{\sqrt{2}} = 400k.$

member 1-4.

$$\left[\begin{array}{cc|cc} x & x & x & x \\ x & x & x & x \\ \hline x & x & 400K & 0 \\ x & x & 0 & 0 \end{array}\right]$$

member 3-4.

$$\left[\begin{array}{cc|cc} x & x & x & x \\ x & x & x & x \\ \hline x & x & 200K & 200K \\ x & x & 200K & 200K \end{array}\right]$$

member 2-4.

$$\left[\begin{array}{cc|cc} x & x & & \\ x & x & & \\ \hline x & x & 0 & 0 \\ x & x & 0 & 400K \end{array}\right]$$

$$\begin{bmatrix} 400 \\ -300 \end{bmatrix} = \begin{bmatrix} 600K & 200K \\ 200K & 600K \end{bmatrix} \begin{bmatrix} u_4 \\ v_4 \end{bmatrix} \qquad u_4 = 0.9375\ mm \qquad v_4 = -0.8125\ mm$$

C. For 0 Force, $u_4 = -v_4$.

$$\begin{bmatrix} 400 \\ -300 \end{bmatrix} = \begin{bmatrix} 400K & 0 \\ 0 & x \end{bmatrix} \begin{bmatrix} u_4 \\ -u_4 \end{bmatrix}$$

$400K u_4 = 400 \qquad u_4 = 1 \times 10^{-3}$

$-300 = -x u_4 \qquad x = 300K.$

$\frac{A_2E}{L} = 300K \qquad A_2 = 1500.$

Yes, U can

2. DoF = 2 , V_2, M_2.

b) P = 32 KN.

$$F_{OK} = \begin{bmatrix} F/2 \\ FL/8 \\ F/2 \\ -PL/8 \end{bmatrix} = \begin{bmatrix} 16 \\ 8 \\ 16 \\ -8 \end{bmatrix}$$

$w = 12 \quad M_{K_2} = 0.$

$$F_{OK} = \begin{bmatrix} 5wL/8 \\ wL^2/8 \\ 3wL/8 \\ 0 \end{bmatrix} = \begin{bmatrix} 15 \\ 6 \\ 9 \\ 0 \end{bmatrix}$$

member 1-2.

x x	x x	
x x	x x	
x x	2400	-2400
x x	-2400	3200

member 2-3.

600	1200	x	0
1200	2400	x	0
x	x	x	0
0	0	0	0

Apply Boundary condition.

$$\begin{bmatrix} 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 3000 & -1200 \\ -1200 & 5600 \end{bmatrix} \begin{bmatrix} V_2 \\ M_2 \end{bmatrix} + \begin{bmatrix} 16 \\ -8 \end{bmatrix} + \begin{bmatrix} 15 \\ 6 \end{bmatrix}$$

$V_2 = -0.01114$

$M_2 = -2.03 \times 10^{-3}$

2). $\begin{bmatrix} 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 3000 & -1200 \\ -1200 & 5600 \end{bmatrix} \begin{bmatrix} -2\times10^{-2} \\ M_2 \end{bmatrix} + \begin{bmatrix} 0.5P \\ 0.25P \end{bmatrix} + \begin{bmatrix} 15 \\ 6 \end{bmatrix}$.

$3000\times(-2\times10^{-2}) - 1200M_2 + 0.5P + 15 = 0$.

$-1200(-2\times10^{-2}) + 5600M_2 + 0.25P + 6 = 0$.

$M_2 = \dfrac{-60 + 0.5P + 15}{1200} = \dfrac{24 + 0.25P + 6}{-5600}$

$P = 69.7$ KN.

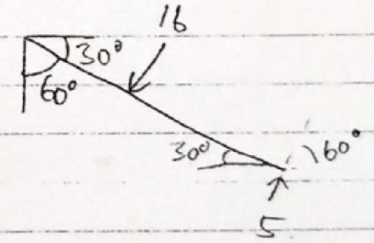
3. $\dfrac{EA}{L} = 2\times10^8$ N/m $= 2\times10^5$ KN/m.

$\theta = -30^\circ$

$M_{K2} = 0$.

$F_{OK} = \begin{bmatrix} 0 \\ 11F/16 \\ 3FL/16 \\ 0 \\ 5F/16 \\ 0 \end{bmatrix}$

$5F/16 = 5$



$F_{OKm} = \begin{bmatrix} X \\ X \\ X \\ 5\cos60 \\ 5\sin60 \\ 0 \end{bmatrix} = \begin{bmatrix} 2.5 \\ 4.33 \\ 0 \end{bmatrix}$

Yes, U can.

member 1-2 $\theta = -30$ $AE/L = 4000 \times 200/2 = 400k$.

$3EI/L^3 = 300$.

x	x	x	x	x
x	y	y	x	x
x	y	y	x	x
x	x	x	0.75(400K)+0.25(300)	-0.433(400K)+0.433(300)
x	y	x	-0.433(400K)+0.433(300)	0.25(400K)+0.75(300)
x	x	x	0	0

Applying boundary condition.

$$\begin{bmatrix} -2\times10^5 u \\ -2\times10^5 v \end{bmatrix} = \begin{bmatrix} 300075 & -173070.1 \\ -173070.1 & 100225 \end{bmatrix} \begin{bmatrix} u \\ v \end{bmatrix} + \begin{bmatrix} 2.5 \\ 4.33 \end{bmatrix}$$

$$\begin{bmatrix} 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 500075 & -173070.1 \\ -173070.1 & 300225 \end{bmatrix} \begin{bmatrix} u \\ v \end{bmatrix} + \begin{bmatrix} 2.5 \\ 4.33 \end{bmatrix}$$

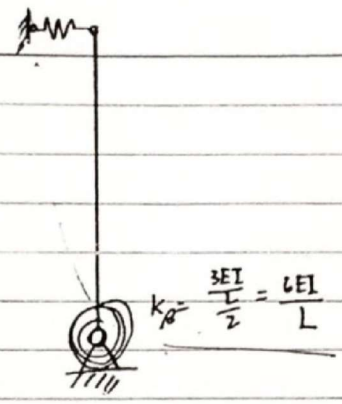
$u = -1.248 \times 10^{-5}$

$v = -2.16 \times 10^{-5}$

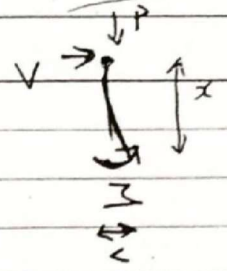
$M = EI\frac{d^2v}{dx^2}$ = Yes, U can

4. b) i)

$k_s = \frac{6EI}{L^3}$



$k_\beta = \frac{\frac{3EI}{L}}{\frac{L}{2}} = \frac{6EI}{L}$



$M + Pv = V_x$

$M = V_x - Pv$

$EI\,v'' = V_x - Pv$

$EI\frac{d^2v}{dx^2} = V_x - Pv$

$v'' = \frac{V}{EI}x - \frac{P}{EI}v$

$v'' + \frac{P}{EI}v = \frac{V}{EI}x$

$v'' + \omega^2 v = \frac{V}{EI}x$

$v_p = C_0 + C_1 x$

$\omega^2 C_1 x + \omega^2 C_0 = \frac{V}{EI}x$

$C_0 = 0$

$C_1 = \frac{V}{EI} \times \frac{EI}{P}$

$= \frac{V}{P}$

$v_p = \frac{V}{P}x$

$v = A\sin\omega x + B\cos\omega x + \frac{V}{P}x$

$v(0) = 0$

$0 = B + \frac{V}{P}(0)$

$B = 0$

$v = A\sin\omega x + \frac{V_1}{P}x$

$v' = A\omega\cos\omega x + \frac{V_1}{P}$

$v'(L) = A\omega\cos\omega L + \frac{V_1}{P}$

$\beta = A\omega\cos\omega L + \frac{V_1}{P}$

$A = (\beta - \frac{V_1}{P})/\omega\cos\omega L$

$v = (\beta - \frac{V_1}{P})/\omega\cos\omega L \sin\omega x + \frac{V_1}{P}x$

ii) when $EI_1 = \infty$

$\beta = 0$

$\therefore v = -\frac{V_1}{P}/\omega\cos\omega L \sin\omega x + \frac{V_1}{P}x$