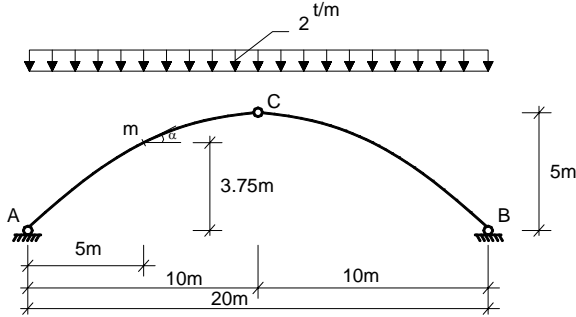


YAPI STATİĞİ YARIYIL SONU SINAVI

SORU 1:

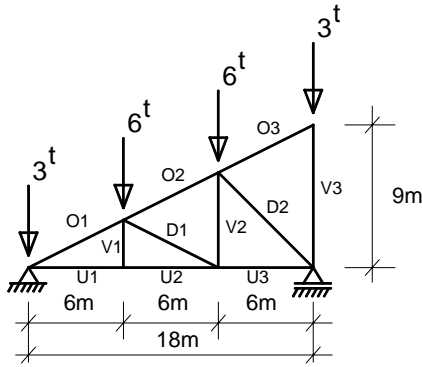


Şekilde ölçüleri ve yükleme durumu verilen üç mafsallı kemerin

- mesnet tepkilerini,
- m kesitindeki N_m , T_m , M_m iç kuvvetleri hesaplayınız.

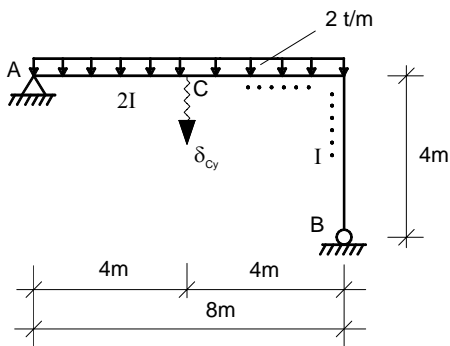
$\sin\alpha=0.45$
 $\cos\alpha=0.89$

SORU 2:



Şekilde ölçüleri ve yükleme durumu verilen kafes sistemin çubuk kuvvetlerini CREMONA yöntemi ile hesaplayıp sonuçları bir tabloda özetleyiniz.

SORU 3:

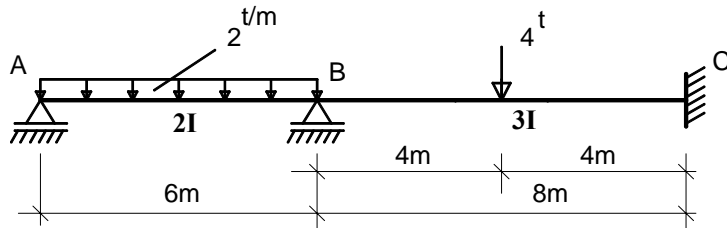


Şekilde ölçüleri ve yükleme durumu verilen çerçevenin

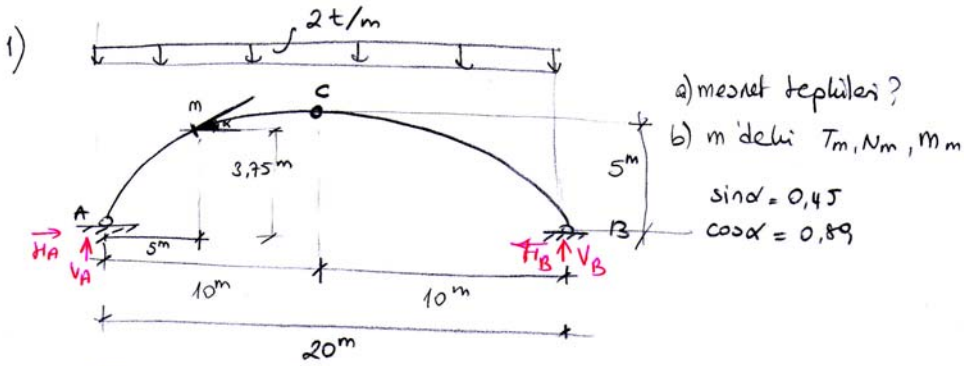
- mesnet tepkilerini Kuvvet Yöntemi ile hesaplayınız.
- C noktasının düşey yer değiştirmesini ($\delta_{Cy}=?$) hesaplayınız.

$EI=4.12 \times 10^{10} \text{ kgcm}^2$

SORU 4:



Şekilde ölçüleri ve yükleme durumu verilen sürekli kirişte T,M iç kuvvet diyagramlarını Moment Dağıtma (Cross) Yöntemi ile çiziniz.

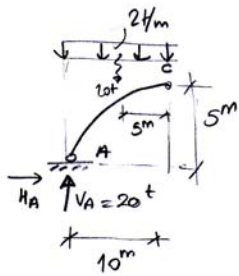


a) $\sum \vec{M}_A = 0 \quad H_A - H_B = 0 \Rightarrow H_A = H_B$

$\uparrow \sum Y = 0 \quad V_A - 2 \times 20 + V_B = 0$
 $V_A + V_B = 40^t$

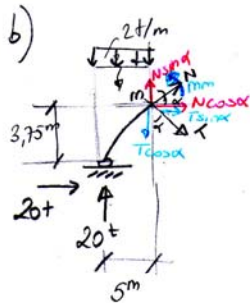
$\sum \vec{M}_A = 0 \quad -2 \times 20 \times 10 + V_B \cdot 20 = 0$

$V_B = 20^t \Rightarrow V_A = 20^t$



$\sum \vec{M}_C = 0 \quad 20 \times 5 + H_A \times 5 - 20 \times 10 = 0$

$H_A = 20^t \Rightarrow H_B = 20^t$



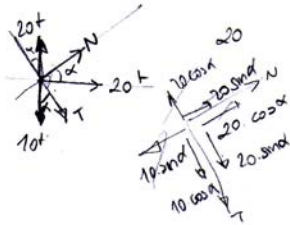
$\leftarrow \sum X = 0 \quad -20^t - T \sin \alpha - N \cos \alpha = 0$

$\uparrow \sum Y = 0 \quad 20^t - 2 \times 5 - T \cos \alpha + N \sin \alpha = 0$

$\sum \vec{M}_m = 0 \quad 20 \times 3,75 - 20 \times 5 + 2 \times 5 \times 2,5 + M_m = 0$
 $M_m = 0$

$\left. \begin{aligned} N &= -22,3^t \\ T &= -0,1^t \end{aligned} \right\}$

Ya da:



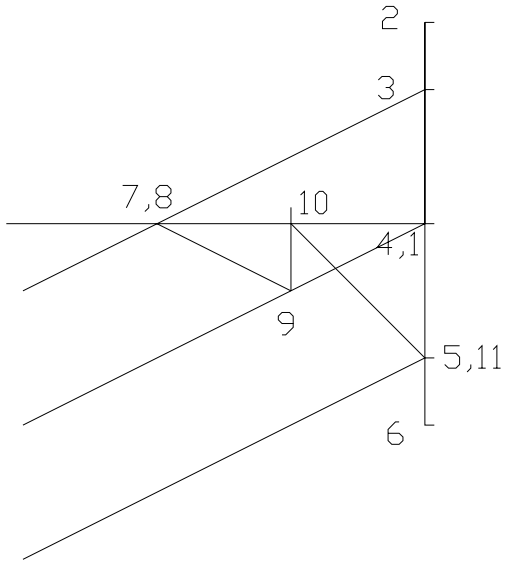
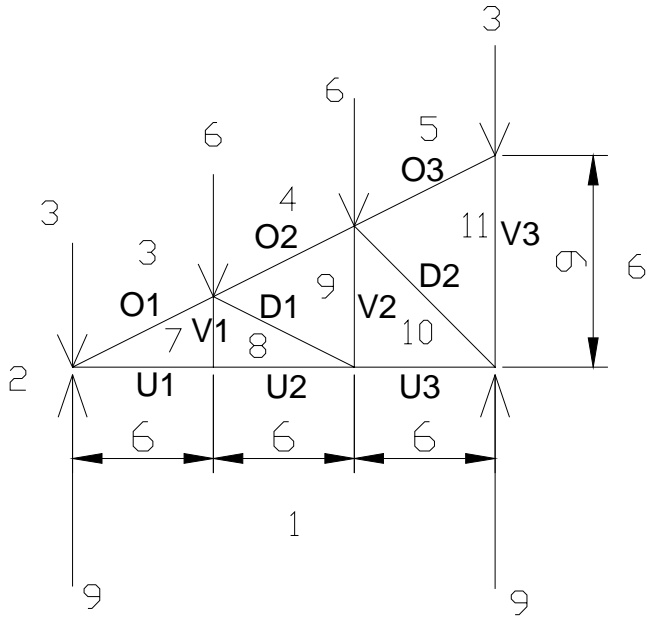
$\sum N = 0$

$-20 \sin \alpha - N - 20 \cos \alpha + 10 \sin \alpha = 0$
 $-10 \sin \alpha$
 $N = -10 \sin \alpha - 20 \cos \alpha = -22,3^t$

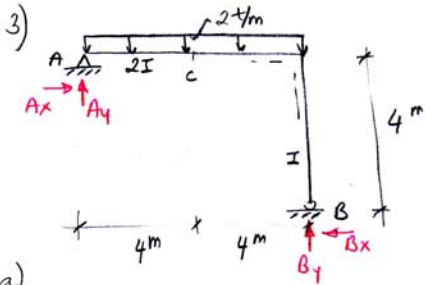
$\sum T = 0$

$10 \cos \alpha - 20 \sin \alpha - T - 10 \cos \alpha = 0$
 $T = 10 \cos \alpha - 20 \sin \alpha = 8,9 - 9 = -0,1$

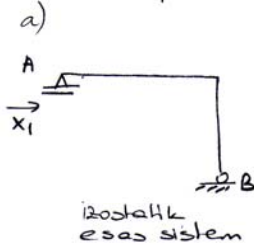
SORU 2:



cubuk	cekme	basinc
O1		13.4
O2		6.7
O3	0.0	
U1	12	
U2	12	
U3	6	
V1	0.0	
V2	3	
V3		3
D1		6.7
D2		8.5

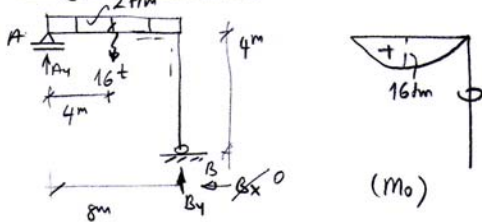


a) mesnet tepeleri = ?
 b) δ_{11} = ?
 $EI = 4,12 \times 10^{10} \text{ kgcm}^2$



$$\delta_{11} \cdot X_1 + \delta_{10} = 0$$

I. δ_{10} yükler ve $X_1 = 0$

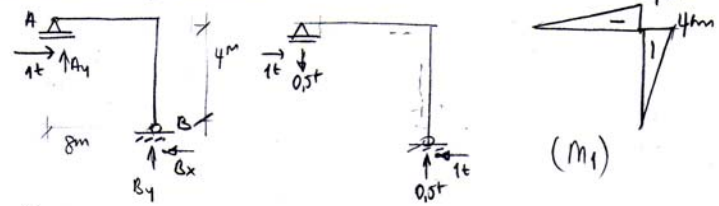


$$A_y + B_y = 16t$$

$$\sum \vec{M}_A = 0 \Rightarrow -16 \times 4 + B_y \cdot 8 = 0$$

$$B_y = 8t, A_y = 8t$$

II. $X_1 = 1t$, δ_{10} yükler = 0



$$B_x = 1t$$

$$A_y = -B_y, \sum \vec{M}_A = 0 \Rightarrow B_y \cdot 8 - 1t \cdot 4 = 0$$

$$B_y = 0,5t$$

$$A_y = -0,5t$$

$$\delta_{11} = \int \frac{m_1 \cdot m_1}{EI} \cdot ds = \left[\left(\frac{1}{8m} \times \frac{4m}{8m} \right) \cdot \frac{1}{2EI} \right] + \left[\left(\frac{1}{4m} \times \frac{4m}{4m} \right) \cdot \frac{1}{EI} \right]$$

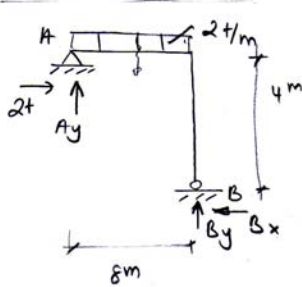
$$= \left(\frac{1}{3} \cdot 8 \cdot (-4) \cdot (-4) \cdot \frac{1}{2EI} \right) + \left(\frac{1}{3} \cdot 4 \cdot (-4) \cdot (-4) \cdot \frac{1}{EI} \right) = \frac{42,67}{EI} = \delta_{11}$$

$$\delta_{10} = \int \frac{m_1 \cdot M_0}{EI} \cdot ds = \left[\left(\frac{16tm}{8m} \times \frac{4m}{8m} \right) \cdot \frac{1}{2EI} \right] + 0 = \frac{1}{3} \cdot 8 \cdot (+16) \cdot (-4) \cdot \frac{1}{2EI}$$

$$\delta_{10} = -\frac{85,33}{EI}$$

$$\delta_{11} \cdot X_1 + \delta_{10} = 0$$

$$\frac{42,67}{EI} \cdot X_1 - \frac{85,33}{EI} = 0 \quad \left. \vphantom{\frac{42,67}{EI} \cdot X_1 - \frac{85,33}{EI} = 0} \right\} X_1 = 2^t$$



mesnet tepkileri: $A_x = 2^t = X_1$

$$\sum X = 0 \Rightarrow -2 + B_x = 0 \Rightarrow B_x = 2^t$$

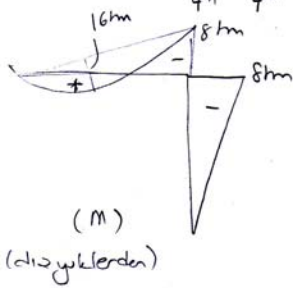
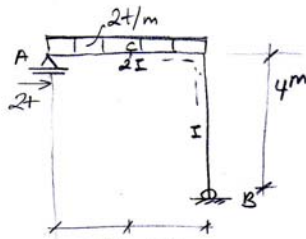
$$\sum Y = 0 \Rightarrow A_y + B_y = 16^t$$

$$\sum M_A = 0 \Rightarrow -2 \times 8 \times 4 + B_y \cdot 8 - 2 \times 4 = 0$$

$$B_y = 9^t \Rightarrow A_y = 7^t$$

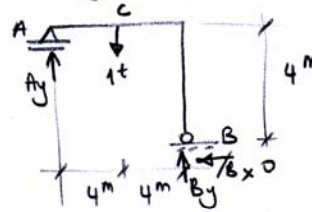
b) $\delta_{cy} = ?$

Kısaltma teoremi ile



$$\delta_{cy} = \int \frac{m \cdot \bar{m}}{EI} \cdot ds$$

Birim yüklenme



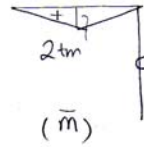
$$A_y + B_y = 1^t$$

$$\sum M_A = 0$$

$$-1 \times 4 + B_y \times 8 = 0$$

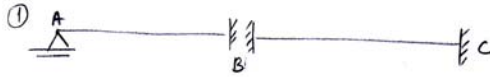
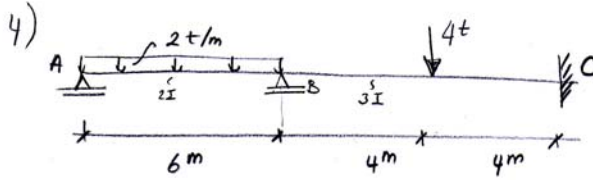
$$B_y = 0,5^t$$

$$A_y = 0,5^t$$



$$\delta_{cy} = \int \frac{m \cdot \bar{m}}{EI} \cdot ds = \left[\left(\frac{16^t}{8m} + \frac{8^t}{8m} \right) \times \left(\frac{2^t}{8m} \right) \right] \times \frac{1}{2EI} \\ = \left[\left(\frac{1}{3} \cdot 8^m \cdot (1 + 0,5 \cdot 0,5) \cdot (16) \cdot (2) \right) + \left(\frac{1}{6} \cdot 8^m \cdot (1 + 0,5) \cdot (-8) \cdot (2) \right) \right] \cdot \frac{1}{2EI}$$

$$\Rightarrow \delta_{cy} = \frac{37,33}{EI} = 0,9 \text{ cm}$$



② uc rijitlikleri:

$$B \text{ dn } \rightarrow R_{BA} = \frac{3E \cdot 2I}{L} = \frac{3 \cdot 2 \cdot EI}{6m} = EI$$

$$R_{BC} = \frac{4E \cdot 3I}{L} = \frac{4 \cdot E \cdot 3I}{8m} = 1,5EI$$

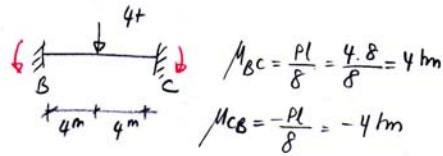
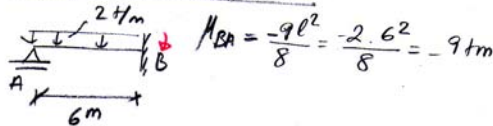
③ Dağıtma katsayıları:

$$B \text{ dn: } \rightarrow k_{BA} = \frac{R_{BA}}{R_{BA} + R_{BC}} = \frac{EI}{2,5EI} = 0,4$$

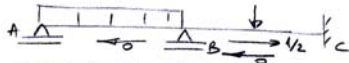
$$k_{BC} = \frac{R_{BC}}{R_{BA} + R_{BC}} = \frac{1,5EI}{2,5EI} = 0,6$$

$\Sigma k = 1$

④ Ankastrelik momentler:



⑤ Cross:



A	B		C
	B-A	B-C	
	0,4	0,6	
	-9	4	-4
	2	3	1,5
	-7	7	-2,5
		-7	

↑ +
↓ -
kuvvet y.
← +
→ -
cross

