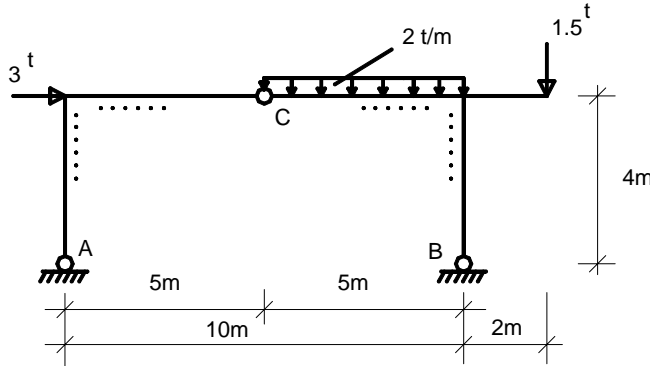


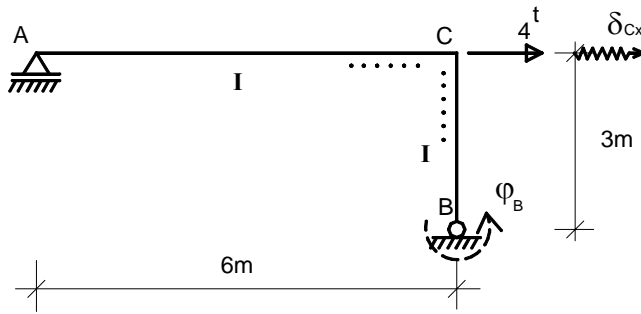
YAPI STATİĞİ YARIYIL SONU SINAVI

SORU 1:



Şekilde ölçüleri ve yükleme durumu verilen üç mafsallı çerçevenin N, T, M iç kuvvet diyagramlarını çiziniz.

SORU 2:

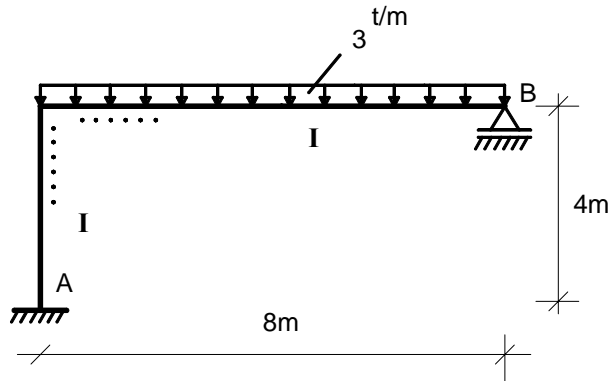


Şekilde ölçüleri ve yükleme durumu verilen çerçevede;

- N, T, M iç kuvvet diyagramlarını çiziniz.
- C noktasının yatay yer değiştirmesini ( $\delta_{Cx}=?$ ),
- B mesnetinin dönmelerini ( $\phi_B=?$ ) hesaplayınız.

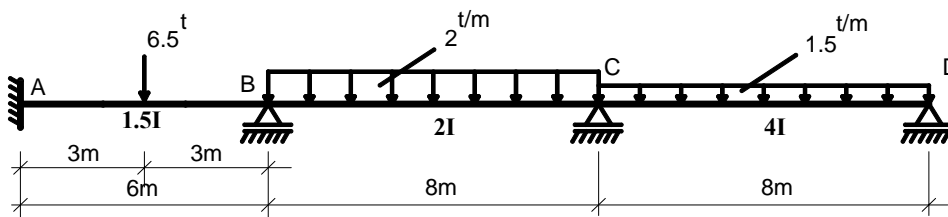
$$EI = 5.4 \times 10^{10} \text{ kgcm}^2$$

SORU 3:



Şekilde ölçüleri ve yükleme durumu verilen çerçevenin mesnet tepkilerini Kuvvet Yöntemi ile hesaplayınız.

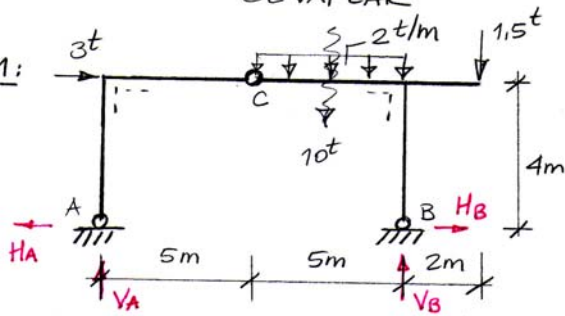
SORU 4:



Şekilde ölçüleri ve yükleme durumu verilen sürekli kirişte uç momentlerini Moment Dağıtma (Cross) Yöntemi ile hesaplayınız.

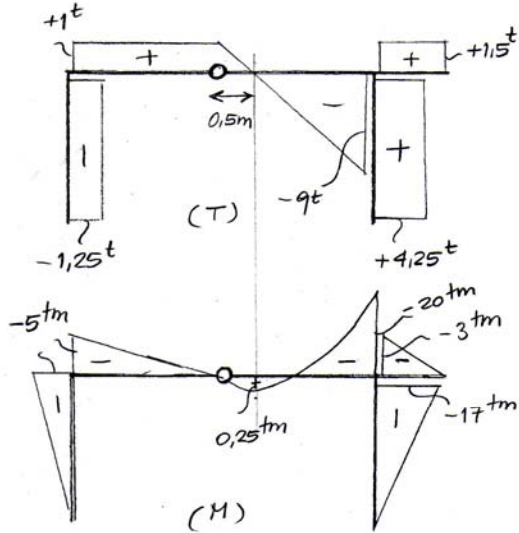
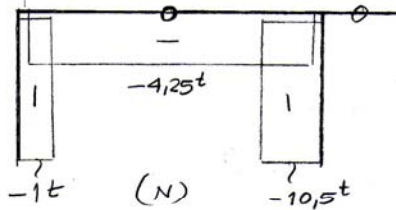
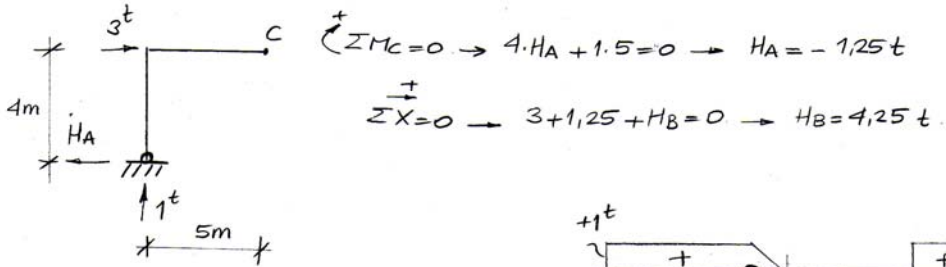
CEVAPLAR

SORU 1:

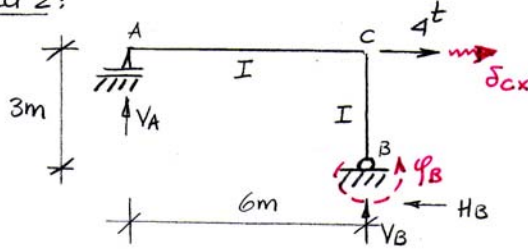


$$\begin{aligned} \sum M_B = 0 &\rightarrow 10 \cdot V_A + 3 \cdot 4 - 10 \cdot 2,5 + 1,5 \cdot 2 = 0 \rightarrow V_A = 1t \\ \sum M_A = 0 &\rightarrow 10 \cdot V_B - 3 \cdot 4 - 10 \cdot 7,5 - 1,5 \cdot 12 = 0 \rightarrow V_B = 10,5t \end{aligned}$$

KONTROL:  $\sum Y = 0 \rightarrow V_A + V_B = 10 + 1,5$   
 $1 + 10,5 = 11,5 \checkmark$

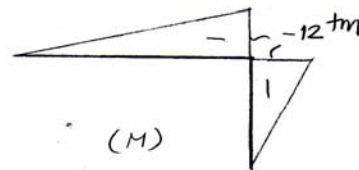
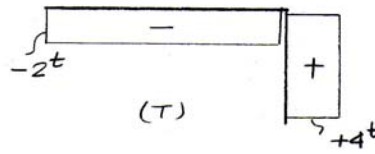
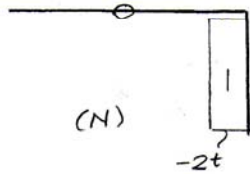


SOLU 2:

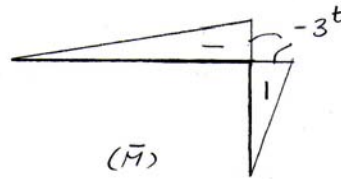
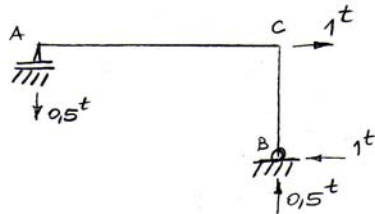


$$\begin{aligned} \sum M_B = 0 &\rightarrow 6 \cdot V_A + 4 \cdot 3 = 0 \\ &V_A = -2t \\ \sum Y = 0 &\rightarrow V_B = 2t \\ \sum X = 0 &\rightarrow H_B = 4t \end{aligned}$$

a)

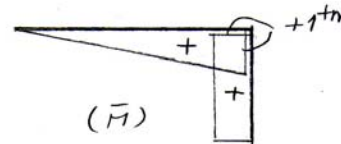
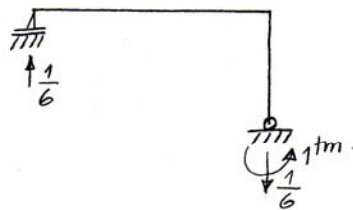


b)



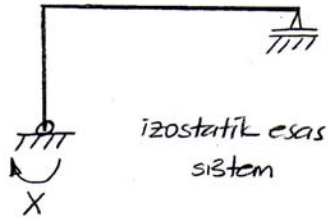
$$\delta_{cx} = \frac{1}{8} \cdot \frac{2}{3} \cdot (-3)(-12) \cdot \frac{1}{EI} + \frac{1}{8} \cdot \frac{2}{3} \cdot (-12)(-3) \cdot \frac{1}{EI} = \frac{108}{EI} = \frac{108 \cdot 10^9}{5,4 \cdot 10^{10}} = 2 \text{ cm}$$

c)

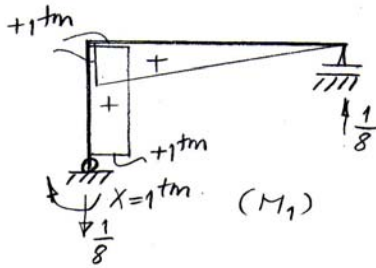


$$\varphi_B = \frac{1}{8} \cdot \frac{2}{3} \cdot (-12)(+1) \cdot \frac{1}{EI} + \frac{1}{2} \cdot 3 \cdot (-1/2)(+1) \cdot \frac{1}{EI} = -\frac{42}{EI} = -\frac{42 \cdot 10^7}{5,4 \cdot 10^{10}} = -0,008 \text{ radian}$$

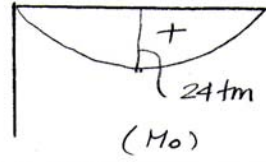
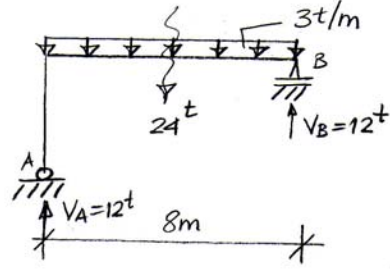
SORU 3:



(X=1) DURUMU



(X=0) DURUMU

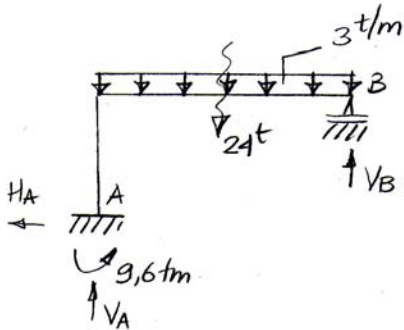


• Süreklilik Denklemi:  $\delta_{11}X + \delta_{10} = 0$ .

$$\delta_{11} = 4 \cdot (1) \cdot (1) \cdot \frac{1}{EI} + \frac{1}{3} \cdot 8 \cdot (1) \cdot (1) \cdot \frac{1}{EI} = \frac{20}{3EI}$$

$$\delta_{10} = \frac{1}{3} \cdot 8 \cdot (1) \cdot (24) \cdot \frac{1}{EI} = \frac{192}{3EI}$$

$$\frac{20}{3EI} X + \frac{192}{3EI} = 0 \rightarrow X = -9,6 \text{ tm}$$



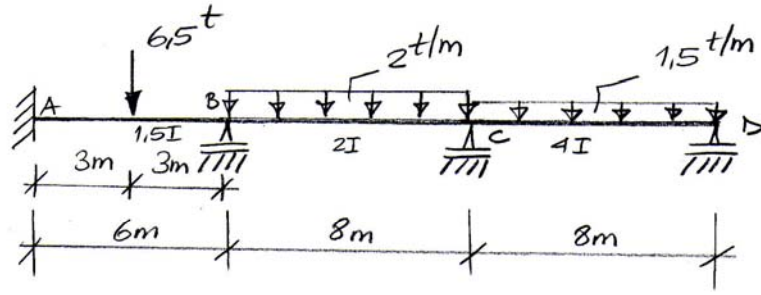
$$\sum M_A = 0 \rightarrow 8V_B - 24 \cdot 4 + 9,6 = 0$$

$$V_B = 10,8 t$$

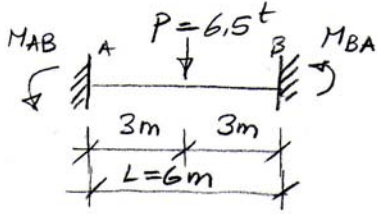
$$\sum Y = 0 \rightarrow V_A + V_B = 24 \rightarrow V_A = 13,2 t$$

$$\sum X = 0 \rightarrow H_A = 0$$

SORU 4:

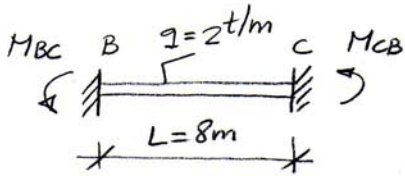


1) ANKASTRELİK MOMENTLERİ



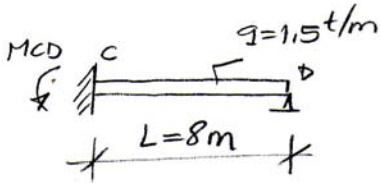
$$M_{AB} = \frac{P.L}{8} = \frac{6,5 \cdot 6}{8} = 4,88 \text{ tm.}$$

$$M_{BA} = -4,88 \text{ tm.}$$



$$M_{BC} = \frac{q.L^2}{12} = \frac{2 \cdot 8^2}{12} = 10,67 \text{ tm.}$$

$$M_{CB} = -10,67 \text{ tm.}$$



$$M_{CD} = \frac{q.L^2}{8} = \frac{1,5 \cdot 8^2}{8} = 12 \text{ tm.}$$

2) UÇ RİJİTLİKLERİ (EI=1)

B Düğüm Noktası

$$R_{BA} = \frac{4EI}{L} = \frac{4E(1,5I)}{6} = 1,0$$

$$R_{BC} = \frac{4EI}{L} = \frac{4E(2I)}{8} = 1,0$$

C Düğüm Noktası

$$R_{CB} = \frac{4EI}{L} = \frac{4E(2I)}{8} = 1,0$$

$$R_{CD} = \frac{3EI}{L} = \frac{3E(4I)}{8} = 1,5$$

### 3.) DAĞITMA KATSAYILARI

B Düğüm Noktası

$$k_{BA} = \frac{R_{BA}}{R_{BA} + R_{BC}} = \frac{1}{1+1} = 0,5, \quad k_{BC} = 0,5$$

C Düğüm Noktası

$$k_{CB} = \frac{R_{CB}}{R_{CB} + R_{CD}} = \frac{1}{1+1,5} = 0,40, \quad k_{CD} = 0,60$$

### 4.) DENGELEME TABLOSU

A	B		C		D
	0,50	0,50	0,40	0,60	
+4,88	-4,88	+10,67	-10,67	+12,00	
-1,45 ←	-2,90	-2,90	→ -1,45		
<u>+3,43</u>		+0,03 ←	→ +0,05	+0,07	
	-0,015	-0,015			
	<u>-7,785</u>	<u>+7,785</u>	-12,07	+12,07	

