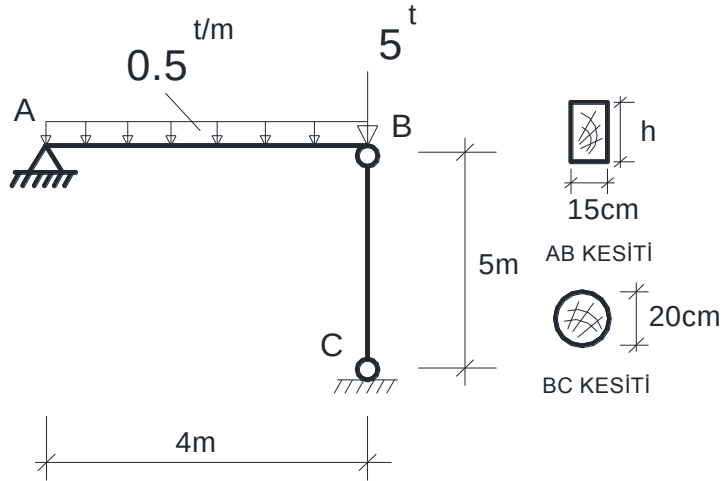


MUKAVEMET YARIYIL SONU SINAVI

SORU 1:



Şekilde ölçüleri ve yükleri verilen çerçeve sistemin;

- N, T, M iç kuvvet diyagramlarını çiziniz,
- AB kirişinde gerekli h yüksekliğini belirleyiniz.
- BC kolonunun güvenli olup olmadığını kontrol ediniz.

$$\sigma_{emn} = 100 \text{ kg/cm}^2$$

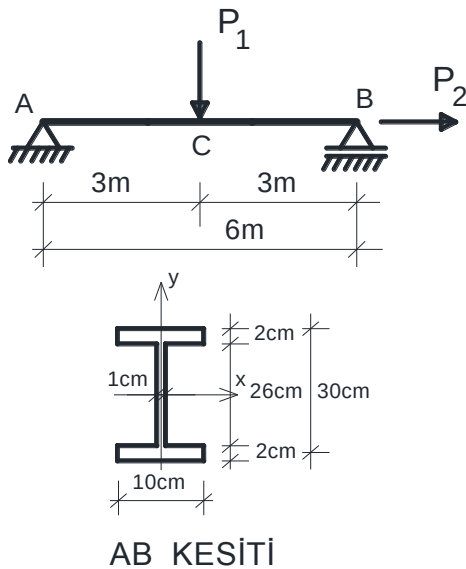
$$\tau_{emn} = 10 \text{ kg/cm}^2$$

$$\lambda < 70 \text{ için } \sigma_{kr} = 293 - 1.94\lambda$$

$$E = 100000 \text{ kg/cm}^2$$

$$n = 3$$

SORU 2:

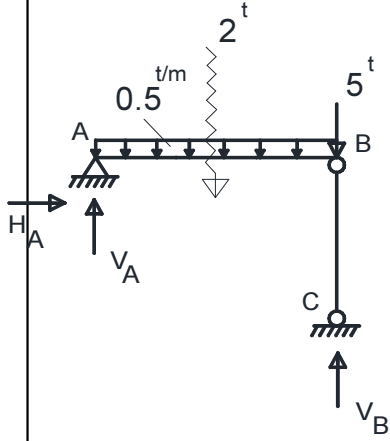


Şekilde ölçüleri ve yükleme durumu verilen basit kirişte;

- $P_1 = 3.5 \text{ t}$, $P_2 = 0$ olduğuna göre C noktasındaki düşey yer-değiştirmeyi ($f_c=?$) hesaplayınız.
- $P_1 = 0$, $P_2 = 24 \text{ t}$ olduğuna göre AB çubuğundaki uzamayı ($\Delta_{AB}=?$) hesaplayınız.
- $P_1 = 3.5 \text{ t}$, $P_2 = 24 \text{ t}$ olduğuna göre maksimum ve minimum normal gerilmeleri hesaplayıp ($\sigma_{\max}=?$, $\sigma_{\min}=?$) kesitte gerilme dağılımını çiziniz.

$$E = 2100000 \text{ kg/cm}^2$$

CEVAP 1:



$$\Sigma M_A = 0 \quad V_B \times 4 - 5 \times 4 - 2 \times 2 = 0 \quad V_B = 6 \text{ t}$$

$$\Sigma Y = 0 \quad V_A + V_B - 2 - 5 = 0, \quad V_A = 1 \text{ t}$$

a)

$$W_x = \frac{M_{\max} \cdot 100000}{\sigma_{\text{em}}}$$

$$= \frac{1 \times 100000}{100}$$

$$= 1000.00 \text{ cm}^3$$

$$h = \sqrt{\frac{6 \cdot W_x}{b}}$$

$$= \sqrt{\frac{6 \times 1000.00}{15}}$$

$$= 20.00 \text{ cm}$$

$$\tau_{\max} = \frac{1.5 \cdot T_{\max}}{b \cdot h} \cdot 1000$$

$$= \frac{1.5 \times 1}{15 \times 20.00} \times 1000$$

$$= 5.00 \text{ kg/cm}^2$$

b)

$$I = \frac{3.14 \cdot D^4}{64}$$

$$= \frac{3.14 \times 20^4}{64}$$

$$= 7850.00 \text{ cm}^4$$

$$A = \frac{3.14 \cdot D^2}{4}$$

$$= \frac{3.14 \times 20^2}{4}$$

$$= 314.00 \text{ cm}^2$$

$$i = \sqrt{\frac{I}{A}}$$

$$= \sqrt{\frac{7850.00}{314.00}}$$

$$= 5.00 \text{ cm}$$

$$\lambda = \frac{sk}{i}$$

$$= \frac{500}{5.00}$$

$$= 100.00$$

$$P_{kr} = \frac{3.14^2 \cdot E \cdot I}{sk^2}$$

$$= \frac{3.14^2 \times 100000 \times 7850.00}{500^2}$$

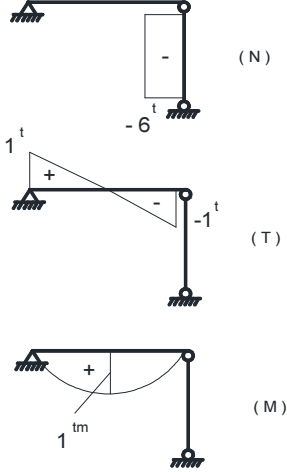
$$= 31.0 \times 10^3 \text{ kg}$$

$$P_{\text{em}} = \frac{P_{kr}}{1000 \cdot n}$$

$$= \frac{31.0 \times 10^3}{1000 \times 3}$$

$$= 10.32 \text{ t}$$

Kolona gelen yük 6 ton olduğundan kolon güvenlidir.



CEVAP 2:

a)

$$I_x = \frac{b \cdot h^3}{12} - \frac{(b - t_g) \cdot (h - 2 \cdot t_b)^3}{12}$$

$$= \frac{10 \times 30^3}{12} - \frac{(10 - 1) \times (30 - 2 \times 2)^3}{12}$$

$$= 9\,318.00 \text{ cm}^4$$

$$W_x = \frac{I_x}{0.5 \cdot h}$$

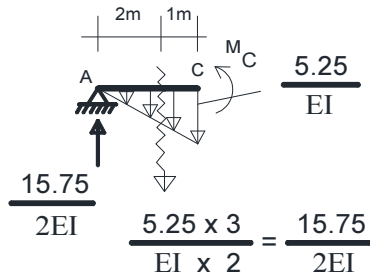
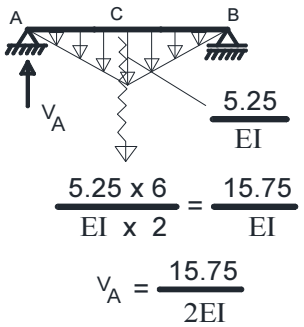
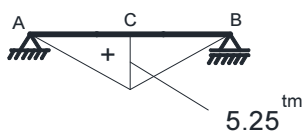
$$= \frac{9\,318.00}{0.5 \times 30}$$

$$= 621.20 \text{ cm}^3$$

$$A = 2 \cdot b \cdot t_b + (h - 2 \cdot t_b) \cdot t_g$$

$$= 2 \times 10 \times 2 + (30 - 2 \times 2) \times 1$$

$$= 66.00 \text{ cm}^2$$



$$\sum M_C = 0 \longrightarrow \frac{15.75}{2EI} \times 3 - \frac{15.75}{2EI} \times 1 - M_C = 0$$

$$M_C = f_C = \frac{15.75}{EI} = \frac{15.75 \times 10^9}{2.1 \times 10^6 \times 9318} = 0.8 \text{ cm}$$

b)

$$\Delta_{AB} = \frac{P_2 \cdot L}{E \cdot A}$$

$$= \frac{24 \times 600}{2100 \times 66}$$

$$= 0.1039 \text{ cm}$$

	Ders		Sayfa
	Konu		
	Uygulama No:		Tarih

c)

$$M_{max} = \frac{P_L \cdot L}{4}$$

$$= \frac{3.5 \times 600}{4}$$

$$= 525.00 \text{ tcm}$$

$$\sigma_{max} = \frac{P_2}{A} + \frac{M_{max}}{W_x}$$

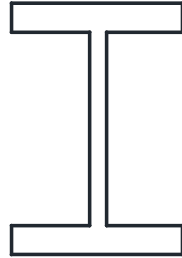
$$= \frac{24}{66} + \frac{525.00}{621.2}$$

$$= 1.21 \text{ t/cm}^2$$

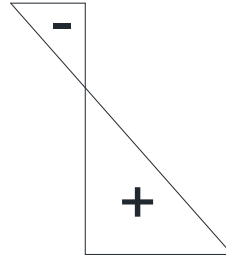
$$\sigma_{min} = \frac{P_2}{A} - \frac{M_{max}}{W_x}$$

$$= \frac{24}{66} - \frac{525.00}{621.2}$$

$$= -0.4815 \text{ t/cm}^2$$



-0.48



+1.21