

MUKAVEMET FINAL SINAVI (24/06/2021)

Konsol kirişin ankastre ucunda eğilme momentleri:

$$M_z = 2P \cdot l \quad \text{ve} \quad M_y = P \cdot l$$

Bu momentler nedeniyle oluşacak normal gerilmeler:

$$\sigma_z = \frac{M_z}{I_{zz}} \cdot y \quad \text{ve} \quad \sigma_y = \frac{M_y}{I_{yy}} \cdot z$$

$$I_{zz} = b(2b)^3/12 = (2/3)b^4; \quad I_{yy} = 2b \cdot b^3/12 = (1/6)b^4$$

C noktasında ($z=y=0$) normal gerilme olmayacak; kayma gerilmesi ise en büyük değerine ulaşacak:

$$\tau_c = (3/2) \frac{2P}{A} + (3/2) \frac{P}{A} = \frac{9P}{2b \cdot 2b} = \frac{9P}{4b^2}$$

D noktasında kayma gerilmesi olmayacak; normal gerilme en büyük değerine ulaşacak:

$$\sigma_D = \frac{2PL}{\frac{2}{3}b^4} \cdot b + \frac{P \cdot l}{\frac{1}{6}b^4} \cdot \frac{b}{2} = \frac{3PL}{b^3} + \frac{3PL}{b^3} = \frac{6PL}{b^3} \quad (\text{Çekme-tension})$$

E noktasında normal gerilme ve kayma gerilmesi var;

$$\sigma_E = \frac{PL}{\frac{1}{6}b^4} \cdot \frac{b}{2} = \frac{3PL}{b^3} \quad \text{ve} \quad \tau_E = \frac{3}{2} \frac{P}{A} = \frac{3P}{4b^2}$$

Sayısal örnek için $mn = 86$ olsun!

$$P = 1 + 6/10 = 1,6 \text{ [kN]}; \quad M_z = 5,952 \text{ [kNm]}$$

$$L = 1 + 86/100 = 1,86 \text{ [m]}; \quad M_y = 2,976 \text{ [kNm]}$$

$$b = 50 + 5 \times 6 = 80 \text{ [mm]}; \quad I_{zz} = 2730,6 \text{ [cm}^4\text{]}$$

$$I_{yy} = 682,6 \text{ [cm}^4\text{]}$$

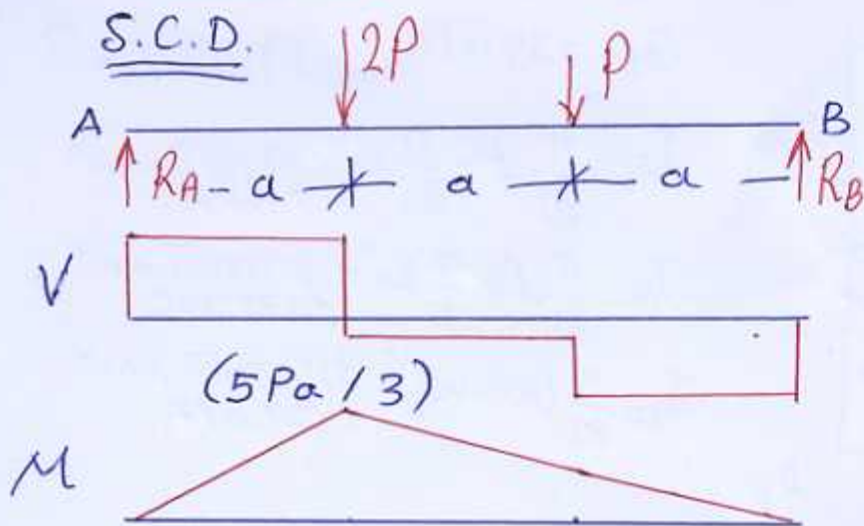
$$\tau_c = 0,375 + 0,1875 = 0,5625 \text{ [MPa]} \quad A = b \times 2b = 128 \text{ [cm}^2\text{]}$$

$$\sigma_D = 34,875 \text{ [MPa]}$$

$$\sigma_E = 17,44 \text{ [MPa]} \quad \text{ve} \quad \tau_E = 0,1875 \text{ [MPa]}$$

SORU-1

S.C.D.



$$R_A = \frac{5P}{3} ; R_B = \frac{4P}{3}$$

$$V_{maks} = 5P/3$$

$$M_{maks} = 5Pa/3$$

$$\tau_{maks} = (3V_{maks}/2A)$$

$$\sigma_{maks} = \frac{M_{maks}}{W_{min}} = \frac{5Pa \cdot 6}{3b^3}$$

a) $\tau_{maks} \leq \tau_{em} = 2[\text{MPa}] = 2000[\text{kPa}]$

$$\frac{3.5P}{3 \cdot 2 \cdot b^2} \leq \tau_{em}$$

$$b^2 \geq 5P/2\tau_{em}$$

b) $\sigma_{maks} \leq \sigma_{em} = 8[\text{MPa}] = 8000[\text{kPa}]$

$$\sigma_{maks} = \frac{10Pa}{b^3} \leq \sigma_{em} \Rightarrow b^3 \geq \frac{10 \cdot P \cdot a}{\sigma_{em}}$$

Sayısal örnek : $m n = 10$ olsun!

$$P = 10[\text{kN}]$$

$$L = 2,1[\text{m}]$$

$$a = 0,7[\text{m}]$$

$$R_A = 16,6[\text{kN}]$$

$$R_B = 13,3[\text{kN}]$$

$$V_{maks} = 16,6[\text{kN}]$$

$$M_{maks} = 11,6[\text{kN.m}]$$

a) $b^2 \geq \frac{5 \times \overset{10000}{16666,6}[\text{N}]}{2 \cdot 2[\text{MPa}]}$

$$b \geq \overset{111,8}{144,3}[\text{mm}] \Rightarrow b = \overset{112}{145}[\text{mm}]$$

b) $b^3 \geq \frac{10 \cdot \overset{10000}{16666}[\text{N}] \cdot 700[\text{mm}]}{8[\text{N/mm}^2]}$

$$b \geq 206,1[\text{mm}] \checkmark$$