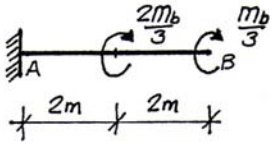
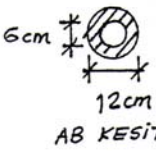
UYGULAMA 4
BURULMA MOMENTİ ETKİSİ

SORU 1:





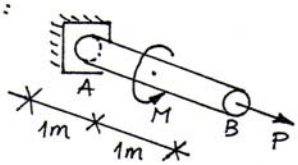
$\tau_{em} = 900\ kg/cm^2$
$G = 800.000\ kg/cm^2$

Şekilde ölçüleri ve yükleme durumu verilen konsol kirişte B ucundaki dönme miktarı $\varphi_{BA} = \frac{0,1}{\pi}$ radyan ölçülmüştür.

a-) M_b burulma momentini hesaplayınız.

b-) Konsol kirişteki maksimum kayma gerilmesini (τ_{max}) hesaplayınız.

SORU 2:



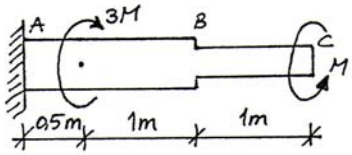
$\sigma_{em} = 1400\ kg/cm^2$
$\tau_{em} = 900\ kg/cm^2$
$E = 2,1 \times 10^6\ kg/cm^2$, $G = 800.000\ kg/cm^2$

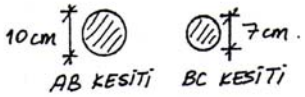
Şekilde ölçüleri ve yükleme durumu verilen konsolda,

a-) $M = 0$, $P = 100$ t. iken kesitin d çapını ve çubuktaki uzama miktarını (ΔL_{BA}),

b-) $P = 0$, $M = 1,75$ tm iken kesitin d çapını ve B ucunun A ucuna göre dönme miktarını (φ_{BA}) hesaplayınız.

SORU 3:





$\tau_{em} = 900\ kg/cm^2$, $G = 800.000\ kg/cm^2$.

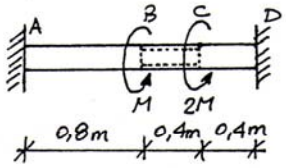
Şekilde ölçüleri ve yükleme durumu verilen konsol kirişte,

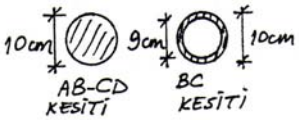
a-) $M = 0,5$ tm. ise burulma momenti diyagramını çiziniz.

b-) AB ve BC kesitlerinin güvenli olup olmadığını kontrol ediniz.

c-) C ucunun A ucuna göre dönme miktarını (φ_{CA}) hesaplayınız.

SORU 4:





$\tau_{em} = 900\ kg/cm^2$
$G = 800.000\ kg/cm^2$

Şekilde ölçüleri ve yükleri verilen hiperstatik sistemde,

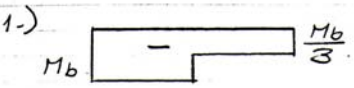
a-) AB ve BC kesitlerinin taşıyabilecekleri en büyük burulma momentlerini hesaplayınız.

b-) Sistemin taşıyabileceği M momentini hesaplayınız.

UYGULAMA 4 ÇÖZÜMLERİ

$$I_o = \frac{\pi(12^4 - 6^4)}{32} = 1909 \text{ cm}^4$$

1-)



a-) $\varphi_{BA} = \frac{M_b \cdot 200}{800 \cdot 1909} + \frac{(M_b/3) \cdot 200}{800 \cdot 1909} = \frac{0,1}{\pi}$.

$\frac{1,33 M_b \cdot 200}{800 \cdot 1909} = \frac{0,1}{\pi}$, $M_b = 1,83$ tm.

b-) $\tau_{max} = \frac{183}{1909} \cdot 6 = 0,58 < 0,9$ t/cm²

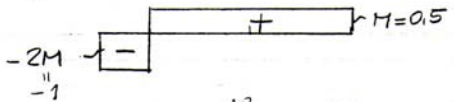
2-) a-) $\frac{100}{\frac{\pi d^2}{4}} \leq 1,4 \rightarrow d \geq 9,54$ cm. $\rightarrow d = 10$ cm.

$\Delta L_{AB} = \frac{100 \cdot 200}{2100 \cdot \frac{\pi \cdot 10^2}{4}} = 0,12$ cm.

b-) $\frac{175}{\frac{\pi d^4}{32}} \cdot \frac{d}{2} \leq 0,9 \rightarrow d \geq 9,97$ cm $\rightarrow d = 10$ cm.

$\varphi_{BA} = \frac{175 \cdot 100}{800 \cdot \frac{\pi \cdot 10^4}{32}} = 0,022$ radyan.

3-) a-)



b-) $I_o^{AB} = \frac{\pi \cdot 10^4}{32} = 982 \text{ cm}^4$

$I_o^{BC} = \frac{\pi \cdot 7^4}{32} = 236 \text{ cm}^4$

$\tau_{max}^{AB} = \frac{100}{982} \cdot 5 = 0,51 \text{ t/cm}^2 < 0,9 \text{ t/cm}^2$.

$\tau_{max}^{BC} = \frac{50}{236} \cdot 3,5 = 0,74 \text{ t/cm}^2 < 0,9 \text{ t/cm}^2$

c-) $\varphi_{CA} = \frac{(-100) \cdot 50}{800 \cdot 982} + \frac{50 \cdot 100}{800 \cdot 982} + \frac{50 \cdot 100}{800 \cdot 236} = 0,026$ radyan.

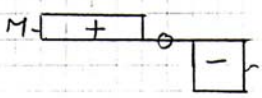
4-) a) $I_o^{AB} = \frac{\pi \cdot 10^4}{32} = 982 \text{ cm}^4$, $I_o^{BC} = \frac{\pi(10^4 - 9^4)}{32} = 338 \text{ cm}^4$

$(M_b)_{max}^{AB} = \frac{0,9 \cdot 982}{5} = 1,77$ tm., $(M_b)_{max}^{BC} = \frac{0,9 \cdot 338}{5} = 0,61$ tm.

b-) $M_A + M_B = 3M$ (1), $\varphi_{AD} = \frac{M_A \cdot 80}{G \cdot 982} + \frac{(M_A - M) \cdot 40}{G \cdot 338} + \frac{(M_A - 3M) \cdot 40}{G \cdot 982}$ (2,91)

$80 M_A + 40 \cdot 2,91 (M_A - M) + 40 (M_A - 3M) = 0$.

$236,4 M_A - 236,4 M = 0 \rightarrow M_A = M$, $M_B = 2M$



$2M = 1,77 \rightarrow M = 0,885$ tm.