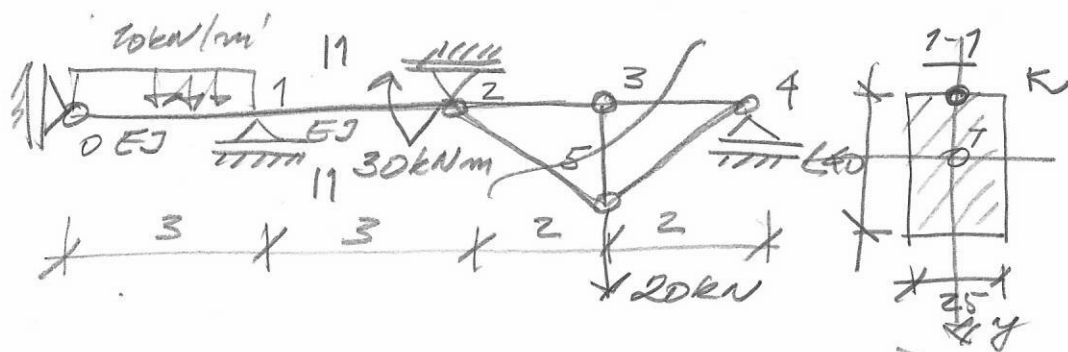


UNIVERZITET U BANJALUCI
 ARHITEKTONSKO-GRADJEVINSKO-BEOVETSKI FAKULTET
 KATEDRA ZA MEHANIKU I TEORIJU KONSTRUKCIJA
 STUDIJSKI PROGRAM ARHITEKTURA

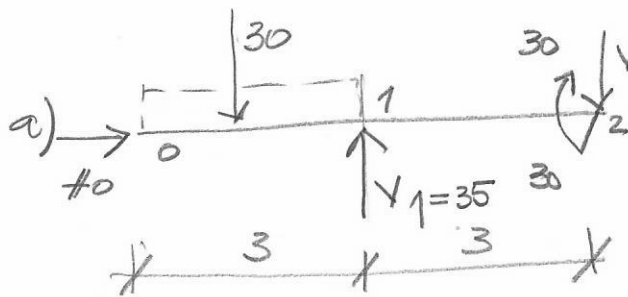
26.02.2021.

MEHANIKA I ODPORNOST MATERIJALA

ZA NOSAČ I OPIREĆENJE NA SKICI TREBA:



- NACRTATI DIJAGRAME M , T , N NA PUNOM NOSAČU I ISPISATI ANALITIČKE IZRAZE NA DELU 0-1
- ODREDITI SILE U ŠTAPOVIMA PO DVE METODE U NAZNAČENOM PRESEKU
- IZVRŠITI ANALIZU STANJA NAPONA UTACKI K PRESEKA 1-1
- ODREDITI σ , ϵ , ΔL U ŠTAPU 3-4 AKO JE $E = 210 \text{ GPa}$, $F = 30 \text{ cm}^2$ NA ŠTAPU 3-4
- MOR MAKS. ANALOGIJOM ODREDITI v_0 , y_0 , ψ
- SKICIRATI DEFORMISANU OSU PUNOG NOSAČA.



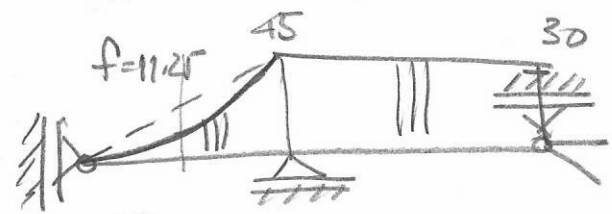
$$\sum H = H_0 = 0$$

$$\sum M_2 = 3V_1 + 30 - 45 \cdot 30 = 0$$

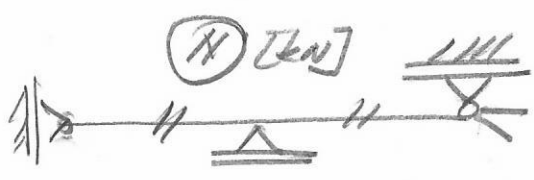
$$\underline{V_1 = 35 \text{ kN}}$$

$$\sum M_1 = \frac{1}{2} \cdot 3 + 30 - 30 \cdot 1.5 = 0$$

$$\underline{V_2 = 5 \text{ kN}}$$



$$\textcircled{T} \text{ [kN]}$$



$$\textcircled{N} \text{ [kN]}$$

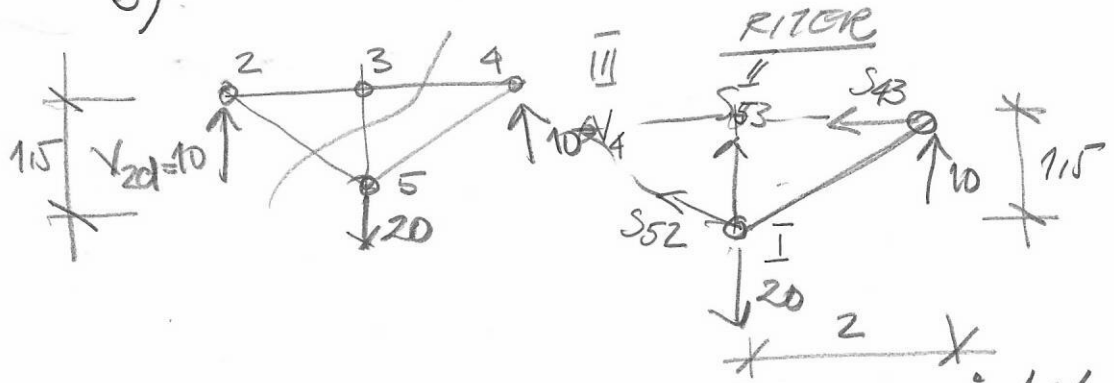
$$M_x(z) = -10 \cdot \frac{z^2}{2} = -5z^2 \quad 0 \leq z \leq 3 \text{ m}$$

$$M_x(0) = 0 \quad M_x(3) = -5 \cdot 3^2 = -45 \text{ kNm}$$

$$\underline{T_y(z) = -10z} \quad T_y(0) = 0 \quad T_y(3) = -30 \text{ kN}$$

$$\underline{N(z) = 0}$$

6)



$$\sum M_I = 2 \cdot 10 + 1.5 \cdot S_{43} = 0$$

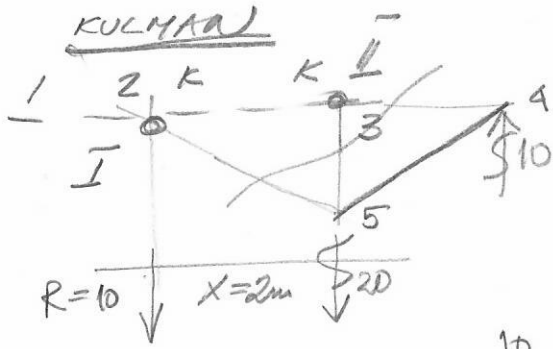
$$\underline{S_{43} = -13,3 \text{ kN}}$$

$$\sum M_{II} = S_{52} \cdot 0,8 \cdot 1,5 - 2 \cdot 10 = 0$$

$$\underline{S_{52} = 16,6 \text{ kN}}$$

$$\sum M_{III} = 2 \cdot (S_{53} - 20) + 4 \cdot 10 = 0$$

$$\underline{S_{53} = 0 \text{ kN}}$$

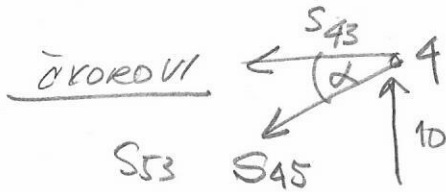
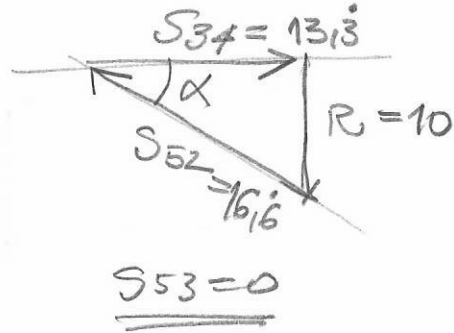


$$S_{52} = \frac{10}{0,6} = 16,6$$

$$S_{34} = 16,6 \cdot 0,8 = 13,3$$

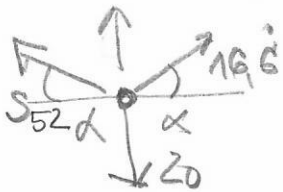
$$R = 20 - 10 = 10$$

$$X \cdot R = 2 \cdot 10 = 20 \Rightarrow X = 2m$$



$$\sum V = 10 - S_{43} \cdot 0,6 = 0 \quad S_{43} = -13,3$$

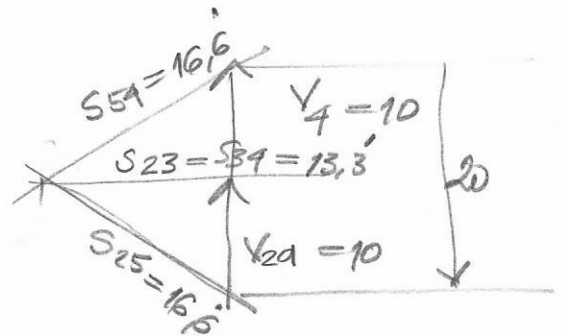
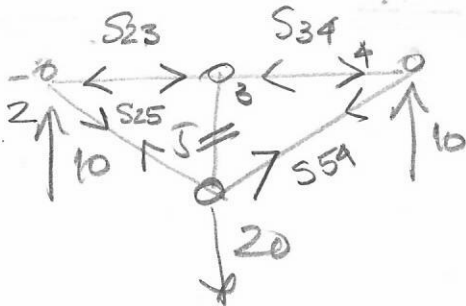
$$\sum H = S_{45} - 13,3 \cdot 0,8 = 0 \quad S_{45} = 16,6$$



$$\sum H = (S_{52} - 16,6) \cdot 0,8 = 0 \quad S_{52} = 16,6$$

$$\sum V = 2 \cdot 16,6 \cdot 0,6 - 20 + S_{53} = 0 \quad S_{53} = 0$$

KREMONA



c) $M_{1L} = -45 \text{ kNm}$

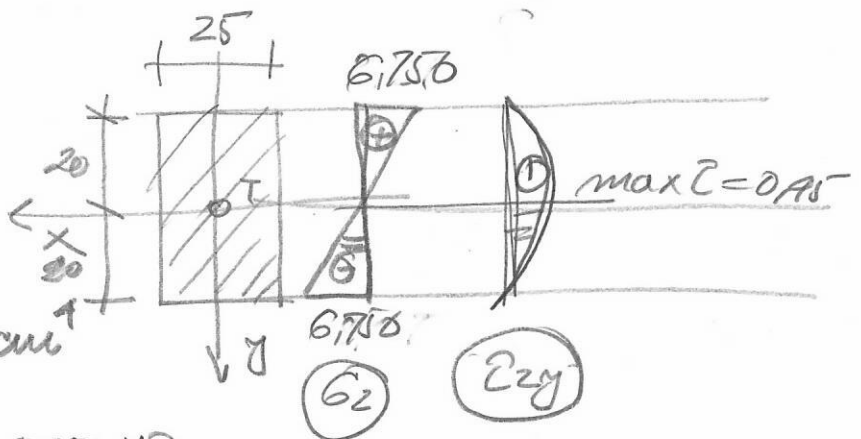
$T_{1L} = -30 \text{ kN}$

$N_{1L} = 0$

$$J_x = \frac{25 \cdot 40^3}{12} = 133\,333,3 \text{ cm}^4$$

$$\sigma_2 = \frac{-45 \cdot 10^{-3} \cdot 20 \cdot 10}{133\,333,3 \cdot 10^{-8}} = -6,750 \text{ MPa}$$

$$\tau_{2y} = \frac{3(-30) \cdot 10^{-3}}{2 \cdot 25 \cdot 40 \cdot 10^{-4}} = -0,45 \text{ MPa}$$



$$d) \quad \sigma = \frac{S_{39}}{F} = \frac{-13,3 \cdot 10^{-3}}{30 \cdot 10^{-4}} = -4,4 \text{ MPa}$$

$$\epsilon = \frac{\sigma}{E} = \frac{-4,4 \cdot 10^{-3}}{210} = -21,164 \cdot 10^{-6}$$

$$\Delta L = \epsilon \cdot L = -21,164 \cdot 10^{-6} \cdot 2,5 = 52,91 \cdot 10^{-6} \text{ m} = \underline{\underline{0,053 \cdot 10^{-3} \text{ m}}}$$

e)

$v_c = v_d = 0$
 $p_c = p_d \neq 0$
 $N = 0$
 $M \neq 0$

$\phi_1 = 22,5$
 $M_c = M_d = 0$
 $\bar{v}_c = \bar{v}_d \neq 0$
 $\bar{M} = 0$
 $\bar{T} = 0$

$\phi_2 = 67,5$
 $\phi_3 = 67,5$
 $\phi_4 = 45$

$\bar{v}_0 = 10,5$
 $\bar{v}_2 = 52,5$

$M_{1d} = 67,5 \cdot 1 + 45 \cdot 2 - \bar{v}_2 \cdot 3 = 0$
 $\bar{v}_2 = 52,5$

$\sum Y = 2 \cdot 67,5 + 45 - 22,5 - 52,5 - \bar{v}_0 = 0$
 $\bar{v}_0 = -105,00$

$\bar{M}_{1c} = \bar{M}_0 + 67,5 \cdot 1 - 22,5 \cdot 1,5 - 105 \cdot 3 = 0$
 $\bar{M}_0 = 281,25$

$\varphi_0 = \frac{\bar{M}_0}{EJ} = \frac{281,25}{EJ}$
 $\varphi_1 = \frac{\bar{T}_1}{EJ} = \frac{-105 - 22,5 + 67,5}{EJ} = \frac{-60}{EJ}$

$\varphi_0 = \frac{\bar{T}_0}{EJ} = \frac{-105}{EJ}$

f)

$\sum A \quad E = 30 \text{ GPa}$
 $EJ = 30 \cdot 10^3 \cdot 106666,6 \cdot 10^{-8}$
 $= 32 \text{ MN m}^2$

$v_0 = \frac{281,25 \cdot 10^{-3}}{32} = 8,789 \cdot 10^{-3} \text{ m}$

$\varphi_0 = \frac{-105 \cdot 10^{-3}}{32} = 3,281 \cdot 10^{-3} \text{ rad}$

$\varphi_1 = \frac{-60 \cdot 10^{-3}}{32} = -1,875 \cdot 10^{-3} \text{ rad}$