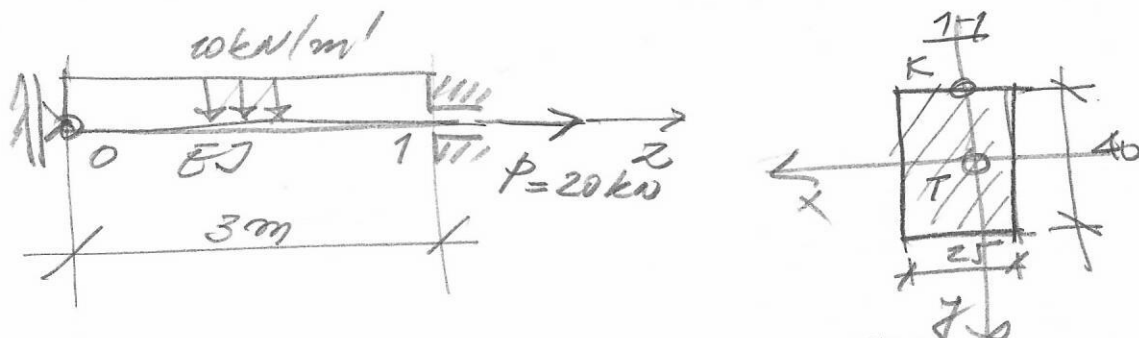


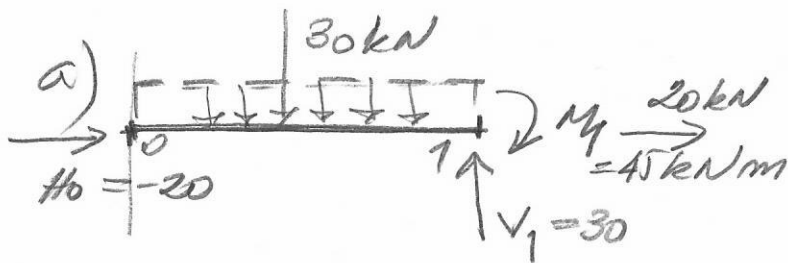
12.02.2021.

MEHANIKA I OTPORNOST MATERIJALA

ZA NOSAČE I OPTEREĆENJE NA SKICI TREBA!



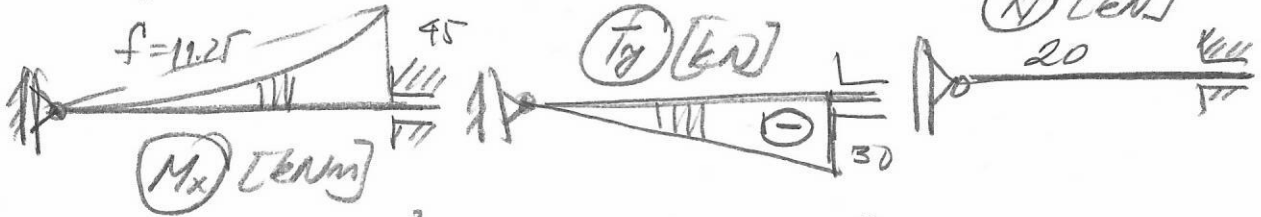
- 30 a) NACRTATI DIJAGRAME PRESEČNIH SILA  
 I ISPISATI ANALITIČKE IZRAZE ZA  $M(z)$ ,  
 $N(z)$ ,  $T(z)$
- 20 b) NACRTATI DIJAGRAME KOMP. NAPONA U  
 PRESEKU 1
- 10 c) IZVRŠITI ANALIZU STANJA NAPONA U  
 TAČKI K PRESEKA 1
- 30 d) ODREDITI  $v_0$ ,  $\varphi_0$  I  $\Delta l$
- 10 e) SKICIRATI DEFORMISANU OSU NOSAČA



$$\sum H = H_0 + 20 = 0 \quad H_0 = +20 \text{ kN}$$

$$\sum V = V_1 - 30 = 0 \quad V_1 = 30 \text{ kN}$$

$$\sum M_2 = M_1 - 30 \times 1,5 = 0 \quad M_1 = 45 \text{ kNm}$$



$$M_x(z) = -p \cdot y \cdot \frac{z^2}{2} = -\frac{10}{2} z^2 = -5z^2$$

$$T_y(z) = -10z$$

$$N(z) = 20$$

b)

$$F = 25 \times 40 = 1000 \text{ cm}^2$$

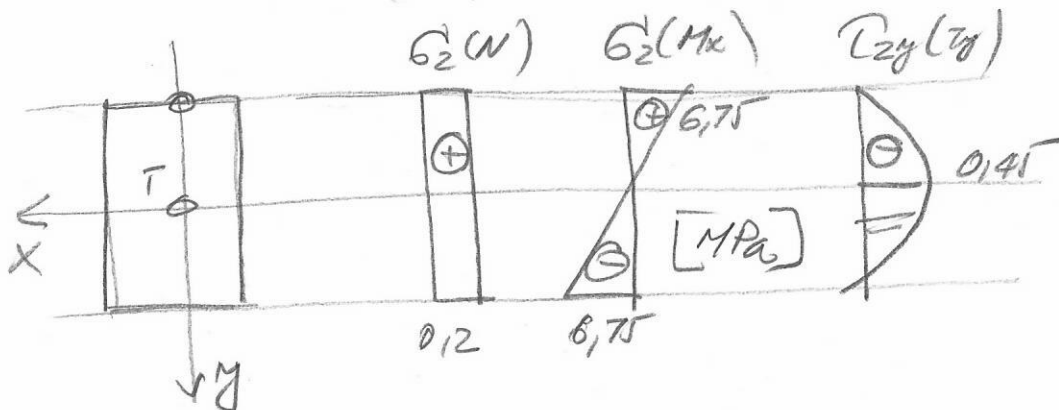
$$J_x = \frac{25 \times 40^3}{12} = 133333,3 \text{ cm}^4$$

$$M_{x,1} = -45 \text{ kNm} \quad T_{x1} = -30 \text{ kN} \quad N = 20 \text{ kN}$$

$$\sigma_2(N) = \frac{N}{F} = \frac{20 \times 10^{-3}}{1000 \times 10^{-4}} = 0,2 \text{ MPa}$$

$$\sigma_2(M_x) = \frac{M_x}{J_x} y_{\max} = \frac{-45 \times 10^{-3} \times 20 \times 10^{-2}}{133333,3 \cdot 10^{-8}} = -6,75 \text{ MPa}$$

$$\max \tau_{zy} = \frac{3}{2} \frac{T_y}{F} = \frac{3}{2} \frac{-30 \times 10^{-3}}{1000 \times 10^{-4}} = -0,45 \text{ MPa}$$

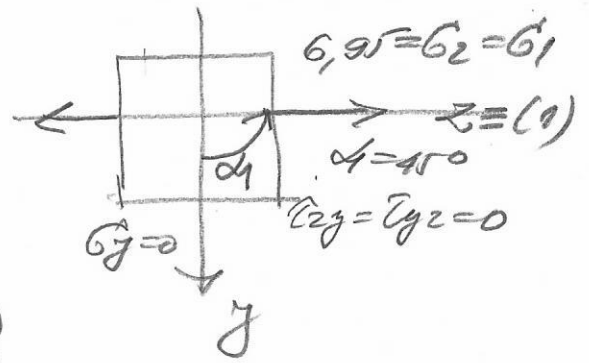


c)

$$\sigma_{z;k} = 0,2 + 6,77 = 6,97 \text{ MPa}$$

$$\tau_{zy} = \tau_{yz} = 0$$

$$\sigma_y = 0$$

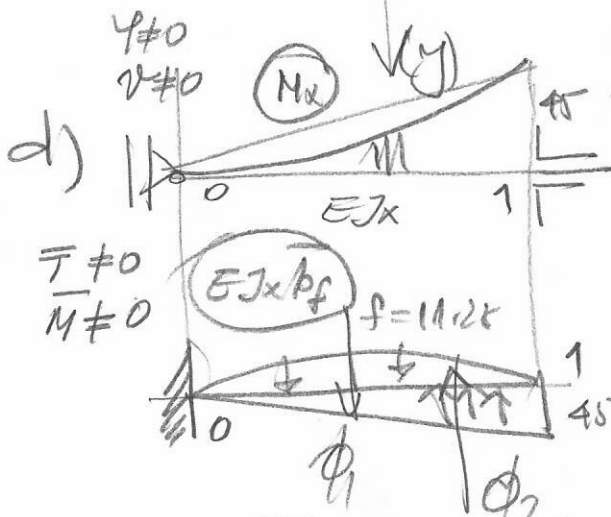
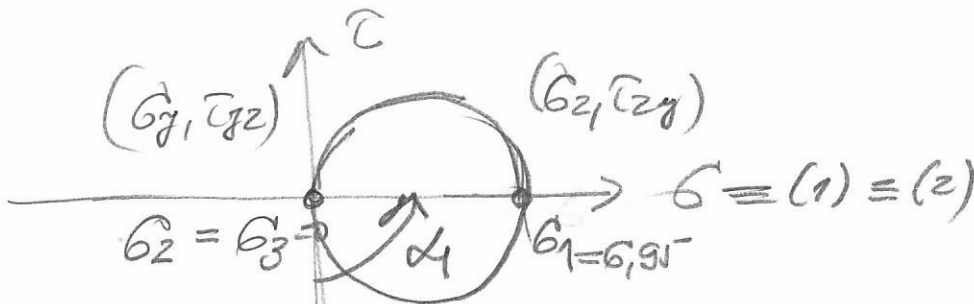


$$\tan 2\alpha_1 = \frac{-2 \cdot \tau_{yz}}{\sigma_y - \sigma_z} = \frac{-2 \cdot 0}{0 - 6,77} = \frac{0}{-}$$

$$\left. \begin{array}{l} \sin 2\alpha_1 = 0 \\ \cos 2\alpha_1 < 0 \end{array} \right\} 2\alpha_1 = 180^\circ \Rightarrow \alpha_1 = 90^\circ$$

$$\sigma_{\max/min} = \frac{\sigma_y + \sigma_z}{2} \pm \sqrt{\left(\frac{\sigma_y - \sigma_z}{2}\right)^2 + \tau_{yz}^2}$$

$$= \frac{6,97}{2} \pm \sqrt{\left(\frac{6,97}{2}\right)^2 + 0^2} = \frac{6,97}{2} \pm \frac{6,97}{2} = \begin{cases} 6,97 = \sigma_1 \\ 0 = \sigma_2 \\ 0 = \sigma_3 \end{cases}$$



$$\begin{aligned} E &= 306 \text{ Pa} \\ J &= 733\,333,3 \text{ cm}^4 \\ F &= 1000 \text{ cm}^2 \\ T_0 &= 0 \quad EJx = 40 \text{ MN m}^2 \\ M_0 &= 0 \quad EF = 3000 \text{ MN} \end{aligned}$$

$$\phi_1 = \frac{2}{3} \cdot 3 \cdot 11,25 = 22,5 \text{ kNm}^2$$

$$\phi_2 = 45 \times \frac{3}{2} = 67,5 \text{ kNm}^2$$

$$v_0 = \frac{M_0}{EJ} = \frac{67,5 \times 2 - 22,5 \times 1,5}{40 \times 10^3} = 2,531 \times 10^{-3} \text{ m}$$

$$\phi_0 = \frac{T_0}{EJ} = \frac{-67,5 + 22,5}{-3 \cdot 40 \times 10^3} = -1,125 \times 10^{-3} \text{ rad}$$

$$\Delta L = \frac{N \cdot L}{EF} = \frac{20 \times 10 \cdot 3}{3000} = 0,02 \times 10^{-3} \text{ m}$$

