

UNIVERZITET U BANJALUCI

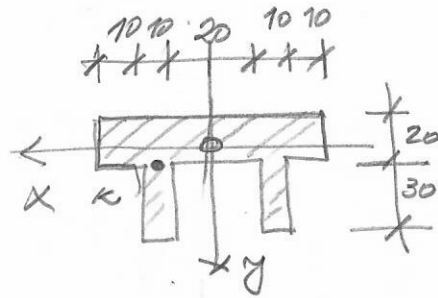
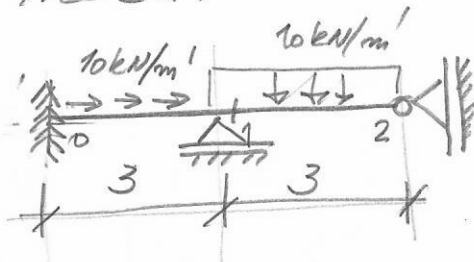
ARHITEKTONSKO GRAĐEVINSKO GEODETSKI FAKULTET
KATEĐORA ZA MEĐANIKU I TEORIJU KONSTRUKCIJA
STUDIJSKI PROGRAM GRAĐEVINARSTVO

APRILSKI ISPITNI ROK

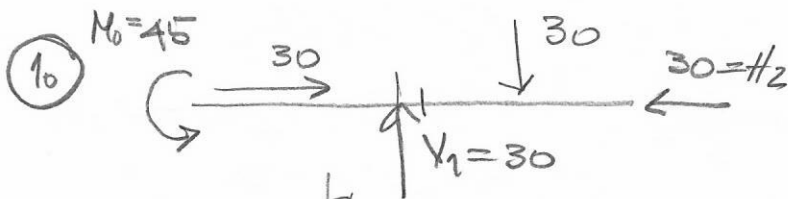
19.06.2020.

OTPORNOST MATERIJALA I

10) ZA NOSAČ I OPIREĆEĐE NA SKICI
TREBA:



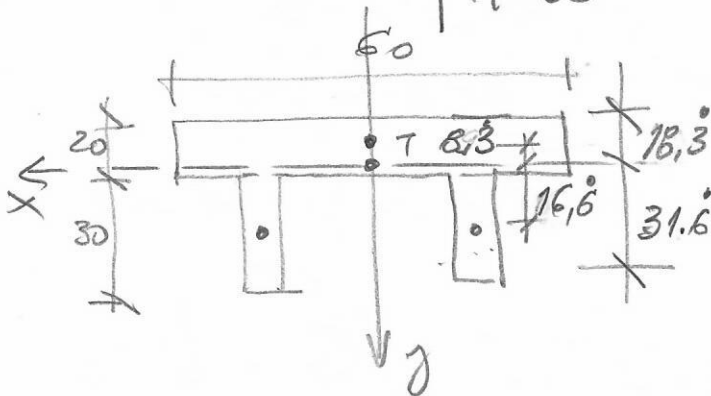
- SKAČUNATI I NACRTATI DIJAGRAME KOMPONENTALNIH NAPONA U PRESEKU 1 DESNO
- IZVEŠITI ANALIZU NAPONA I NACRTATI MODOV KRUG NAPONA U TAČKI K PRESEKA 1 DESNO. TAČKA K NALAZI SE NA NOŽICI PRESEKA (IZNAD REBRA) GORE
- INTEGRACIJOM DIF. JEDENAČINA ODREDITI HORIZONTALNO POMERANJE ČVORA 1 I VERTIKALNO POMERANJE ČVORA 0.
- MOR MARSVELOVOM ANALIZIJOM ODREDITI σ_0 , σ_1 I σ_2
- SKICIRATI DEFORMISANU OSU NOSAČA



$$M_{1d} = -45 \text{ kNm}$$

$$T_{1d} = 30 \text{ kN}$$

$$N_{1d} = -30 \text{ kN}$$



$$F = 20 \cdot 60 + 2 \cdot 30 \cdot 10 = 1800 \text{ cm}^2$$

$$y_T = \frac{1200 \cdot 10 + 600 \cdot 35}{1800} = 18,3 \text{ cm}$$

$$J_x = \frac{1}{12} (60 \cdot 20^3 + 2 \cdot 10 \cdot 30^3) + 1200 \cdot 8,3^2 + 600 \cdot 16,6^2 = 335000 \text{ cm}^4$$

$$\sigma_2^{1g} = \frac{-45 \cdot 10^{-3} \cdot (-0,183)}{335000 \cdot 10^{-8}} = 2,462 \text{ MPa}$$

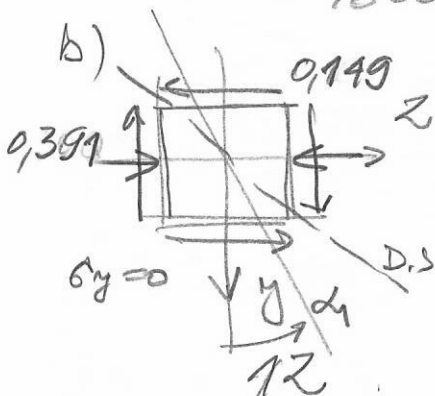
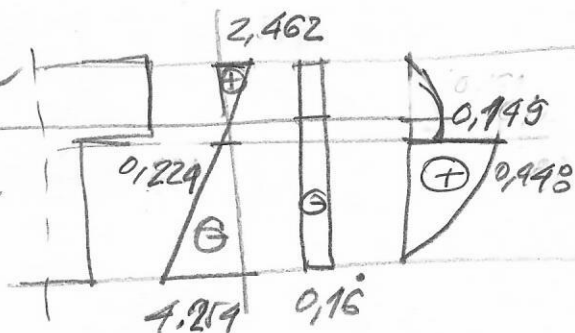
$$\sigma_2^{1k} = \frac{-45 \cdot 10^{-3} \cdot 0,016}{335000 \cdot 10^{-8}} = -0,224 \text{ MPa}$$

$$\sigma_2^{1d} = \frac{-45 \cdot 10^{-3} \cdot 0,316}{335000 \cdot 10^{-8}} = -4,254 \text{ MPa}$$

$$\tau_{zy}^{1kg} = \frac{30 \cdot 10^{-3} \cdot 1200 \cdot 8,3 \cdot 10^{-6}}{335000 \cdot 10^{-8} \cdot 0,6} = 0,149 \text{ MPa}$$

$$\tau_{zy}^{1kd} = \tau_{zy}^{1kg} \cdot \frac{0,6}{0,2} = 0,448 \text{ MPa}$$

$$\sigma_2^{1(N)} = \frac{-30 \cdot 10^{-3}}{1800 \cdot 10^{-4}} = -0,16 \text{ MPa}$$

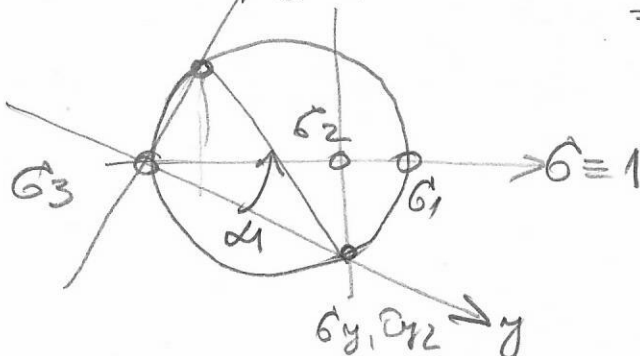


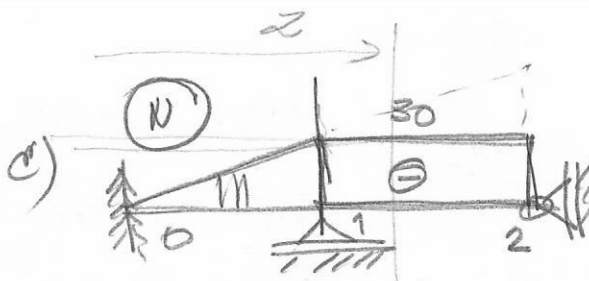
$$\tan 2\alpha_1 = \frac{-2 \cdot (-0,149)}{0 - (-0,391)} = \frac{(+)}{(+)} 0,762$$

$$\alpha_1 = \frac{1}{2} \arctan 0,762 = 18,65^\circ$$

$$\sigma_{max/min} = \frac{-0,391}{2} \pm \sqrt{\left(\frac{0,391}{2}\right)^2 + 0,149^2}$$

$$= -0,196 \pm 0,246 = \begin{cases} 0,056 = \sigma_1 \\ 0 = \sigma_2 \\ 0,436 = \sigma_3 \end{cases}$$





$$E = 30 \text{ GPa} \quad EF = 5400 \text{ kN}$$

$$N_1(z) = P_2 \cdot z = -10z$$

$$N_2(z) = -30$$

$$\frac{dw}{dz} = \epsilon_z = \frac{\sigma_z}{E} = \frac{N(z)}{EF}$$

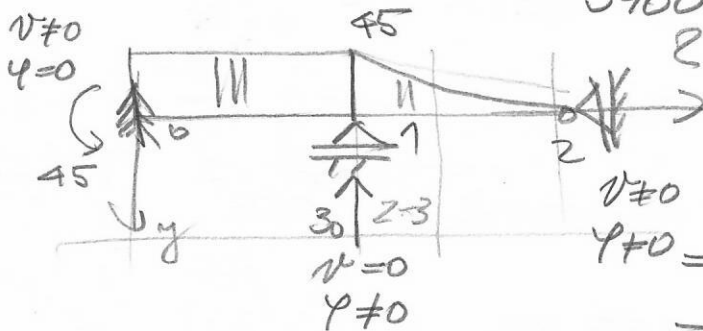
$$EF w' = N(z)$$

$$EF w_1'(z) = C_1 - 30z \quad EF w_2'(6) = C_1 - 30 \cdot 6 = 0$$

$$C_1 = 180$$

$$EF w_2'(3) = 180 - 30 \cdot 3 = 90$$

$$EF w_2''(3) = \frac{90 \cdot 10^{-3}}{5400} = 0,016 \cdot 10^{-3} \text{ m}^{-3}$$



$$M_1(z) = -45$$

$$M_2(z) = -45 + 30 \cdot (z-3) - 10 \frac{(z-3)^2}{2}$$

$$V \neq 0 \quad \phi \neq 0$$

$$V + 0 = -45 + 30z - 90 - 5(z^2 - 6z + 9)$$

$$= -180 + 60z - 5z^2$$

$$EJ = 30 \cdot 10^3 \cdot 335800 \cdot 10^{-8} = 100,74 \text{ MNm}^2$$

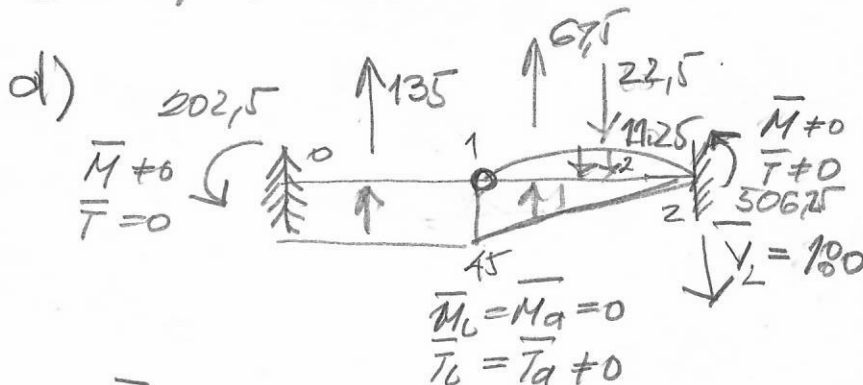
$$EJ v_1''(z) = 45$$

$$EJ v_1'(z) = C_1 + 45z \Rightarrow EJ v_1'(0) = C_1 = 0$$

$$EJ v_1(z) = C_2 + \frac{45}{2} z^2 \quad EJ v_1(3) = C_2 + \frac{45}{2} \cdot 3^2 = 0$$

$$EJ v_1(z) = -202,5 + 22,5z^2 \quad C_2 = -202,5$$

$$EJ v_1(0) = -202,5 \quad v_1(0) = \frac{-202,5 \cdot 10^{-3}}{100,74} = -2,010 \cdot 10^{-3} \text{ m}$$



$$\phi_1 = 45 \cdot 3 = 135$$

$$\phi_2 = \frac{135}{2} = 67,5$$

$$\phi_3 = \frac{2}{3} \cdot 112,5 \cdot 3 = 22,5$$

$$\bar{M}_0 = 135 \cdot 1,5 = 202,5$$

$$\bar{V}_2 = 135 + 67,5 - 22,5 = 180$$

$$\bar{M}_2 = 180 \cdot 3 + 22,5 \cdot 1,5 - 67,5 = 506,25$$

$$v_0 = \frac{M_0}{EJ} = \frac{-202,5 \cdot 10^{-3}}{100,74} = -2,010 \cdot 10^{-3} \text{ m}$$

$$\varphi_1 = \frac{T_1}{EJ} = \frac{135 \cdot 10^{-3}}{100,74} = 1,340 \cdot 10^{-3} \text{ rad}$$

$$v_2 = \frac{M_2}{EJ} = \frac{506,25 \cdot 10^{-3}}{100,74} = 5,025 \cdot 10^{-3} \text{ rad}$$

