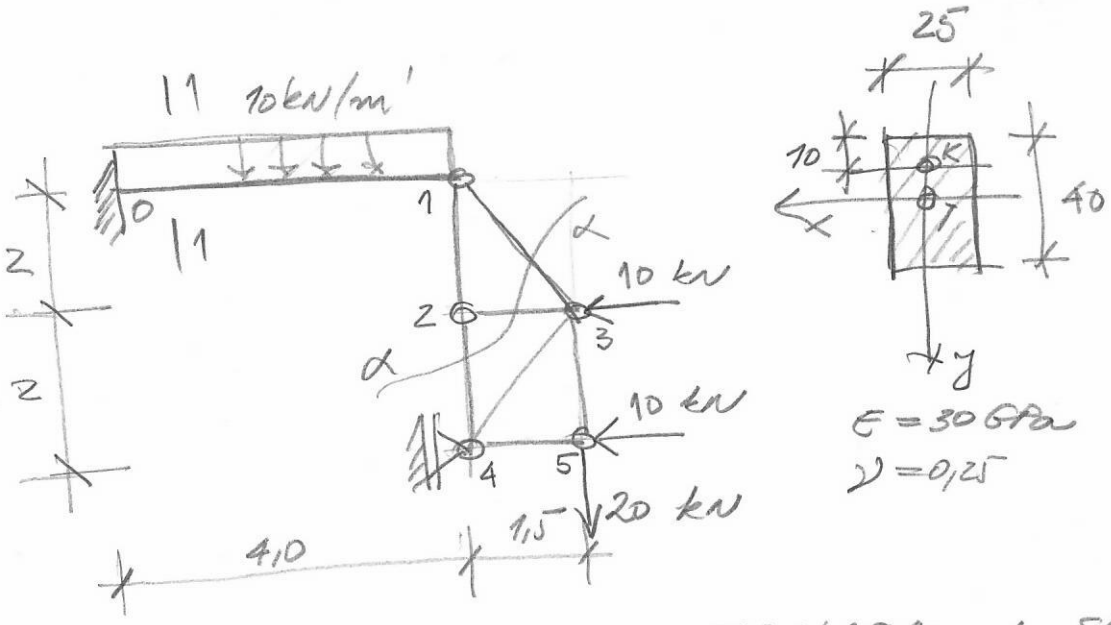
UNIVERZITET U BANJALUCI
ARHITEKTONSKO-GRAĐEVINSKO-GEODETSKI FAKULTET
KATEDRA ZA MEHANIKU I TEORIJU KONSTRUKCIJA
STUDIJSKI PROGRAM ARHITEKTURA

02.07.2021.

MEHANIKA I OTPORNOST MATERIJALA

ZA NOSAČ I OPTEREĆENJE NA SKICI TREBA:



a) ODREDITI REAKCIJE OSLONACA I SILE VEZA IZMEĐU KRUTIH PLOČA

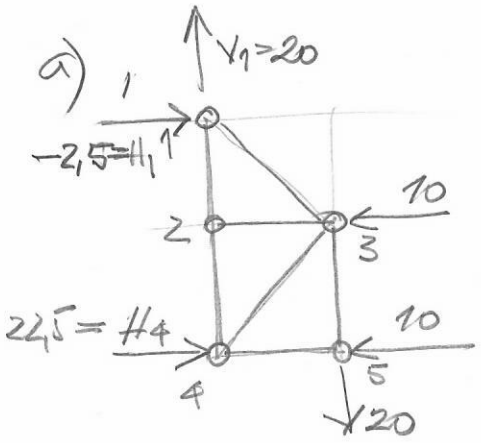
b) NA PUNOM DELU NOSAČA ISPISATI FUNKCIJE PRESEČNIH SILA I NACRTATI NJIHOVE DIJAGRAME $M_x(z)$, $T_y(z)$ I $N(z)$

c) PO SOPSTVENOM IZBORU DVE METODE ODREDITI SILE U ŠTAPOVIMA S_{13}, S_{23} I S_{24}

d) U PRESEKU 0 ODREDITI DIJAGRAME KOMPONENTALNIH NAPONA

e) MOR-MAKSUELOVOM KONSTRUKCIJOM ODREDITI φ_0, v_1 I φ_1 A ZATIM SKICIRATI DEFORMISANU OSU NOSAČA NA DELU 0-1

a)



$\Sigma Y = V_1 - 20 = 0 \qquad V_1 = 20\ kN$

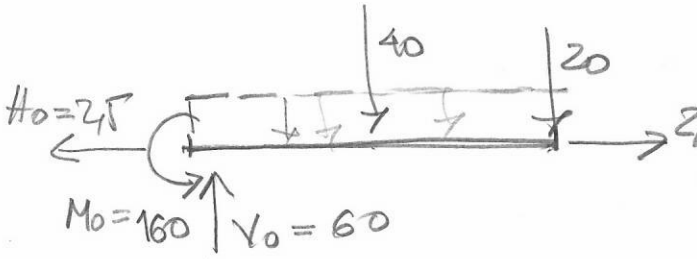
$\Sigma M_1 = 4H_4 - 10(2+4) - 15 \cdot 20 = 0$

$H_4 = 22{,}5\ kN$

$\Sigma M_5 = 4H_1 + 15 \cdot 20 - 2 \cdot 10 = 0$

$H_1 = -2{,}5\ kN$

$\Sigma H = 22{,}5 - 2{,}5 - 2 \cdot 10 = 0 \qquad 0 = 0\ \checkmark$



$\Sigma Y = V_0 - 40 - 20 = 0 \qquad V_0 = 60$

$\Sigma H = H_0 - 2{,}5 = 0 \qquad H_0 = 2{,}5$

$\Sigma M_0 = M_0 - 40 \cdot 2 - 20 \cdot 4 = 0 \qquad M_0 = 160$

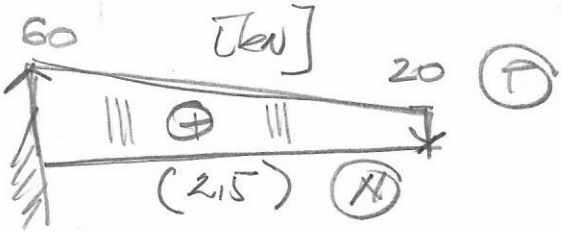
b)

$M_x(z) = -160 + 60z - 10 \cdot \frac{z^2}{2} = -160 + 60z - 5z^2$

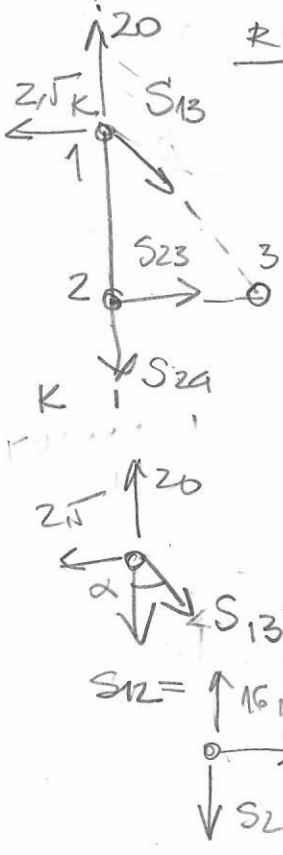
$T_y(z) = 60 - 10z$

$N(z) = 2{,}5$

$f = 10 \cdot \frac{4^2}{8} = 20\ kNm$



c)



KLEŠTĚ

$\Sigma M_1 = 2\,S_{23} = 0 \qquad S_{23} = 0$

$\Sigma M_2 = 2(2{,}5 - 0{,}6\,S_{13}) = 0 \qquad S_{13} = 4{,}16\dot{6}$

$\Sigma M_3 = 1{,}5(S_{24} - 20) + 2 \cdot 2{,}5 = 0 \qquad S_{24} = 16{,}6\dot{}$

ČTYŘOBY I:

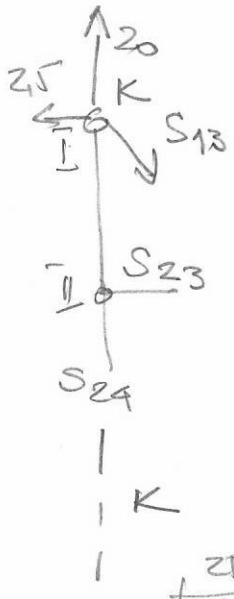
$2{,}5 - 0{,}6\,S_{13} = 0 \qquad S_{13} = 4{,}16\dot{6}\ kN$

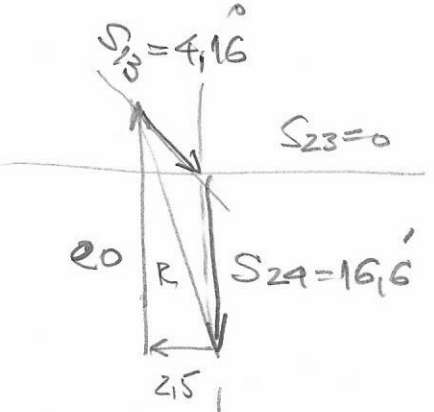
$S_{12} + 4{,}16\dot{} \cdot 0{,}8 - 20 = 0 \qquad S_{12} = 16{,}6\dot{}\ kN$

$16{,}6\dot{} - S_{24} = 0 \qquad S_{24} = 16{,}6\dot{}\ kN$

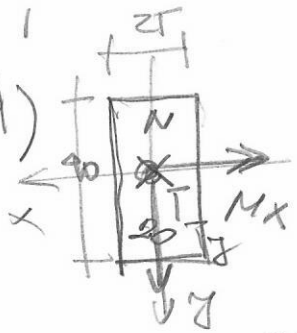
$S_{23} = 0$

KULMAN





a)



$F = 25 \times 40 = 1000\ cm^2$

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

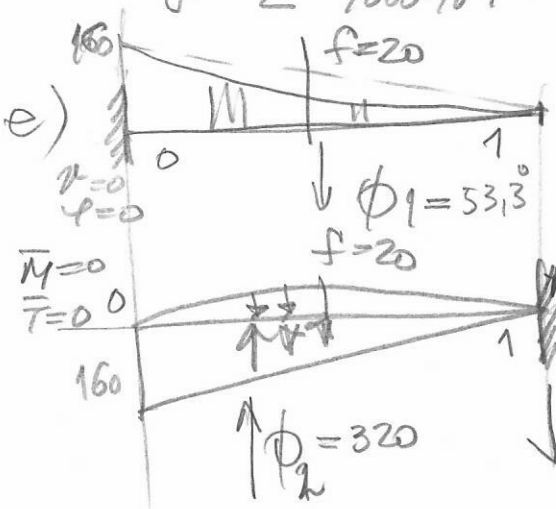
$N = 2{,}5\ kN \quad T = 20\ kN \quad M = -160\ kNm$

$$\sigma_z(N) = \frac{N}{F} = \frac{25 \cdot 10^{-3}}{1000 \cdot 10^{-4}} = 0{,}025\ MPa$$

$$\sigma_z(M_x) = \frac{M_x}{J_x} y = \frac{-160 \cdot 10^{-3} \cdot 20 \cdot 10^{-2}}{133333{,}3 \cdot 10^{-8}} = -24\ MPa$$

$$\max \tau_{zy} = \frac{3}{2} \frac{20 \cdot 10^{-3}}{1000 \cdot 10^{-4}} = 0{,}3\ MPa$$

e)



$EJ = 30 \cdot 10^3 \cdot 133333{,}3 \cdot 10^{-8} =$

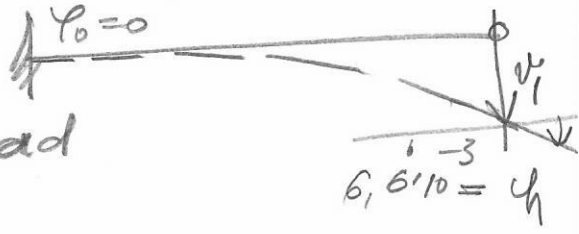
$EJ = 40\ MNm^2$

$\phi_1 = \frac{2}{3} \cdot 20 \cdot 4 = 53{,}3$

$\phi_2 = \frac{1}{2} 160 \cdot 4 = 320$

$\Sigma \bar{V} = 320 - 53{,}3 - \bar{V}_1 = 0 \quad \bar{V}_1 = 266{,}6$

$\Sigma \bar{M}_1 = 320 \cdot \frac{2}{3} \cdot 4 - 53{,}3 \cdot 2 - \bar{M}_1 = 0 \quad \bar{M}_1 = 746{,}6$



$$\varphi_0 = \frac{T_0}{EJ} = 0\ rad$$

$$\varphi_1 = \frac{\bar{T}_1}{EJ} = \frac{266{,}6 \cdot 10^{-3}}{40} = 6{,}6 \cdot 10^{-3}\ rad$$

$$v_1 = \frac{M_1}{EJ} = \frac{746{,}6 \cdot 10^{-3}}{40} = 18{,}6 \cdot 10^{-3}\ mm$$