

Project 5
Kupicun Geoxipn
2018050043

Problem 1

$$d_1 = 65 \text{ mm} \quad d_2 = 105 \text{ mm} \quad E_2 = 5$$

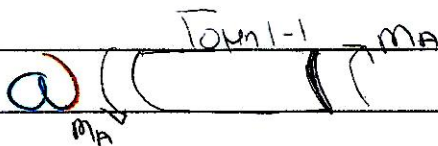
$$l_1 = 1 \text{ m} \quad l_2 = 0,8 \text{ m} \quad E_3 = 15$$

$$G_1 = 70 \text{ GPa} + E_2 G_P$$

$$G_2 = 80 \text{ GPa} + E_3 G_P$$

$$\tau_{\text{max}1} = 120 \text{ MPa}$$

$$\tau_{\text{max}2} = 90 \text{ MPa}$$



$$T_1 = T_{\text{max}} = 120 \text{ MPa}$$

$$\frac{T_1 \cdot 0,0325}{\frac{1}{2} \pi (0,0325)^4} = 120 \cdot 10^6$$

$$T_1 = 6,47 \text{ kNm}$$

$$T_{122-2}$$



$$\frac{6,47 \cdot 1}{\frac{1}{2} \pi (0,0325)^4 \cdot 75 \cdot 10^9} = \frac{T_2 \cdot 0,8}{\frac{1}{2} \pi (0,0525)^4 \cdot 95 \cdot 10^9}$$

$$T_2 = 69,76 \text{ kNm}$$

$$\tau_{\text{max}2} = \frac{69,76 \cdot 10^3 \cdot \left(\frac{0,105}{2}\right) \cdot 10^{-3}}{\frac{1}{2} \pi \left(\frac{0,105}{2}\right)^4}$$

$$= 0,31 \text{ MPa}$$

$$T_2 < \tau_{\text{max}2} \text{ OK}$$

$$M_{\text{extraction}} = M_t = 647,1031$$

$$= 6,78 \text{ kNm}$$

$$\theta) \Phi_r = \frac{69,76 \cdot 10^3 \cdot 0,8}{\frac{1}{2} \pi \cdot \left(\frac{0,105}{2}\right)^4 \cdot 95 \cdot 10^9}$$

$$= 0,049 \text{ rad}$$

$$0,049 \cdot \frac{180}{\pi} \approx 2,81^\circ$$

Arbunon 2

$$r_{\text{upri}} = 1,5 \text{ cm}$$

$$G_{st} = (85 + E_3) \text{ GPa}$$

$$AB = 90 \text{ cm}$$

$$r_{\text{dga}} = 3 \text{ cm}$$

$$G_{br} = (58 + E_2) \text{ GPa}$$

$$BC = 60 \text{ cm}$$

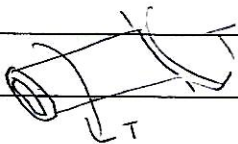
$$E_2 = 5$$

$$E_{st} = 80 \text{ MPa}$$

$$E_3 = 15$$

$$\tau_{\text{abr}} = 40 \text{ MPa}$$

Torzi 1-1



$$\tau_{st1} = \tau_{\text{abr}}$$

$$\frac{T_{st1-1} \cdot 3}{\frac{1}{2} \pi (3^4 - 1,5^4)} = 80 \text{ MPa}$$

$$T_{st1-1} \cdot 3 = 9542,59$$

$$T_{st1-1} = 3180,86 \text{ Nm}$$

$$\tau_{br1} = \tau_{\text{abr}}$$

$$\frac{T_{br1-1} \cdot 1,5}{\frac{1}{2} \pi (1,5^4)} = 40 \text{ MPa}$$

$$\rightarrow T_{br1-1} = 212,06 \text{ Nm}$$

$$T_{br1-1} \cdot 1,5 = 318,09$$

$$\Phi_{St} = \Phi_{Br}$$

$$\frac{T_{St} L_{St}}{J_{St} G_{St}} = \frac{T_{Br} L_{Br}}{J_{Br} G_{Br}}$$

$$\frac{T_{St} (60 \times 10^3)}{\frac{1}{2} \pi (3^4 - 1,5^4) \cdot 100 \cdot 10^9} = \frac{T_{Br} 60}{\frac{1}{2} \pi (1,5^4) 83 \cdot 10^9}$$

$$47840,63 T_{St} = 455625 T_{Br}$$

$$T_{St} = 9,52 T_{Br}$$

$$\Gamma_a T_{St-1} = 3180,86 \text{ Nm}$$

$$\Gamma_a T_{Br-1} = 212,06 \text{ Nm}$$

$$T_{St} = 212,06 \cdot 9,52$$

$$3180,86 = 9,52 T_{Br}$$

$$T_{St} = 2018,81 \text{ Nm}$$

$$T_{Br} = 334,12 \text{ Nm}$$

$$T = T_{St} + T_{Br}$$

$$= 2018,81 + 334,12$$

$$= 2352,93 \text{ Nm}$$