

The Answers of ME 208-2 Quiz 1

$$1) A_{AB} = \frac{\pi}{4} (0,03)^2 = 706,86 \times 10^{-6} \text{ m}^2$$

$$A_{BC} = \frac{\pi}{4} (0,02)^2 = 314,16 \times 10^{-6} \text{ m}^2$$

$$G_{All} = 160 \times 10^6 \text{ Pa}$$

$$\sigma = \frac{P}{A} \Rightarrow P = \sigma A$$

$$\text{Portion AB} \Rightarrow P = (706,86 \times 10^{-6}) (160 \times 10^6) = 113,1 \times 10^3 \text{ N}$$

$$\text{Portion BC} \Rightarrow P = (314,16 \times 10^{-6}) (160 \times 10^6) = 50,3 \times 10^3 \text{ N}$$

$$\delta_{All} = 4 \times 10^{-3}$$

$$\delta_c = \sum \frac{PL}{AE} \Rightarrow \frac{P}{E} \left(\frac{L_{AB}}{A_{AB}} + \frac{L_{BC}}{A_{BC}} \right)$$

$$P = E \delta_c \left(\frac{L_{AB}}{A_{AB}} + \frac{L_{BC}}{A_{BC}} \right)^{-1} = (73 \times 10^9) (4 \times 10^{-3}) \left(\frac{1,2}{706,86 \times 10^{-6}} + \frac{0,8}{314,16 \times 10^{-6}} \right)^{-1}$$
$$\approx 68,8 \times 10^3 \text{ N}$$

Smaller value is chosen \Rightarrow

$$P = 50,3 \times 10^3 \text{ N} = 50,3 \text{ kN}$$

$$2) P = 75 \text{ kN} = 75 \times 10^3 \text{ N}$$

$$A = \frac{\pi}{4} d^2 = \frac{\pi}{4} (0,07)^2 = 380,13 \times 10^{-6} \text{ m}^2$$

$$\sigma = \frac{P}{A} = \frac{75 \times 10^3}{380,13 \times 10^{-6}} = 197301 \times 10^6 \text{ Pa}$$

$$\varepsilon_x = \frac{\sigma}{E} = \frac{197,301 \times 10^6}{200 \times 10^9} = 986,51 \times 10^{-6}$$

$$a) \delta_x = L \varepsilon_x = (200 \text{ mm}) (986,51 \times 10^{-6}) \Rightarrow \boxed{\delta_x = 0,1973 \text{ mm}}$$

$$b) \varepsilon_y = -\nu \varepsilon_x = -(0,3)(986,51 \times 10^{-6}) = -295,95 \times 10^{-6}$$

$$\delta_y = L \varepsilon_y = (22 \text{ mm}) (-295,95 \times 10^{-6}) \Rightarrow \boxed{\delta_y = -0,00651 \text{ mm}}$$