College of Engineering & Technology

Department: Mechanical Engineering | Marks: 15
Lecturer: Dr. Rola Afify | Time: 11.00 - 12.00
Course Code: ME356 | Date: 11/11/2015

Name: Model Answer R.N.:

Answer the following questions:

Question one (6 marks)

A shaft 50 mm diameter and 0.7 m long is subjected to a torque of 1200 N.m. Calculate the shear stress and the angle of twist. Take G = 90 GPa.
(Hint: $\frac{T}{J}=\frac{G\theta}{L}=\frac{\tau}{r}$)

$d = 50\ mm$

$\ell = 0.7\ m$

$T = 1200\ N.m$

$\tau = ??$

$\theta = ??$

$G_1 = 90\ GPa$

$$\tau = \frac{Tr}{J}$$

$$= \frac{1200 * 10^3 * 25}{\frac{\pi}{32}(50)^4}$$

$$= 48.89\ MPa$$

$$\theta = \frac{TL}{GJ}$$

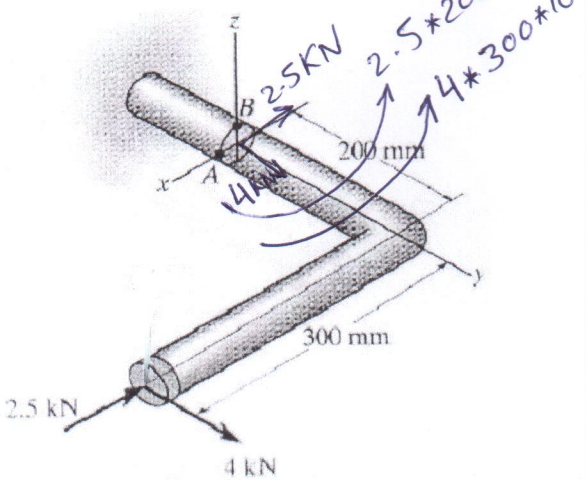
$$= \frac{1200 * 10^3 * 0.7 * 10^3}{90 * 10^3 * \frac{\pi}{32}(50)^4}$$

$$= 0.01521\ rad.$$

$$= 0.87^\circ$$

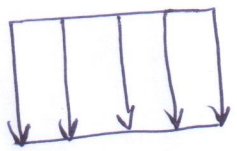
Question two (9 marks)

The 50 mm diameter rod, shown in figure, is subjected to the loads shown. Determine the maximum stress at the surface containing A and B.

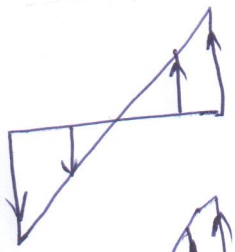


Good Luck 1/1

Dr. Rola Afify



$$\sigma_t = \frac{F}{A} = \frac{4*10^3}{\frac{\pi}{4}(50)^2} = 2.037 \text{ MPa}$$



$$\sigma_{b1} = \frac{My}{I} = \frac{2.5*10^3*200*25}{\frac{\pi}{64}(50)^4} = 40.74 \text{ MPa}$$

$$\sigma_{b2} = \frac{My}{I} = \frac{4*10^3*300*25}{\frac{\pi}{64}(50)^4} = 97.785 \text{ MPa}$$

all the stresses from the same Kinds

$$\sigma_{max.} = \sigma_t + \sigma_{b1} + \sigma_{b2}$$

$$= 2.037 + 40.74 + 97.785$$

$$= 140.562 \text{ MPa}$$