College of Engineering & Technology

Department: Mechanical Engineering | Marks: 15
Lecturer: Dr. Rola Afify | Time: 3.00 - 4.00
Course Code: ME356 | Date: 11/11/2015

Name: Model. Answer R.N.:

Answer the following questions:

Question one (6 marks)

A shaft 40 mm diameter is made from steel and the maximum allowable shear stress for the material is 50 MPa. Calculate the maximum torque that can be safely transmitted by the shaft. Take G = 90 GPa.

$d = 40\,mm$

$\tau_{max\,all} = 50\,MPa$

$T_{max} = ??$

soln

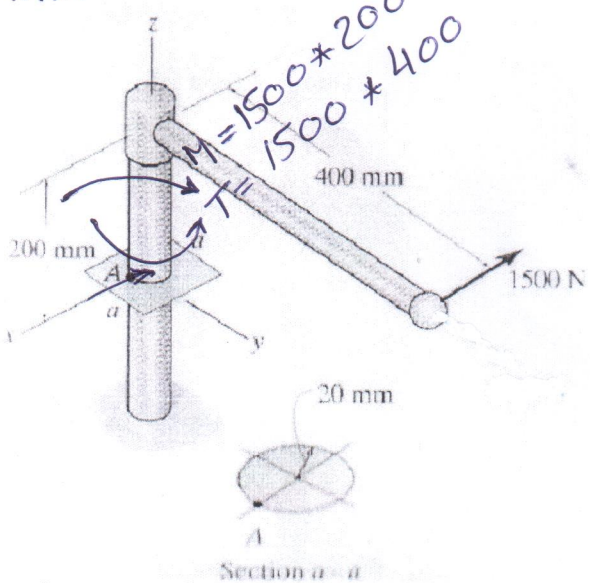
$$\tau = \frac{Tr}{J} = \frac{T_{max} * 20}{\frac{\pi}{32}(40)^4} = \tau_{max\,all}$$

$$50 = \frac{20\,T_{max}}{251327.4}$$

$$T_{max} = 628318.53\ N.mm$$

$$= 628.3\ N.m$$

$$= 200\pi\ N.m$$



Question two (9 marks)

Determine the maximum stresses at section a-a shown in Figure.

Good Luck 1/1

Dr. Rola Afify

Torsion $\tau = \frac{Tr}{J} = \frac{1500 * 400 * 20}{\frac{\pi}{32}(40)^4}$

$= 47.75$ MPa

Bending $\sigma_b = \frac{My}{I} = \frac{1500 * 200 * 20}{\frac{\pi}{64}(40)^4}$

$= 47.75$ MPa

The stresses are from different kinds

$$\sigma_{max} = \frac{\sigma_b}{2} + \sqrt{\left(\frac{\sigma_b}{2}\right)^2 + \tau^2}$$

$$= \frac{47.75}{2} + \sqrt{\left(\frac{47.75}{2}\right)^2 + (47.75)^2}$$

$= 77.26$ MPa

$$\tau_{max} = \sqrt{\left(\frac{\sigma_b}{2}\right)^2 + \tau^2}$$

$$= \sqrt{\left(\frac{47.75}{2}\right)^2 + (47.75)^2}$$

$= 53.386$ MPa