Name: ……

Serial number: …… ***Section:*** ……

Quistion: 1 ***(5 marks)***

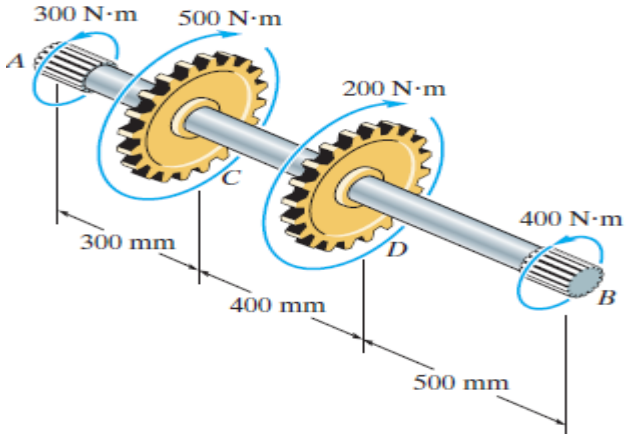
The shearing stress of a solid shaft is not to exceed 40 N/mm^2 when the torque transmitted is 20000 N.m. Determine the minimum diameter of the shaft.

$$c = \left(\frac{2T}{\pi \tau_{allow}}\right)^{1/3} = \left(\frac{2(20000 \times 10^3)\ N.mm}{\pi (40\ N/mm)}\right)^{1/3} = 68,2\ mm$$

$$d = 2c \Rightarrow d = 2(68,2) \Rightarrow \boxed{d = 136,4\ mm}$$

Quistion: 2 ***(7 marks)***

The 40 mm diameter A- 36 steel shaft is subjected to torques shown in figure. Determine the angle of twist of end B with respect to end A. (take G = 75 Gpa).

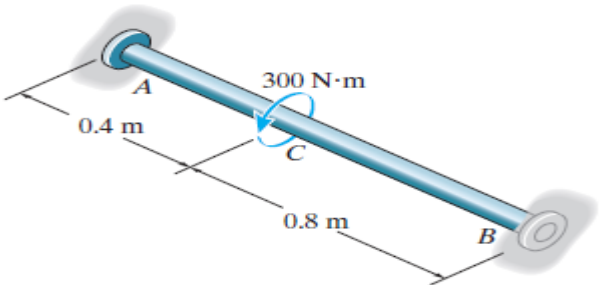


$$\phi_{B/A} = \Sigma \frac{TL}{JG} = \frac{-300(0.3)}{JG} + \frac{200(0.4)}{JG} + \frac{400(0.5)}{JG} = \frac{190}{JG} = \frac{190}{\frac{\pi}{2}(0.02^4)(75)(10^9)}$$

$$= 0.01008 \text{ rad} = 0.578°$$

Quistion 3 ***(8 marks)***

*Find the torque reaction at ends **A** and **B**, for**50 mm** diameter steel shaft loaded as shown in figure.*



$$T_A + T_B - 300 = 0$$

$$\phi_{C/A} = \phi_{C/B}$$

$$\frac{T_A(0.4)}{JG} = \frac{T_B(0.8)}{JG}$$

$$T_A = 2.00T_B$$

$$T_A = 200\ \text{N} \cdot \text{m} \qquad T_B = 100\ \text{N} \cdot \text{m}$$