

Philadelphia University
Faculty of Engineering
Dep. Of Mechanical Engineering
Quiz:2 .A, 2^d sem. 2015
Solid Mech.

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Find the diameter of the solid circular shaft used to transmit 300 kW power at 100 r.p.m. if the shear stress 80 N/mm²

$$P = 300 \times 10^3 \text{ W} \quad \tau = 80 \text{ N/mm}^2$$
$$\omega = 100 \text{ r.p.m} \quad d = ??$$

$$P = \omega T = \frac{2\pi\omega}{60} * T \Rightarrow P = \frac{2\pi\omega}{60} * T$$
$$300 \times 10^3 = \frac{2\pi \cdot 100}{60} T$$

$$T = 286478 \text{ N.m}$$

$$c = \left(\frac{2T}{\pi \tau_{\text{allow}}} \right)^{1/3} = \left(\frac{2(286478)}{\pi * 80} \right)^{1/3} \Rightarrow c = 60.9 \text{ mm}$$
$$d = 121.8 \text{ mm} \Rightarrow d = 122 \text{ mm}$$