

**Philadelphia University**  
**Faculty of Engineering**  
**Dep. Of Mechanical Engineering**  
**Quiz:1 .B,2<sup>d</sup>sem. 2015**  
**Solid Mech.**

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Find the suitable diameter for the solid steel shaft used to transmit 75 kW  
at 200 r.p.m. take allowable shear stress 70 N/mm.

$$P = 75 \times 10^3 \text{ W} ; \omega = 200 \text{ r.p.m} ; \tau_{\text{all}} = 70 \text{ N/mm}^2$$

$$P = \frac{2\pi \omega}{60} * T$$

$$75 \times 10^3 = \frac{2\pi}{60} (200)(T) \Rightarrow T = 3580980 \text{ N}\cdot\text{mm}$$

$$C = \left( \frac{2T}{\pi \tau_{\text{all}}} \right)^{1/3} = \left( \frac{2(3580980)}{\pi * 70} \right)^{1/3} \Rightarrow C = 31,93$$

$$d = 63,86 \text{ mm} \Rightarrow d = 64 \text{ mm}$$