

Torsion in Shafts. Question 5-37 Solution

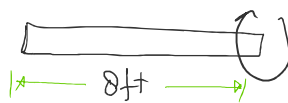
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Given Data :

$$N = 1500 \text{ RPM}; \text{ Power} = 1800 \text{ hp}$$



$$d = 4 \text{ ft} \Rightarrow R = \frac{d}{2} = 2 \text{ ft}$$

To find :- τ_{max}

We know !

$$\frac{\tau_{max}}{R} = \frac{T}{J}$$

$$\Rightarrow \tau_{max} = \frac{J}{R} \times T$$

$$J = \frac{\pi}{2} (2)^4 = 8\pi$$

$$R = 2 \text{ ft}$$

$$T = \frac{\text{Power}}{\omega}$$

$$\text{Power} = 1800 \text{ hp} \times \frac{550 \text{ ft} \cdot \text{lb/s}}{1 \text{ hp}} = 9.9 \times 10^5 \text{ ft} \cdot \text{lb/s}$$

$$\omega = 2\pi N = 2\pi \times 1500/60 = 50\pi \text{ rad/s}$$

$$[\because \text{RPM}/60 = \text{Rev/s}]$$

$$\Rightarrow T = \frac{9.9 \times 10^5}{50\pi} = 6302.54 \text{ lb} \cdot \text{ft}$$

$$\tau_{max} = \frac{8\pi}{2} \times 6302.54 = 79200 \text{ lb/ft}^2$$

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