

Qu. 5

$$\theta = \frac{TL}{GJ}$$

$$J = \frac{\pi}{32} (D^4 - d^4)$$

$$= \frac{\pi}{32} (25^4 - 19^4) \text{ mm}^4$$

$$= \underline{\underline{25560 \text{ mm}^4}}$$

Alloy shaft $\theta = \frac{30 \times 0.4}{27 \times 10^9 \times 25560 \times (10^{-3})^4} = 0.0174 \text{ rad}$
 $= 1^\circ$
 $=$

Steel shaft $\theta = \frac{30 \times 0.4}{80 \times 10^9 \times 25560 \times (10^{-3})^4} = 0.0059 \text{ rad}$
 $= \underline{\underline{0.34^\circ}}$

\therefore only the steel shaft will do.