

## Problem Session 9—Shaft Design

Design a shaft to support the attachments shown below with a minimum design factor of safety of 2.5

The shaft must transmit 2 hp at 1725 RPM. Torque and force on the gear are constant. You may assume that there are no axial loads and that the material selected will be steel with the following properties:

$$\begin{aligned} S_{ut} &= 65 \text{ ksi} \\ S_y &= 40 \text{ ksi} \\ E &= 30 \text{ E6 lb/sq. in} \end{aligned}$$

Theoretical stress concentration factors are:

$$\begin{aligned} K_t &= 3.5 \text{ for step radii in bending} \\ K_t &= 2 \text{ for step radii in torsion} \\ K_t &= 4 \text{ for all keyways} \end{aligned}$$

**Note:**  $F_1 = 5 F_2$

