39. A torque $T \sim N(2000,\ 200^2)$ N is applied to a shaft with a round cross section. The allowable shear stress is $\tau_a \sim N(30, 3^2)$ MPa. If the maximum probability of failure is designed to be $p_f = 10^{-5}$, determine the minimum diameter using the First Order Second Moment Method.

Answer: $d = 100$ mm