8. A shaft has a circular cross section with a diameter of $d \sim N(50, 0.5^2)$ mm. It is designed to transmit a power $H = 10$ kW at 3000 rpm. If the allowable shear stress of the shaft is $\tau_a \sim N(120, 12^2)$ MPa, estimate the probability of failure using the First Order Second Moment Method.

Answer: $p_f = 2.80(10^{-4})$