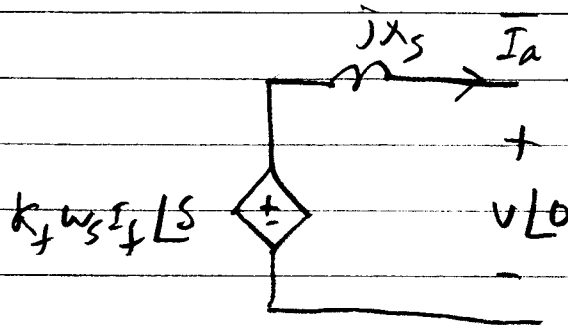


ECE 333 Solution Exam II SP98

①



$$120 = k_f w_s 3 \quad k_f w_s = 40 \Omega$$

$$40 \times 110 = jX_s \times 5 \angle \theta + 120 \angle 0$$

$$5X_s \angle 90 + \theta = -80 \angle 0$$

$$\theta = 90^\circ, \quad X_s = 16 \Omega$$

$$P_{max} = \frac{3 \times 40 \times 1 \times 120}{16} = \boxed{900 \text{ W}}$$

②

(a)

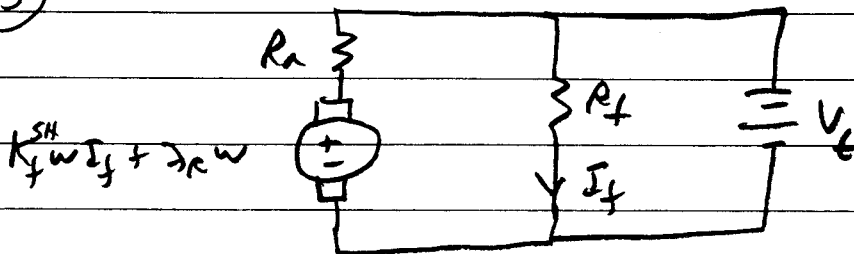
$$2500 = \frac{3 \times 120 \times E}{12} \sin(30^\circ) \quad E = 16.7 \text{ V}$$

$$Q_{IN} = \frac{3 \times 120^2}{12} - \frac{3 \times 120 \times 16.7}{12} \cos 30^\circ = \boxed{-739 \text{ vars}}$$

(b)

Overexcited

③



$$k_f^{SH} \times 1100 \times \frac{2\pi}{60} \times \frac{220}{100} + 8 \approx 220$$

$$k_f^{SH} = 0.836 \frac{\Omega \text{ sec}}{\text{mA}}$$

$$0.836 \times 800 \times \frac{2\pi}{60} \times \frac{220}{R_f} + 8 \times \frac{800}{1100} \approx 220$$

$$\boxed{R_f = 72 \Omega}$$

$$I_a = 10 + \frac{220}{72} = 13.05$$

$$T = 220 \times 13.05 / 800 \left(\frac{2\pi}{60} \right)$$

$$= \boxed{34 \text{ Nm}}$$

(4)

$$230 = K_f^{SH} \times 1150 \frac{2\pi}{60} \times 1.5$$

$$K_f^{SH} = 1.27 \frac{\Omega \text{ sec}}{\text{mA}}$$

$$R_f = \frac{230V}{1.5A} = 153 \Omega \quad I_f = 1.5A$$

(a)

$$230 = (5 - 1.5) \times 4 + E_a \quad E_a = 216V$$

$$1.27 \times \omega \times 1.5 = 216$$

$$\omega = 113.4 \frac{\text{mA}}{\text{sec}} \Rightarrow \boxed{1082 \text{ RPM}}$$

(b)

$$1.27 \times 1300 \frac{2\pi}{60} I_f = 230$$

$$I_f = 1.33A \quad R_f = \frac{230}{1.33} = 173 \Omega$$

$$\text{Add } \boxed{20 \Omega}$$