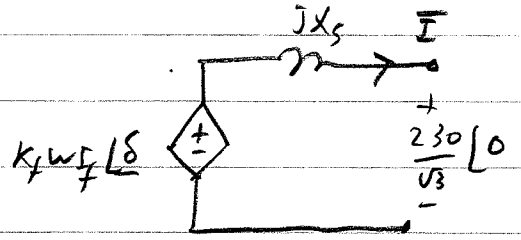
ECE 333

Exam II Solution Spring 2000

#1



$K_f w = \frac{230/\sqrt{3}}{3} = 44.3\ \Omega$

$44.3 \times 2 = X_s \times 8 \qquad X_s = 11\ \Omega$

(a) $3000 = \sqrt{3} \times 230 \times |\bar{I}| \times 1 \qquad |\bar{I}| = 7.53$

$44.3 I_f \angle\delta = j11 \times 7.53 \angle 0 + \frac{230}{\sqrt{3}} \angle 0 \qquad \underline{I_f = 3.5A} \qquad \delta = 32^\circ$

(b) $T = \frac{3000}{1800 \times \frac{2\pi}{60}} = \underline{15.9\ Nm}$

#2

$40 X_s = 277 \qquad X_s = 6.9\ \Omega$

$K_f w \times 4 = 277 \qquad K_f w = 69.25\ \Omega$

(a) $40{,}000 = \frac{3 \times 277 \times 69.25 I_f \sin(-\delta)}{6.9} \qquad I_f \sin(-\delta) = 4.8$

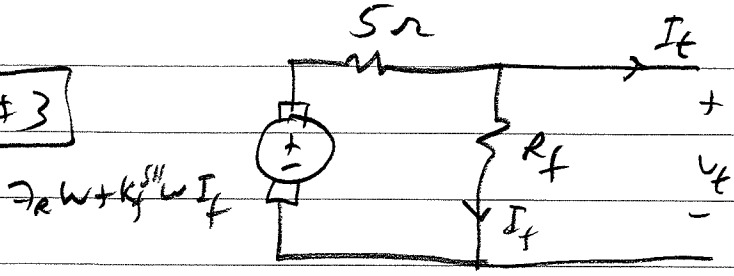
$0 = \frac{3 \times 277^2}{6.9} - \frac{3 \times 277 \times 69.25 I_f \cos(-\delta)}{6.9} \qquad I_f \cos(-\delta) = 4$

$\tan(-\delta) = 1.19 \qquad \underline{I_f = 6.25A}$

$-\delta = 50^\circ$

(b) $P_{max} = \frac{3 \times 277 \times 69.25 \times 4}{6.9} = \underline{33{,}360\ w}$

#3



$\omega_R \omega = 10V$

$10 + k_f^{SH} \omega \times 1 = 5 \times 1 + 120$

$k_f^{SH} \omega = 115$

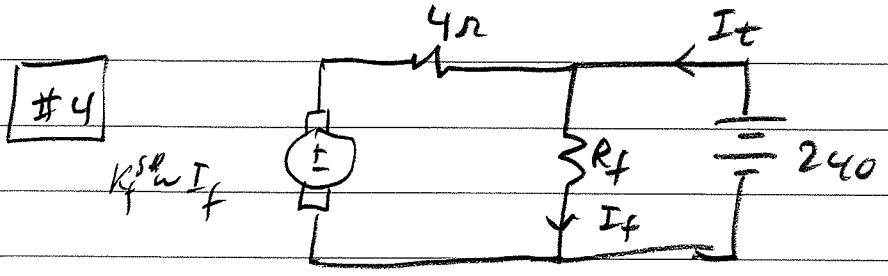
(a) $10 \frac{1050}{1200} + 115 \frac{1050}{1200} I_f = 5 I_a + 120$

$I_t = \frac{120}{30} = 4A$ $\quad 8.75 + 100.6 \frac{120}{R} = 5\left(4 + \frac{120}{R}\right) + 120$

$R = 87\Omega$

(b) Lower due to saturation

#4



(a) $k_f^{SH} \times 1257 \frac{2\pi}{60} \times \frac{240}{80} = 240$ $\quad k_f^{SH} = 0.61\ H$

$0.61 \omega \frac{240}{100} = 240$ $\quad \omega = 164\ r/s \rightarrow 1566\ RPM$

(b) $\frac{0.61 \omega \frac{240}{100} I_a}{\omega} = 20$ $\quad I_a = 13.7A$

$0.61 \omega \times \frac{240}{100} = -4 \times 13.7 + 240$ $\quad \omega = 127\ r/s$

$\downarrow$

$RPM = 1212$