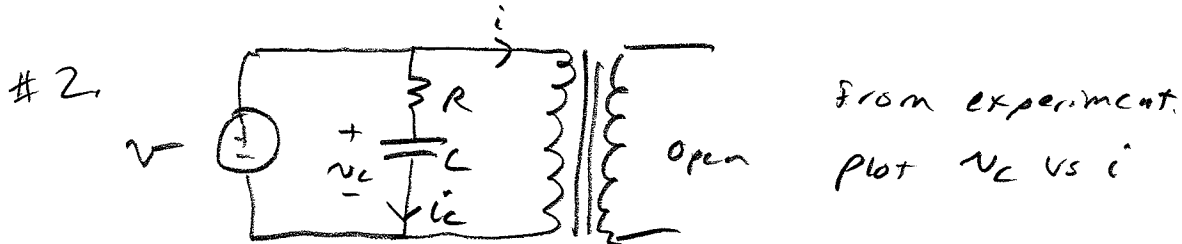


ECE 431 Exam I Solution Spring 2006

- #1. (a) By inspection, min current is unity power factor, so $Q = 800$
 (b) $P = \sqrt{3} \times 208 \times 2.92 = 1052 \text{ W}$
 (c) left of minimum (because $3 > 2.95$), so too low



(a) $R \gg \frac{1}{\omega C}$ so $i_c R \approx v = \frac{d\lambda}{dt}$ and $i_c = C \frac{dv_c}{dt}$

$RC \frac{dv_c}{dt} \approx \frac{d\lambda}{dt}$ so $\lambda = RC v_c$

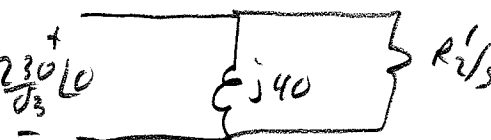
(b) $0.57 \times 750 = 428$

(c) $I_{sc} = \frac{100}{5} \times \frac{25k}{240} = 2083 \text{ A}$

#3. $S = 5 \times 24 = 120 \text{ steps/Rev}$ $360^\circ/\text{Rev}$ so $3^\circ/\text{step}$

(a) 27 steps, 270 steps/sec , $\frac{270}{120} \frac{\text{Rev}}{\text{sec}} \frac{60 \text{ sec}}{\text{min}} = 135 \text{ RPM}$

(b) 45 steps, 150 steps/sec , $\frac{150}{120} \times 60 = 75 \text{ RPM}$

#4.  $T = \frac{P_{\text{TOT}}}{\omega_s} = 13 = \frac{P_{\text{TOT}}}{2\pi 60/3}$ $P_{\text{TOT}} = 1634 \text{ W}$

(a) $1634 = \frac{3 \times (230/\sqrt{3})^2}{R_2'/s}$ $R_2'/s = 32 \Omega$ $\bar{I} = \frac{230/\sqrt{3}}{j40} + \frac{230/\sqrt{3}}{32} = -j3.3 + 4.15$

$|\bar{I}| = 5.3$ (b) $\angle \bar{I} = -38^\circ$ $P_f = 0.78 \text{ lag}$

#5. (a) $S = \frac{1200 - 1080}{1200} = 0.1$ $f_r = 1 \times 60 = 6 \text{ Hz}$

(b) Estimate $P_{\text{TOT}} = 746 \times 2 = 1492$ $P_{\text{TOT}} = \frac{1492}{1-S} = 1657 = \frac{3V^2}{R_2'/s}$ $R_2' = 2.6 \Omega$

OR Estimate $S[0] = -j3 + \frac{120}{R_2'/s} = \frac{12}{R_2'} - j3$ $R_2' = 3 \Omega$