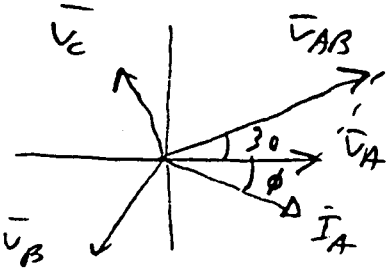
ECE 333

Exam #1 Solution — Spring 1994

#1 $|\bar{S}_{3\phi}| = \sqrt{3} \times 230 \times 15 = 5975$ VA



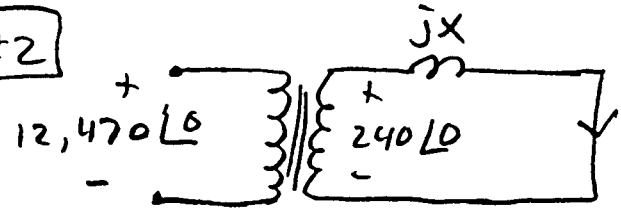
$P_{AB} = 230 \times 15 \times \cos(\measuredangle \bar{V}_{AB} - \measuredangle \bar{I}_A)$

$400 = 230 \times 15 \cos(30° - (-\phi))$

$\cos(30° + \phi) = 0.1159 \qquad 30° + \phi = \pm 83° \qquad \phi = +53°$

$\bar{S} = 5975 \angle +53° = \underline{3567 + j4772}$

#2



$X = \frac{5}{100} \times \frac{240}{100K/240}$

$= .0288\ \Omega$

$|\bar{I}_{sc}| = \frac{240}{.0288} = \underline{8,333\ A}$ (20 times rated)

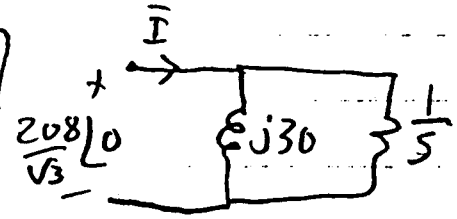
#3 a) $1800 = \frac{120 \times 60}{P} \qquad \underline{P = 4}$

b) $|\bar{S}|_{1\phi} = \frac{230}{\sqrt{3}} \times 4 = 531$ VA $\qquad Q = \sqrt{531^2 - 50^2} = 529$ vars

$Q_{1\phi} = \frac{(230/\sqrt{3})^2}{(1/2\pi 60 C)} \qquad 2\pi 60 C \times \frac{230^2}{3}{}^{1\phi} = 529 \qquad \underline{C = 79.6\ \mu F}$

Y

#4



$T_{TO} = \frac{3\left(\frac{208}{\sqrt{3}}\right)^2 s}{2\pi 60\left(\frac{1}{3}\right)} = 15$ (Shaft)

$s = 0.0436$

(a) $f_R = .0436 \times 60 = \underline{2.6\ Hz}$

(b) $\bar{I} = \frac{208/\sqrt{3}}{j30} + \frac{208/\sqrt{3}}{1/.0436} = -j4 + 5.2, \qquad \underline{|\bar{I}| = 6.6A}$

(c) $\omega = \frac{2\pi 60}{3}(1 - .0436) = 120.2$ r/s $\qquad P = 15 \times 120.2 = 1803$ W

$HP = \underline{2.4}$