Name: _____ (please print)

Signature: _____

ECE 2300 – Quiz #7
December 6, 2012

Keep this quiz closed and face up until you are told to begin.

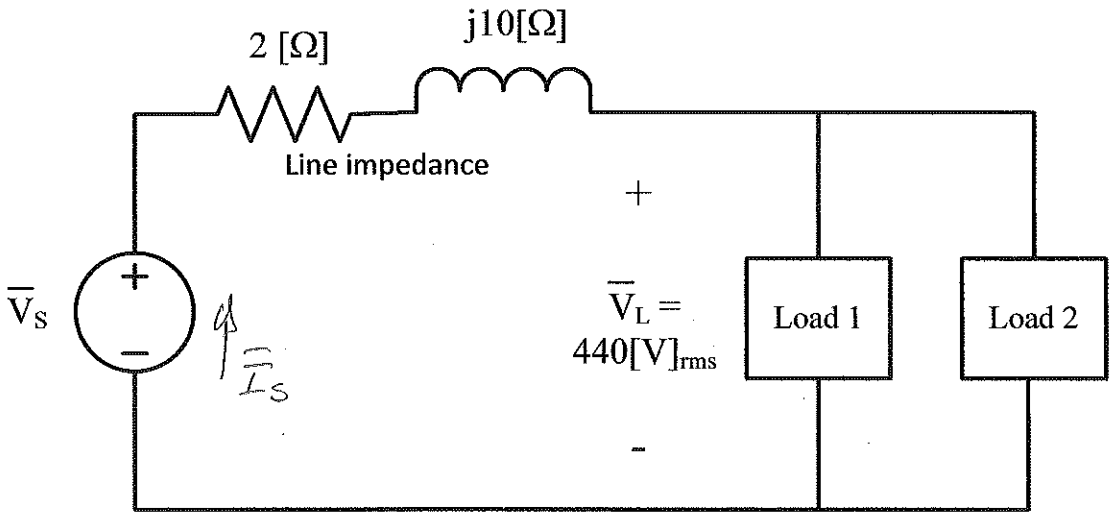
1. This quiz is closed book, closed notes. You may use one 8.5" x 11" crib sheet, or its equivalent.
2. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit.
3. Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.
4. Do not use red ink. Do not use red pencil.
5. You will have 30 minutes to work on this quiz.

_____/20

In the circuit below, the line impedance is being modeled by the resistor and the inductor, indicated. Load 1 is absorbing 12500 [VA] at a power factor of 0.6. Load 2 is absorbing 8500 [VA] at a power factor of 0.7.

→ leading → lagging

a) Find $\overline{V}_S$.
b) Find the complex power S dissipated in the line.



This problem is much like the one done in class: we find S for each load, which gives the current in each load. From that we find $\overline{I}_S$. Alternatively, we can find the total load power $S_1 + S_2$, which gives $\overline{I}_S$ directly.

$S_1 = 12500(0.6) + j\,12500(0.8)$ ← pf = 0.8 because $pf^2 + pf^2 = 1$ and pf = 0.6

↑ lagging

$= 7500 + j\,10000$ [VA]

$S_2 = 8500(0.7) - j\,8500(0.714)$

↓ leading

$pf^2 = 1 - 0.7^2 = 0.51$

$\Rightarrow pf = 0.714$

$= 5950 - j\,6070$ [VA]

$\therefore \quad S_{total} = S_1 + S_2 = 13450 + j\,3930$ [VA]

$= \overline{V}_L \cdot \overline{I}_S^*$

Room for extra work

$$\therefore \quad \bar{I}_c^{\,*} = \frac{13450 + j\,3930}{440} = 30.57 + j\,8.932 \ [A]_{rms}$$

$$\Rightarrow \quad \bar{I}_s = 30.57 - j\,8.932 \ [A]_{rms}$$
$$= 31.85 \angle -16.29^\circ \ [A]_{rms}$$

a) Now $\bar{V}_s = \bar{I}_s (2 + j10) + \bar{V}_L$

$$\Rightarrow \quad \bar{V}_s = (150.5 + j\,287.8) + 440$$

$$\bar{V}_s = 590.5 + j\,287.8 \ [V]_{rms}$$
$$= 656.9 \angle 25.99 \ [V]_{rms}$$

b) $S_{Line} = |\bar{I}_s|^2 (2 + j10)$

$$= 2029 + j\,10,144 \ [VA]$$
$$= 10,345 \angle 78.2^\circ \ [VA]$$