## Electrical Engineering

## HW 6– Chapter 7

# <1>

**7.12** A network is supplied by a 120 V rms, 60-Hz voltage source. An ammeter and a wattmeter indicat that 12 A rms is drawn from the source and 800 W a consumed by the network. Determine:

a. The network power factor.

b. The network phase angle.

c. The network impedance.

d. The equivalent resistance and reactance of the network.

# <2>

**7.13** For the following numeric values, determine the average power, $P$, the reactive power, $Q$, and the complex power, $S$, of the circuit shown in Figure P7.13. *Note*: Phasor quantities are rms.

a. $v_S(t) = 650\cos(377t)$ V
$i_o(t) = 20\cos(377t - 10°)$ A

b. $\tilde{\mathbf{V}}_S = 460\angle 0°$ V rms
$\tilde{\mathbf{I}}_o = 14.14\angle -45°$ A rms

c. $\tilde{\mathbf{V}}_S = 100\angle 0°$ V rms
$\tilde{\mathbf{I}}_o = 8.6\angle -86°$ A rms

d. $\tilde{\mathbf{V}}_S = 208\angle -30°$ V rms
$\tilde{\mathbf{I}}_o = 2.3\angle -63°$ A rms

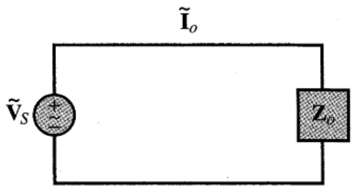



**Figure P7.13**

Hint) a. is amplitude, b,c,d are in rms value.

# <3>

**7.16** For the circuit shown in Figure P7.16, assume $C = 265\ \mu$F, $L = 25.55$ mH, and $R = 10\ \Omega$. Find the instantaneous real and reactive power if:

a. $v_S(t) = 120\cos(377t)$ V (i.e., the frequency is 60 Hz)

b. $v_S(t) = 650\cos(314t)$ V (i.e., the frequency is 50 Hz)

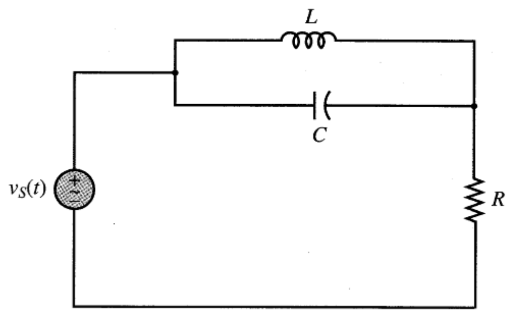



**Figure P7.16**

# <4>

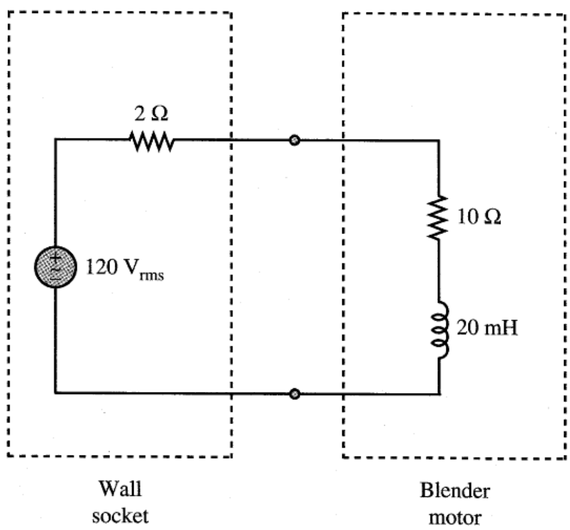
**7.21** The motor inside a blender can be modeled as a resistance in series with an inductance, as shown in Figure P7.21. The wall socket source is modeled as an ideal 120 V rms voltage source in series with a 2-Ω output resistance. Assume the source frequency is $\omega = 377$ rad/s.

a. What is the power factor of the motor?

b. What is the power factor seen by the voltage source?

c. What is the average power, $P_{AV}$, consumed by the motor?

d. What value of capacitor when placed in parallel with the motor will change the power factor seen by the voltage source to 0.9 lagging?




**Hint) problem d, find the capacitor value, which makes the pf to be 0.9.**

## <5>

**7.26** Find the real and reactive power supplied by the voltage source shown in Figure P7.26 for $\omega = 5$ rad/s and $\omega = 15$ rad/s. Let $v_S = 15\cos(\omega t)$ V, $R = 5\ \Omega$, $C = 0.1$ F, $L_1 = 1$ H, $L_2 = 2$ H.

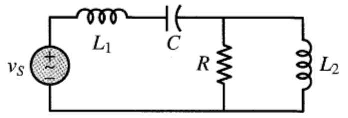



**Figure P7.26**

## <6>

**7.28** For the circuit shown in Figure P7.28, assume $f = 60$ Hz, $\tilde{\mathbf{V}}_S = 90\angle 0$ V rms, $R = 25\ \Omega$, $X_L = 70\ \Omega$, and $X_C = -8\ \Omega$. Calculate:

a. The capacitance $C$ and the inductance $L$.

b. The power factor seen by the voltage source.

c. The new capacitance required to correct that power factor to unity.

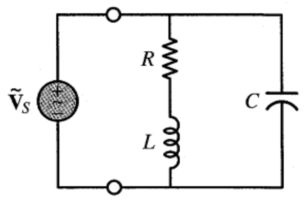



**Figure P7.28**

## <7>

**7.43** For the circuit shown in Figure P7.43, assume that $\tilde{V}_g = 80\angle 0$ V rms, $R_g = 2\ \Omega$, and $R_o = 12\ \Omega$. Assume an ideal transformer. Find:

a. The equivalent resistance seen by the voltage source.

b. The power $P_{\text{source}}$ supplied by the voltage source.

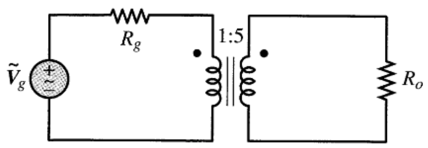



**Figure P7.43**

## <8>

**7.47** For Figure P7.47, assume the transformer is ideal. Find the step-down turns ratio $M = n$ that provides maximum power transfer to $R_o$. Let $R_{\text{in}} = 1{,}200\ \Omega$, $R_o = 100\ \Omega$, and $v_{\text{in}}(t) = V_{\text{pk}}\cos(\omega t)$.

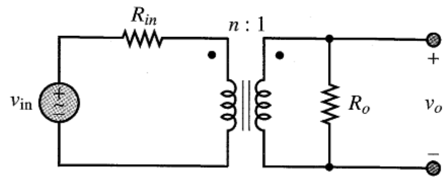



**Figure P7.47**

## <9>

**7.59** The phase currents in a four-wire wye-connected load, such as that shown in Figure 7.49, are:

$$\tilde{\mathbf{I}}_{an} = 22\angle 0 \text{ A rms} \quad \tilde{\mathbf{I}}_{bn} = 10\angle\frac{2\pi}{3} \text{ A rms} \quad \tilde{\mathbf{I}}_{cn} = 15\angle\frac{\pi}{4}$$

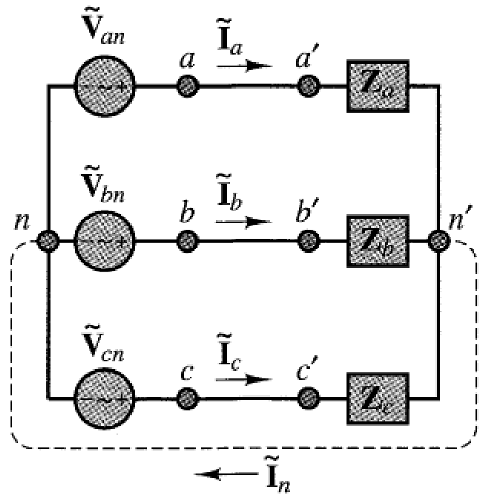



**Figure 7.49** Balanced three-phase AC circuit (redrawn)

<10>

**7.61** For the three-phase network shown in Figure P7.61, find the current in each wire and the real power consumed by the wye network. Let $\tilde{\mathbf{V}}_R = 110\angle 0$ V rms, $\tilde{\mathbf{V}}_W = 110\angle 2\pi/3$ V rms, and $\tilde{\mathbf{V}}_B = 110\angle 4\pi/3$ V rms. $R = 50\ \Omega$, $L = 120$ mH, $C = 133\ \mu$F, $f = 60$ Hz.

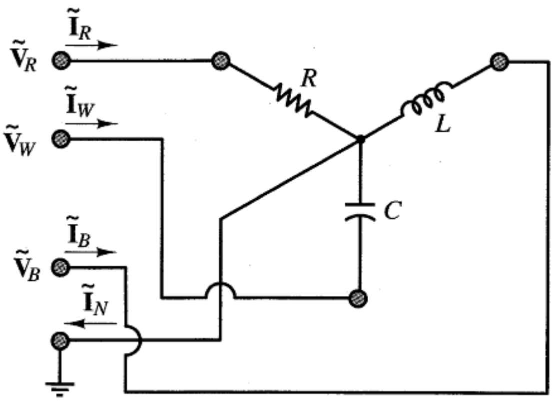



**Figure P7.61**