6.10 The circuit shown in Figure P6.10 is a second-order circuit because it has two reactive components (L and C). A complete solution will not be attempted. However, determine:

a. The behavior of the voltage frequency response at extremely high and low frequencies.

b. The output voltage $\mathbf{V}_o$ if the input voltage has a frequency where:

$$\mathbf{V}_i = 7.07\angle\frac{\pi}{4}\ \text{V} \qquad R_1 = 2.2\ \text{k}\Omega$$

$$R_2 = 3.8\ \text{k}\Omega \qquad X_c = 5\ \text{k}\Omega \qquad X_L = 1.25\ \text{k}\Omega$$

c. The output voltage if the frequency of the input voltage doubles so that

$$X_C = 2.5\ \text{k}\Omega \qquad X_L = 2.5\ \text{k}\Omega$$

d. The output voltage if the frequency of the input voltage again doubles so that

$$X_C = 1.25\ \text{k}\Omega \qquad X_L = 5\ \text{k}\Omega$$

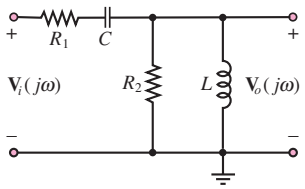

Figure P6.10

6.11 In the circuit shown in Figure P6.11, determine the frequency response function in the form

$$H_v(j\omega) = \frac{\mathbf{V}_o(j\omega)}{\mathbf{V}_i(j\omega)} = \frac{H_{vo}}{1 \pm jf(\omega)}$$

and plot $H_v(j\omega)$.

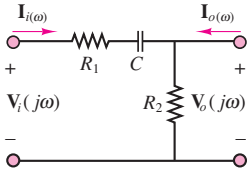

Figure P6.11

6.12 The circuit shown in Figure P6.12 has

$$R_1 = 100\ \Omega \qquad R_L = 100\ \Omega$$

$$R_2 = 50\ \Omega \qquad C = 80\ \text{nF}$$

Compute and plot the frequency response function.

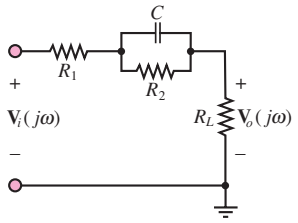

Figure P6.12

6.13

a. Determine the frequency response $\mathbf{V}_{\text{out}}(j\omega)/\mathbf{V}_{\text{in}}(j\omega)$ for the circuit of Figure P6.13.

b. Plot the magnitude and phase of the circuit for frequencies between 1 and 100 rad/s on graph paper, with a linear scale for frequency.

c. Repeat part b, using semilog paper. (Place the frequency on the logarithmic axis.)

d. Plot the magnitude response on semilog paper with magnitude in dB.

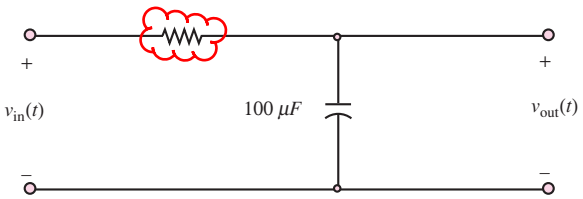

Figure P6.13

6.14 Consider the circuit shown in Figure P6.14.

a. Sketch the amplitude response of $Y = I/V_S$.

b. Sketch the amplitude response of V_1/V_S.

c. Sketch the amplitude response of V_2/V_S.

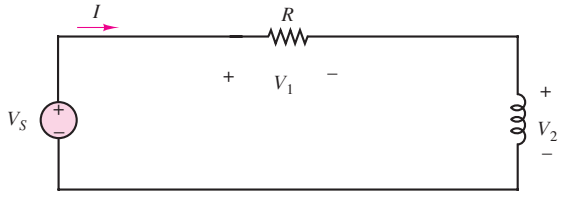

Figure P6.14

Section 6.2: Fourier Analysis

6.15 Use trigonometric identities to show that the equalities in equations 6.16 and 6.17 hold.

6.16 Derive a general expression for the Fourier series coefficients of the square wave of Figure 6.11(a) in the text.