Electrical Engineering

HW 5– Chapter 6

<1>

6.4 Repeat Problem 6.1 for the circuit of Figure P6.4. $R_1 = 300\,\Omega$, $R_2 = R_3 = 500\,\Omega$, $L = 4\,\text{H}$, $C_1 = 40\,\mu\text{F}$, $C_2 = 160\,\mu\text{F}$.

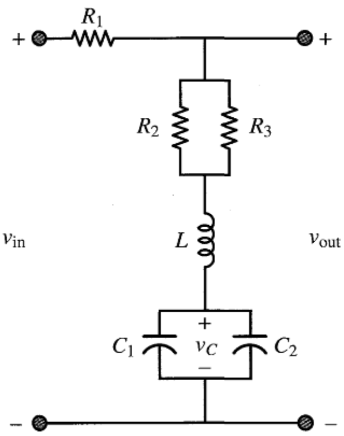


Figure P6.4

(Problems in 6.1)

a. Determine the frequency response

b. Plot the magnitude and phase of the circuit for frequencies between 10 and 10^7 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.)

<2>

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

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

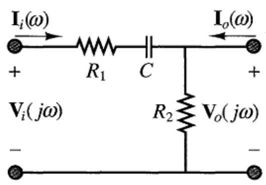


Figure P6.11

Hint: Calculate what it Hv0 and f(w).

<3>

6.12 The circuit shown in Figure P6.12 has

$R_1 = 100\,\Omega$ $\quad R_o = 100\,\Omega$

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

Determine the frequency response $\mathbf{V}_o(j\omega)/\mathbf{V}_{in}(j\omega)$.

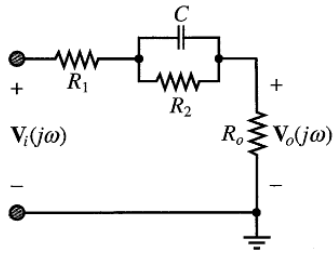


Figure P6.12

<4>

6.20 Compute the Fourier series expansion of the function shown in Figure P6.20, and express it in sine-cosine (a_n, b_n coefficients) form.

$$x(t) = \begin{cases} \sin\left(\frac{2\pi}{T}t\right) & 0 \le t < \frac{T}{2} \\ 0 & \frac{T}{2} \le t < T \end{cases}$$

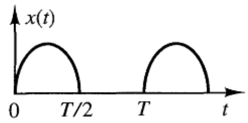


Figure P6.20

<5>

6.22 Write an expression for the signal shown in Figure P6.22 and derive its Fourier series.

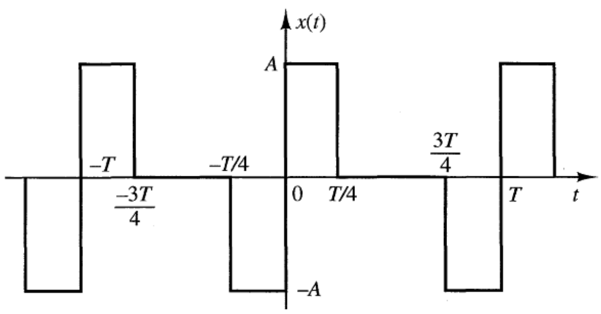


Figure P6.22

<6>

6.50 Consider the circuit shown in Figure P6.50. Determine the resonant frequency and the bandwidth for the circuit.

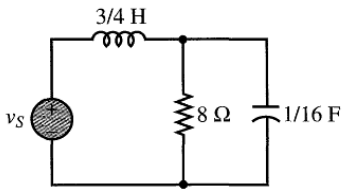


Figure P6.50

<7>

6.53 For the filter circuit shown in Figure P6.53:

a. Determine if this is a low-pass, high-pass, bandpass, or bandstop filter.

b. Determine the frequency response $\mathbf{V}_o(j\omega)/\mathbf{V}_i(j\omega)$ assuming $L = 10\,\text{mH}$, $C = 1\,\text{nF}$, $R_1 = 50\,\Omega$, $R_2 = 2.5\,\text{k}\Omega$

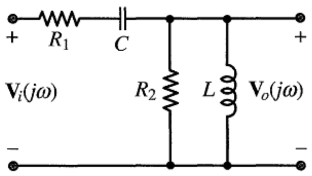
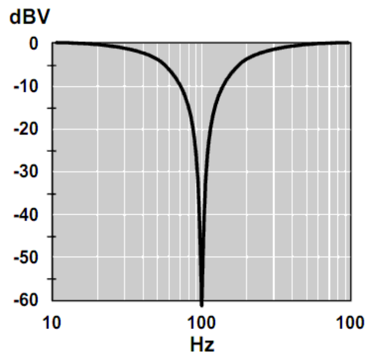


Figure P6.53

(Hint: We may not learn the bandstop(notch) filter. Its frequency response is similar to the following frequency response)



<8>

6.57 In the filter circuit shown in Figure P6.56:

$$R_S = 5\,\text{k}\Omega \qquad C = 0.5\,\text{nF}$$
$$R_o = 100\,\text{k}\Omega \qquad L = 1\,\text{mH}$$

Determine:

a. The voltage frequency response

$$\mathbf{H}_v(j\omega) = \frac{\mathbf{V}_o(j\omega)}{\mathbf{V}_i(j\omega)}$$

b. The resonant frequency.

c. The half-power frequencies.

d. The bandwidth and Q.

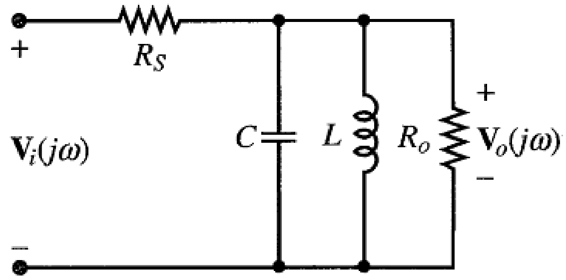


Figure P6.56

(Hint: Half-power frequency is the cut-off frequency. In this filter it may have more than one half-power frequency.)

<9>

6.65 Determine the frequency response $\mathbf{V}_{\text{out}}(\omega)/\mathbf{V}_S(\omega)$ for the network in Figure P6.65. Generate the Bode magnitude and phase plots when $R_S = R_o = 5\,\text{k}\Omega$, $L = 10\,\mu\text{H}$, and $C = 0.1\,\mu\text{F}$.

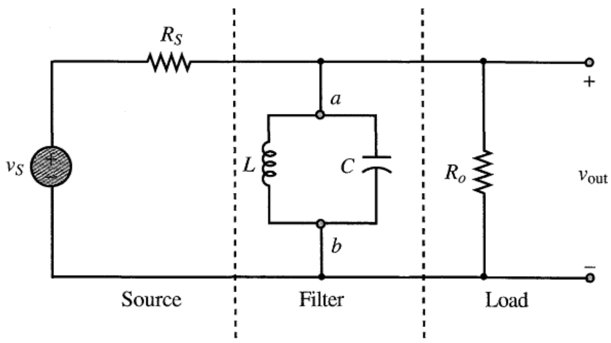


Figure P6.65

<10>

6.69 The circuit of Figure P6.69 is representative of an amplifier-speaker connection. The crossover filter allows low-frequency signals to pass to the woofer. The filter's topography is known as a π network.

a. Find the frequency response $\mathbf{V}_o(j\omega)/\mathbf{V}_S(j\omega)$.

b. If $C_1 = C_2 = C$, $R_S = R_o = 600\ \Omega$, and $1/\sqrt{LC} = R/L = 1/RC = 2{,}000\pi$, generate the Bode magnitude and phase plots in the range 100 Hz $\le f \le$ 10 kHz.