EE2210 Electric Circuits, Spring 2018
Practice problems (Lecture11-Lecture14)

1. Find the magnitude and phase of each of the following expression:

$$(8 + \mathrm{j}7)\left(5e^{j30^\circ}\right)\left(e^{-j39^\circ}\right)(0.3 - j0.1)$$

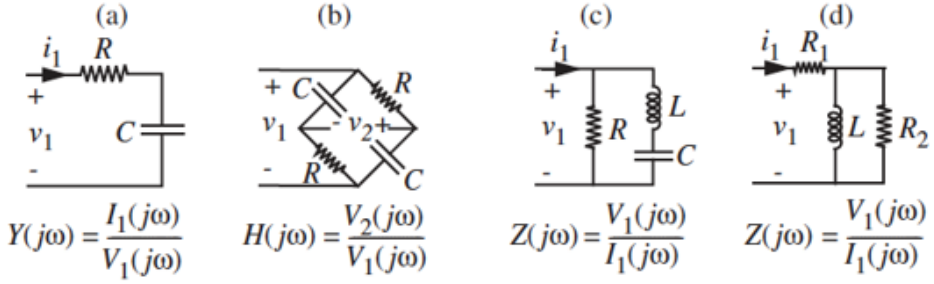
2. Find the real and imaginary parts of the following expressions:
(a)

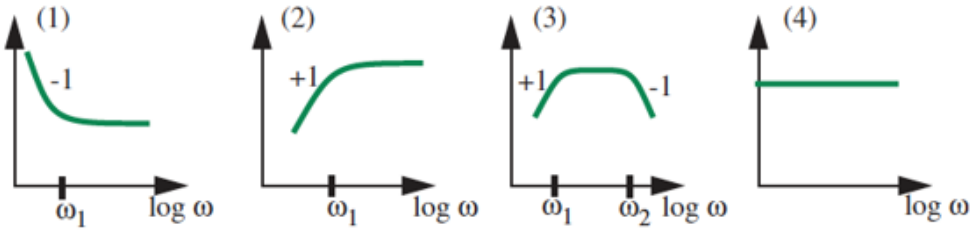
$$(3 + \mathrm{j}5)\left(4e^{j50^\circ}\right)\left(7e^{-j20^\circ}\right)$$

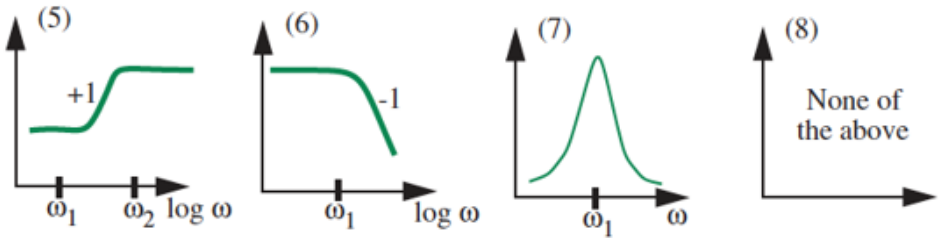
(b)

$$\left(10e^{j50^\circ}\right)\left(e^{j20^\circ}\right)$$

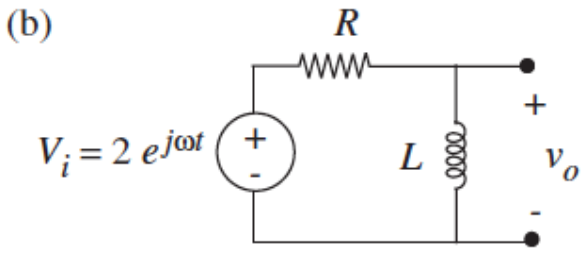
3. For each of the circuits shown in the following figures, select the magnitude of the frequency response for the system function (that is, impedance, admittance)



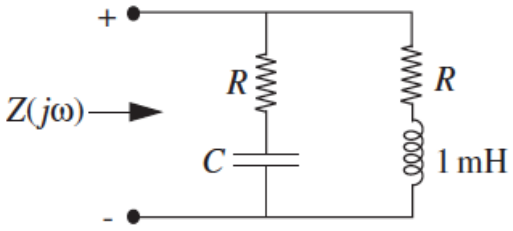




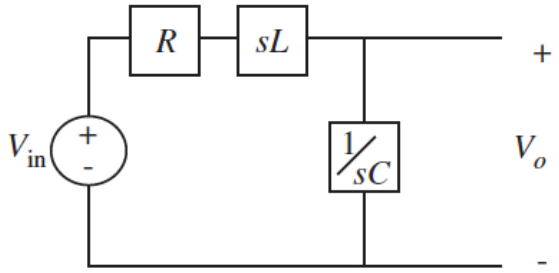
4. Write expressions for $H(j\omega) = V_o/V_i$, its magnitude $|H(j\omega)|$, and its phase angle $\angle H(j\omega)$, as a function of ω in the following figure.



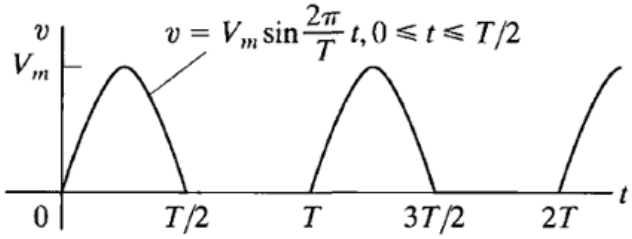
5. The impedance of the network shown in Figure is found to be 2 kΩ and is purely real all frequencies. The value of the inductor is 1 mH as shown. What are the values of R and C ?



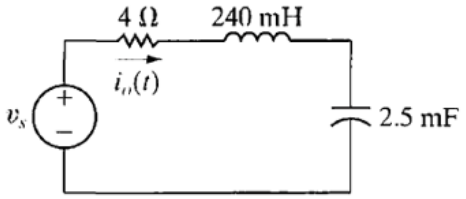
6. The circuit shown in Figure has an input voltage $v_{in1}(t) = V_1\cos(120\pi t)$, and L = 500 mH, C = 80 μF, and R = 50 Ω. Compute the transfer function $H(s) = V_o(s)/V_{in1}(s)$.



7. Find the rms value of the half-wave rectified sinusoidal voltage shown.



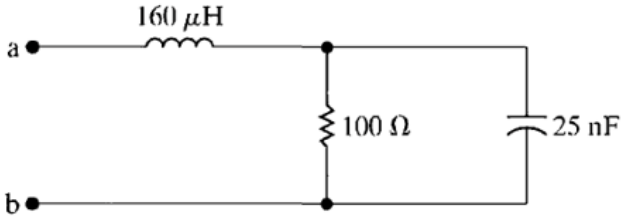
8. Find the steady-state expression for $i_0(t)$ in the circuit in the following figure if v_s = 100sin50t mV.



9.

(a) For the circuit shown in the figure below, find the frequency (in radians per second) at which the impedance Z_{ab} is purely resistive.

(b) Find the value of Z_{ab} at the frequency of (a).



10. A resistor denoted as R_L is connected in parallel with the capacitor in the circuit in the following Figure 14.7. The loaded low-pass filter circuit is shown in the following Figure 14.7.

a) Derive the expression for the voltage transfer function $\frac{V_O}{V_i}$.

b) At what frequency will the magnitude of $H(j\omega)$ be maximum?

c) What is the maximum value of the magnitude of $H(j\omega)$?

d) At what frequency will the magnitude of $H(j\omega)$ equal its maximum value divided by $\sqrt{2}$?

e) Assume a resistance of 10 kΩ is added in parallel with the 100 nF capacitor in the circuit in Fig 14.4.

Find $\omega_c, H(j0), H(j\omega_c), H(j0.1\omega_c), and\ H(j10\omega_c)$.

Figure P14.7

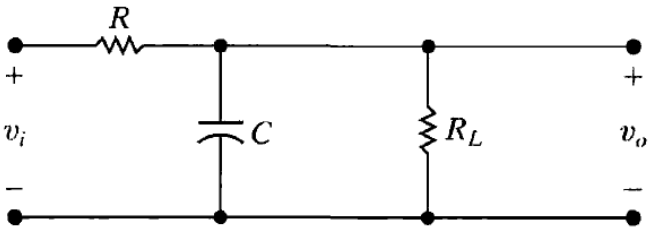


Figure P14.4