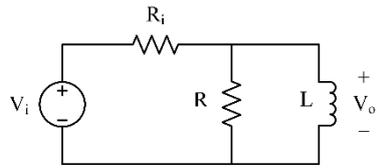
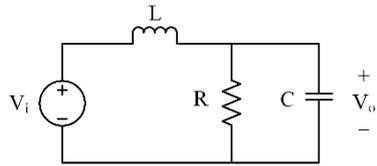


## Analog Electronics Homework 1

1. Find  $H(j\omega) = V_o/V_i$  for each circuit given in Fig. 1.



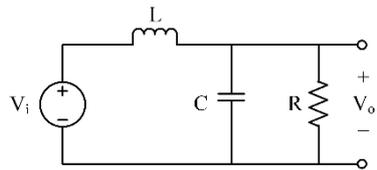
(a)



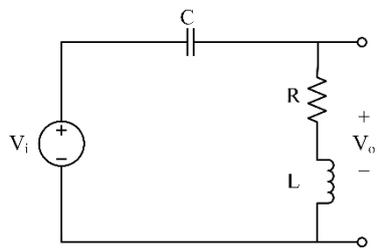
(b)

Figure 1

2. Find  $H(j\omega) = V_o/V_i$  for each circuit given in Fig. 2.



(a)



(b)

Figure 2

3. Sketch the magnitude and phase Bode plots for

$$H(j\omega) = \frac{0.2(10 + j\omega)}{j\omega(2 + j\omega)}$$

4. Sketch the magnitude and phase Bode plots for

$$H(j\omega) = \frac{250(j\omega + 1)}{j\omega(-\omega^2 + 10j\omega + 25)}$$

## Analog Electronics Homework 1

5. Find the transfer function  $H(j\omega)$  with the Bode magnitude plot given in Fig. 3.

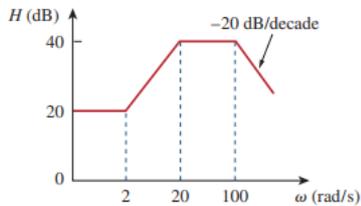


Figure 3

6. Study the circuit given in Fig.4 (without the load resistor).
- As  $\omega \rightarrow 0$ , the inductor behaves like what circuit component? What value will the output voltage  $v_o$  have?
  - As  $\omega \rightarrow \infty$ , the inductor behaves like what circuit component? What value will the output voltage  $v_o$  have?
  - Based on parts (a) and (b), what type of filtering does this circuit exhibit?
  - What is the transfer function of unloaded filter?
  - If  $R=330\Omega$  and  $L=10\text{mH}$ , what is the cutoff frequency of the filter in rad/s?

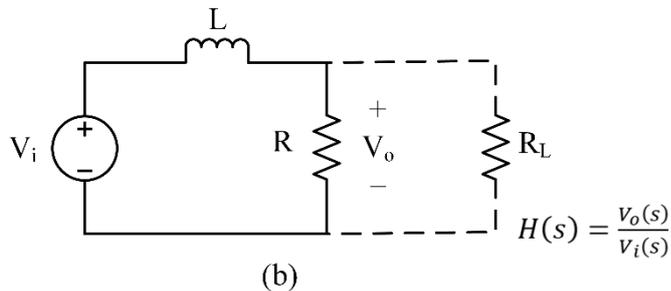


Figure 4

7. Suppose we wish to add a load resistor in parallel with the resistor in the circuit shown in Fig. 4.
- What is the transfer function of the loaded filter?
  - Compare the transfer function of the unloaded filter in previous question and the transfer function of the loaded filter. Are the cutoff frequencies different? Are the passband gains different?
  - What is the smallest value of load resistance that can be used with the filter from Problem 6(e) such that the cutoff frequency of the resulting filter is no more than 5% different from the unloaded filter?

# Analog Electronics Homework 1

8. Find the transfer function for each active filter given in Fig. 5.

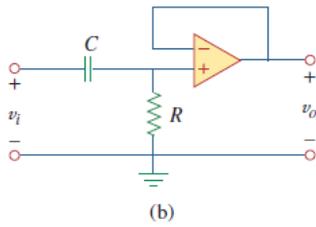
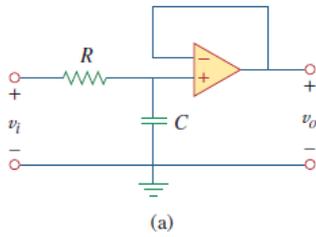


Figure 5

9. The filter in Fig. 5(b) has a 3-dB cutoff frequency at 1kHz. If its input is connected to 120-mV variable frequency signal, find the output voltage at:  
(a) 200Hz                      (b) 2kHz                      (c) 10kHz

10. Obtain the transfer function of the active filter in Fig. 6. What kind of filter is it?

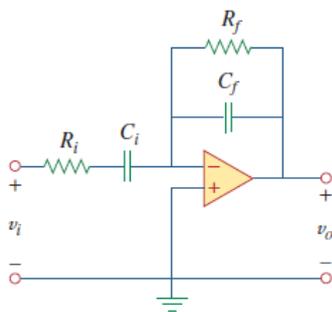


Figure 6