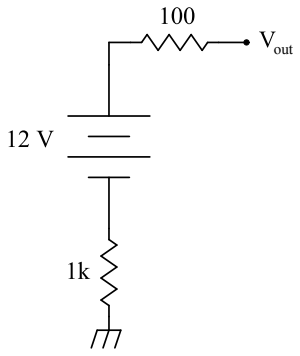
Phys 3150/5190 Homework Assignment 2

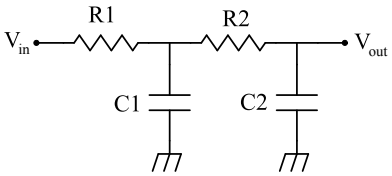
Due 9/12/2012

1. Suppose two circuits are cascaded, with the output of the first driving the input of the second. The first circuit has transfer function $G^{(1)}$ and output impedance $Z^{(1)}_{\rm out}$. The second circuit has transfer function $G^{(2)}$ and input impedance $Z^{(2)}_{\rm in}$. The second circuit does not drive a significant load. Calculate the net transfer function $G_{\rm tot}$ for the pair.

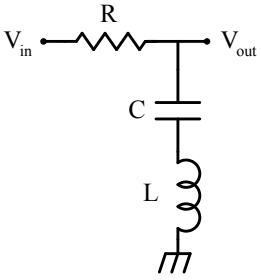
2. What is the output impedance of this circuit? Assume the 12 V battery to be ideal, with no output impedance of its own.



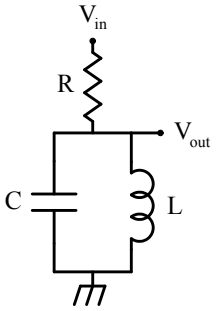
3. Generate Bode plots for the low-pass filter shown, for the three cases $R_1 = 0.1R_2$, $R_1 = R_2$, and $R_1 = 10R_2$. In each case, adjust the capacitor values to keep $R_1C_1 = R_2C_2 \equiv \tau$ constant. Plot the log gain and the phase vs $\log(\omega\tau)$, over a a range $\omega\tau = 10^{-2}$ to 10^2. The difference between the plots shows the loading effect of the second filter on the first.



4. Generate Bode plots (of gain in dB and phase in degrees) for the two circuits shown below. Take $C = 10$ nF, $L = 1$ μH, and compare $R = 100$, 10, and 1 Ω for each circuit. Your plots should span a frequency range from 10 kHz to 100 MHz.



(a)



(b)