1. For the circuit shown below, use National Instruments SPICE (Multisim) to plot the Bode plot of the complex transfer function $V_o/V_i$, as the frequency of the voltage source, $v_i(t)$, varies from $0.1 f_o$ to $10 f_o$, where $f_o$ is the resonant frequency of the circuit. Also plot the capacitor current over the same frequency range (Assume the left terminal is positive). Compare the simulation results with the theoretical results for $f_o$, $Q$, and $\Delta f$ (use the capacitor current plot for this). Assume that the voltage source $v_i(t)$ is a sine wave with an rms value of 1 V. The component values are $R_1 = 1 \Omega$, $R_2 = 100 \text{k}\Omega$, $R_3 = 500 \text{k}\Omega$, $R_4 = 2 \text{k}\Omega$, $L = 300 \text{mH}$, and $C = 1 \text{nF}$. Use either Mathcad and Matlab to plot the magnitude and phase of the voltage $v_o(t)$; assume that the phase of the source $v_i(t)$ is zero with the positive side up. (Note that since the input is unity this is equivalent to finding the Bode plot.)

2. For the circuit shown below plot $i_c(t)$ versus $t$ using either MathCad or Matlab. (Assume the left terminal is positive). The range of $t$ for the plot is from 0 to $4T_d$ where $T_d = 1/f_d$, $f_d = f_o \sqrt{1 - \zeta^2}$, $\zeta = (R/2) \sqrt{C/L}$ and $G = 1/R$ where $R$ is the Thevenin resistance seen by the series combination of $L$ and $C$. The input is $v_i(t) = E_o u(t)$ where $E_o = 10 \text{V}$ and $u(t)$ is the unit step function. Compare the theoretical and simulation results for the driven frequency, $f_d$, and the attenuation factor of the envelope, $\alpha$, (use the $i_c(t)$ plot for this with Multisim). For this circuit $R_1 = 1 \text{k}\Omega$, $R_2 = 100 \text{\Omega}$, $R_3 = 500 \text{\text{k}\Omega}$, $R_4 = 2 \text{\text{k}\Omega}$, $L = 1 \text{H}$, and $C = 0.01 \mu\text{F}$. 

![Circuit Diagram]