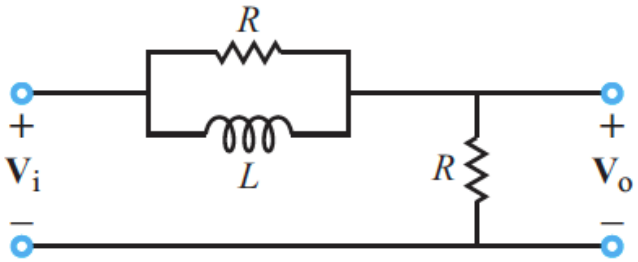
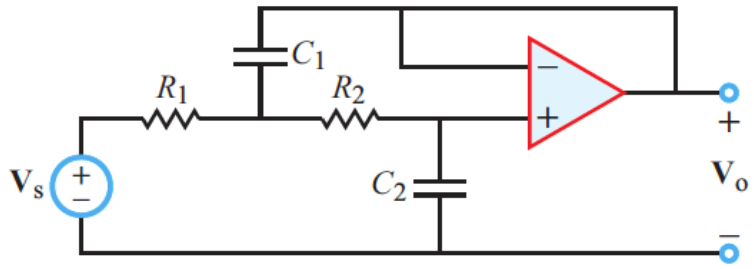
ECE 3337: Signals & Systems Analysis, Class Worksheet 25

1. (25 points) For the following circuit, derive an expression for $\mathbf{H}(\omega)$ and plot the magnitude and phase of $\mathbf{H}(\omega)$ for $R = 50\Omega, L = 2mH$ (you may use MATLAB).



2. (25 points) For the following circuit, derive an expression for $\mathbf{H}(\omega)$ and plot the magnitude and phase of $\mathbf{H}(\omega)$ for $R_1 = R_2 = 100\Omega, C_1 = 10\mu F, C_2 = 0.4\mu F$ (you may use MATLAB). What type of filter is it?



3. (25 points) An audio signal $x(t)$ that is bandlimited to 20kHz is sampled at 30 kHz.
   a. What portion of its spectrum can still be recovered perfectly from its samples, assuming that you have access to an ideal low-pass filter, and
   b. What is the cutoff frequency for this ideal low-pass filter?

4. (25 points) An audio signal $x(t)$ is bandlimited to 20kHz.
   a. Using the convolution property in the frequency domain, calculate the bandwidth of the signal $y(t) = x^2(t)$
   b. Calculate the Nyquist sampling rate for the signal $y(t)$