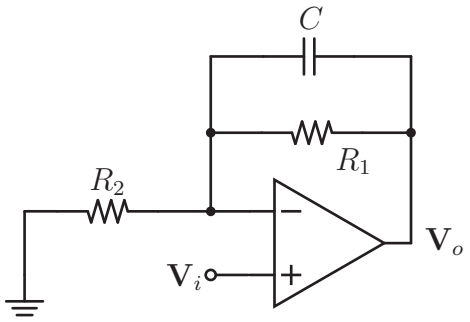
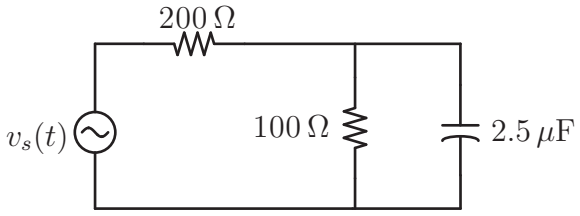
University of California, Berkeley *Spring 2012*
EE 42/100 *Prof. A. Niknejad*

Problem Set 7 (Rev B)
Due Wednesday (5pm), April 11, 2012

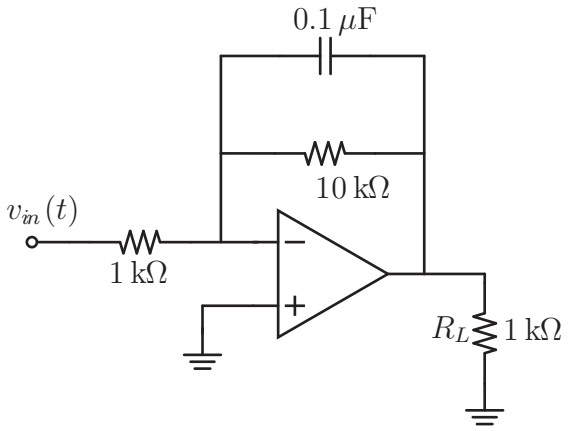
1. Consider the following active filter circuit. Derive the transfer function $H(\omega) = \frac{\mathbf{V}_o}{\mathbf{V}_i}$ using phasor analysis. What type of filter is it? Justify your answer. What is its maximum gain?



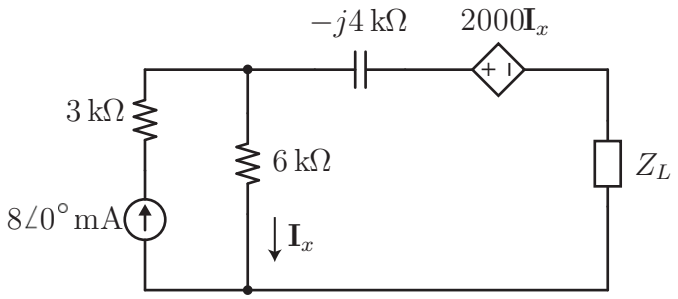
2. In the circuit below, $v_s(t) = 60\cos(4000t)$ V. (a) What is the RMS value of the source voltage? (b) Use AC analysis to find the current $i_s(t)$ supplied by the voltage source. (c) What is the power factor of each circuit element? (d) Calculate the complex power of the voltage source. (e) What is the average power drawn by the resistors? What is the reactive power of the capacitor? You should be able to use your answer from (d) without making any more calculations.



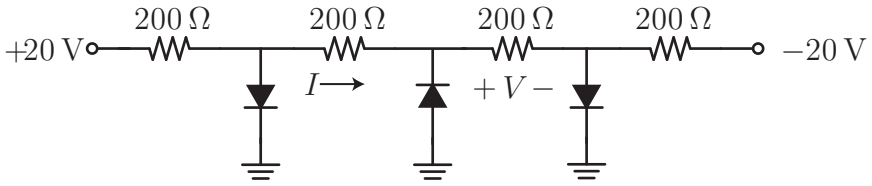
3. Determine the average power delivered to the load R_L in the circuit below, given that $v_{in}(t) = 0.5\cos(2000t)$ V.



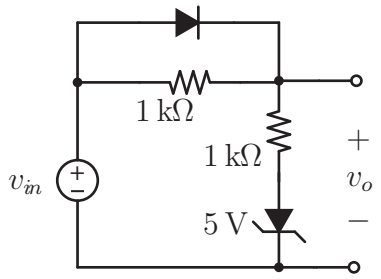
4. Use the maximum power transfer theorem to determine the load impedance Z_L so that it will draw the maximum average power from the circuit.



5. Find the values of I and V in the circuit below, assuming that the diodes are all ideal.



6. Sketch v_o versus v_{in} to scale for the circuit below, assuming that the diodes are ideal. The Zener diode has a breakdown voltage of 5 V.



7. Sketch the output waveform $v_o(t)$ for the circuit below, where $v_s(t) = 10\sin(t)$ V. Assume that the diodes are ideal and that the Zener diode has a breakdown voltage of 5 V. Also, RC is much larger than the period of the input voltage.