GEORGIA INSTITUTE OF TECHNOLOGY
School of Electrical and Computer Engineering

**Course ECE 2040**

**Circuit Analysis**

Assigned: April 6, 2001
Due: April 13, 2001

## Problem Set #11

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**Reading:** Read the following sections from the class notes:
Chapter 8, Sections 8.3
Chapter 9, Sections 9.2.2, 9.3
**Reading:** Some of same topics are discussed in Dorf and Svoboda:
Chapter 10, Section 10.10 (node and mesh equations)
Chapter 11, Sections 11.3, 11.8 (power and complex amplitudes)
Chapter 16, Section 16.6 (frequency responses)

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**Announcement:** Quiz #4 will be held during the class hour on Wednesday, April 18, 2001. It will be a closed book test, although calculators are permitted. You may also bring one 8.5 by 11.0 inch sheet of *handwritten* notes. It will cover problem sets 9–11.

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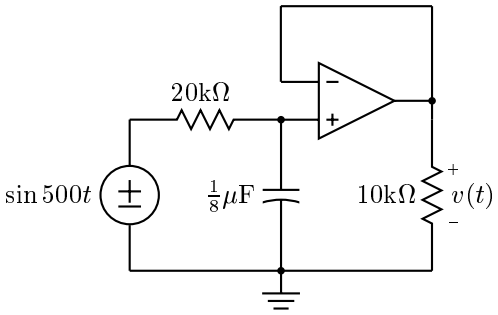
**Problem 11.1:** For the circuit below find $v(t)$.



**Problem 11.2:** For the circuit in Figure 1 find $v(t)$ when $v_s(t) = \cos(\omega t)$.

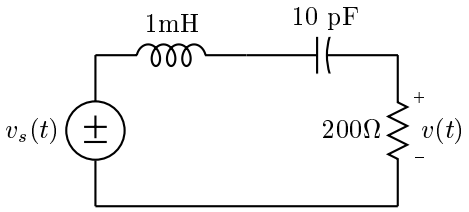



Figure 1: Circuit for Problem 11.2.

**Problem 11.3:** For the circuit in Figure 2 what is the average power supplied by the current source?

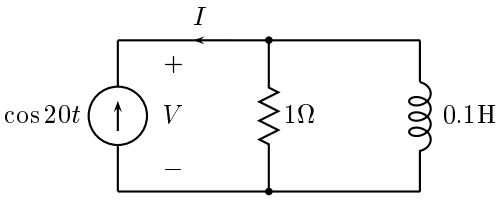



Figure 2: Circuit for Problem 11.3.

**Problem 11.4:** Determine the values of $R$ and $L$ for the circuit in Figure 3 that cause the maximum amount of power to be delivered to the load.

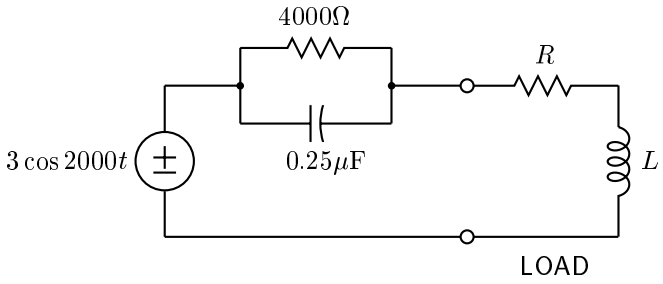
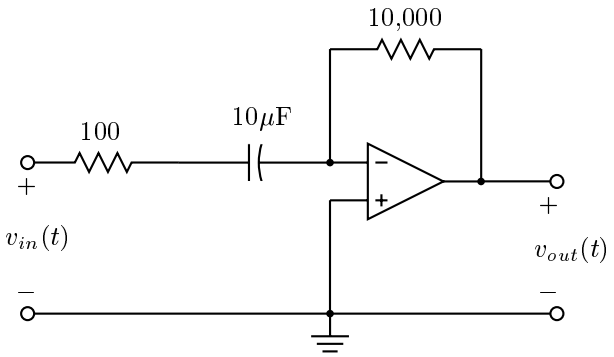



Figure 3: Circuit for Problem 11.4.

**Problem 11.5:**

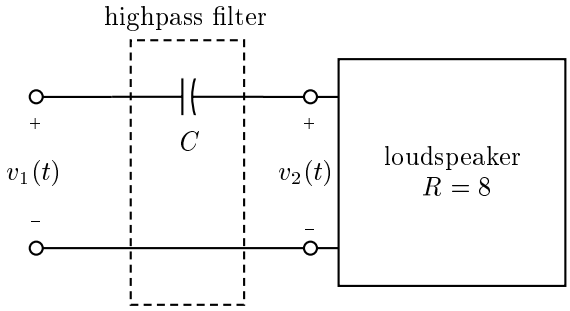


(a) Calculate the frequency response of the above circuit.

(b) Plot the magnitude response.

(c) Plot the phase response.

**Problem 11.6:** Many loudspeaker systems consist of two loudspeakers: the woofer, which reproduces the low frequency part of the signal, and the tweeter, which reproduces the high frequency part of the signal. A crossover network is used to select the high frequency part of the signal and feed it into the tweeter. Such a network functions as a highpass filter. The entire audio signal is applied at the terminals $a - a'$.




(a) Assuming that the equivalent circuit for the tweeter consists of just a resistor with a resistance of $R$, plot the pole-zero pattern of the system function that relates $v_2(t)$ to $v_1(t)$ and sketch the frequency response curves (magnitude and angle).

(b) If $R = 8\Omega$, find the value of the capacitance $C$ so that the half-power frequency of the highpass filter is 5 kHz ($= 2\pi(5000)$ rad/s).