ECE 10C
Homework 6
Due: Tuesday 6/4 at 4:00 pm

Please print out all the worksheets (including this cover page).
Make sure to securely staple all the worksheets together.

Full Name:

ID number:

Number of pages attached:
(excluding cover page)

Name of lab TA:

Problem 1

For the circuit in Fig. 1

1. What type of filter is this? Plot the gain if $R = L = C = 1$.
2. For what values of R is the circuit resonant?
3. Given the type of filter, specify whether you would like this circuit to be resonant with high Q or not.

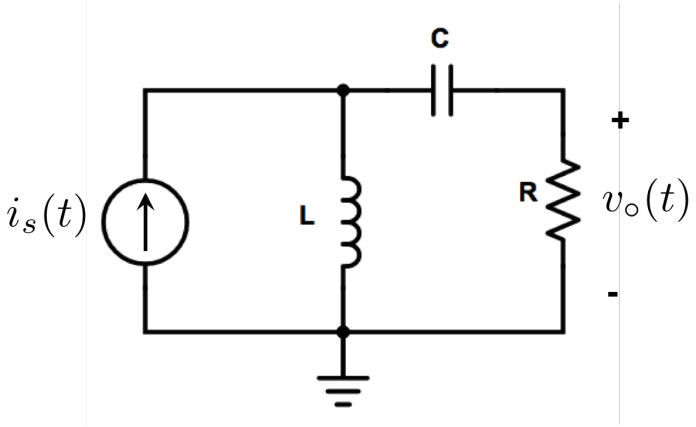


Figure 1

Problem 2

Consider the following circuit.

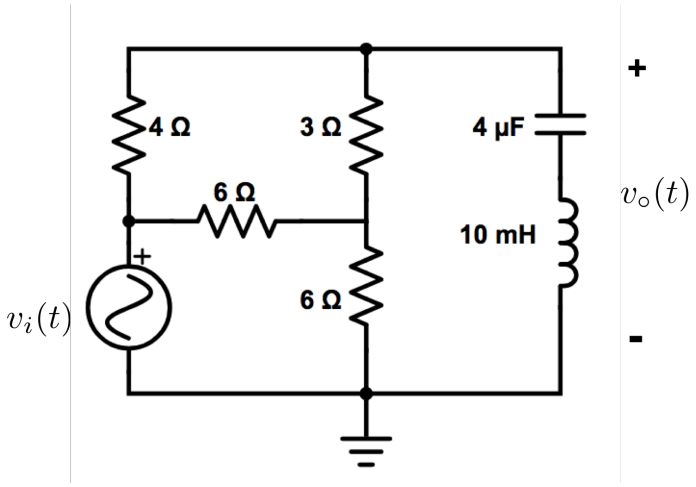
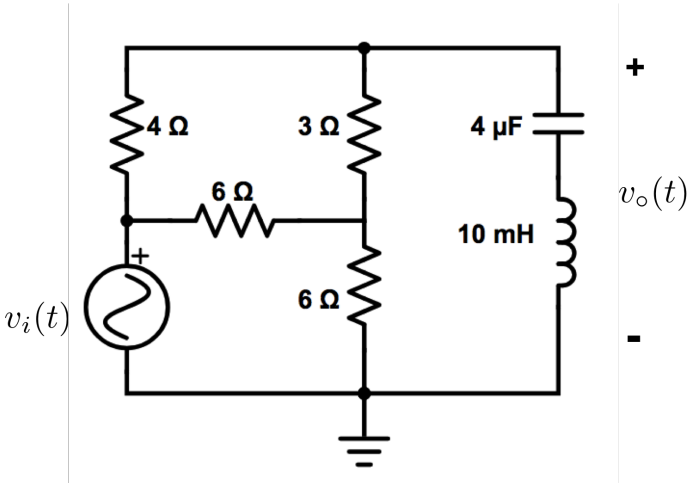


Figure 2

1. Determine the filter type and specify its parameters (e.g., center frequency and bandwidth).

Problem 2 - continued



2. Determine the average power dissipated by the circuit if $v_i(t) = 200\sin(5000t)$.

Problem 3

We would like to build an AM radio receiver using a **series RLC circuit** working as a bandpass filter. We have decided to use a 240 μH inductor with an internal resistance of 12Ω, and a variable capacitor whose capacitance varies between 40 to 360 pF. A radio "tunes" into a certain frequency by adjusting its receiver circuit so that it resonates at that frequency, and it only catches that specific frequency.

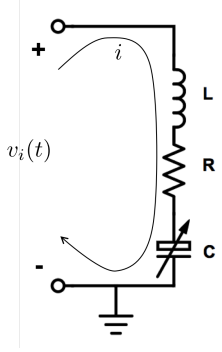


Figure 3: AM radio receiver

1. Determine the range of channel frequencies that we can tune into with this receiver;

2. Determine the receiver's bandwidth;

Problem 3 - continued

3. AM radio broadcasting has assigned channels, ranging from 540 kHz to 1,700 kHz and spaced at 10-kHz intervals. What is the largest value of the internal resistance that would would allow us to avoid adjacent channel interference (i.e., listening to more than one channel at once)?

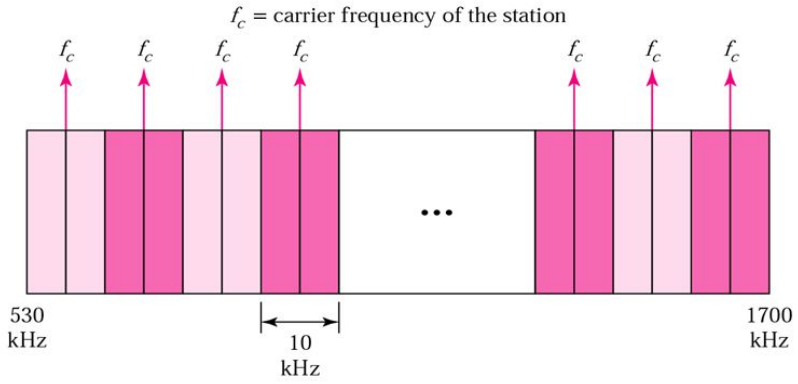


Figure 4: AM radio band

(For simplicity, assume that the bandwidth of the RLC circuit is symmetric around the resonance frequency)