EECS 40
Report: RLC Circuits

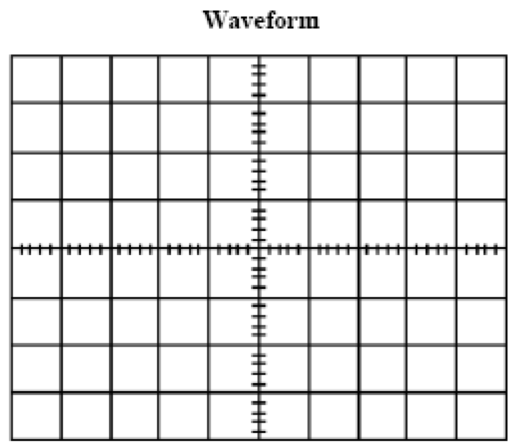
Name1: ______________________________
Name2: ______________________________
TA: ____________________Section: ______

LC circuit

1) Sketch the time varying voltage across the capacitor on the graph provided. (Use a voltage scale that fills the graph nicely)

2) Sketch the time varying voltage across the parallel capacitor and inductor on the same graph. (Be careful to make sure your units match)

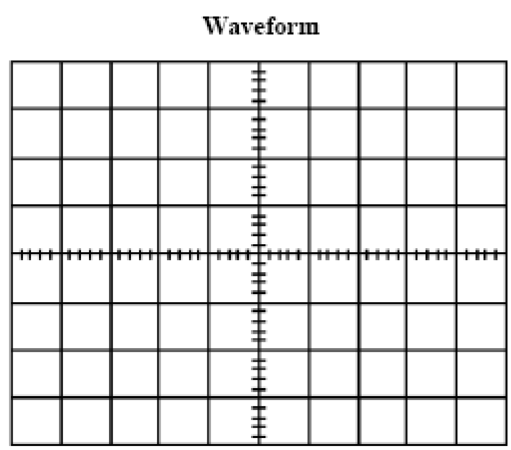
What causes each oscillation?



100Hz graph

3) Graph the voltage across just the capacitor, then add the inductor and graph the resulting waveform. (pay close attention to the units on your y axis!)

Why do you now only see one set of oscillations instead of two?

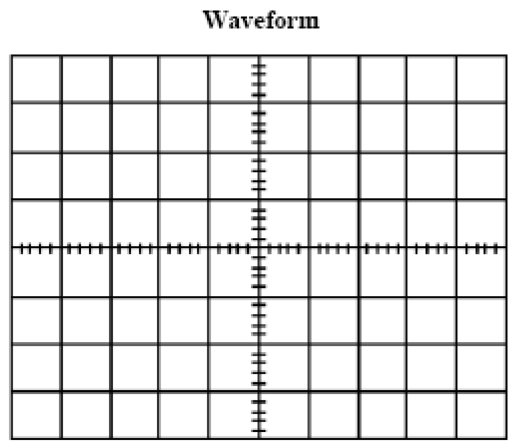


2 KHz graph

4) Measured frequency of voltage oscillation: _______
Calculated value: _______
If there is a discrepancy between the two values, what do you think causes it?

5) Sketch the parallel capacitor and inductor voltage with the 10 mH inductor.

Why does an increase in inductance change the waveform in this way?



2 KHz graph, 10 mH inductor

The function generator never outputs a negative voltage, due to the voltage offset of 1.5V. Then how is it possible that the voltage across the capacitor and inductor becomes negative some of the time?

How do these graphs differ from what would theoretically happen? (hint: the prelab has a question pertaining to this) What can you conclude about the limitations of real capacitors and inductors?

Series RLC Circuit

6) Fill in the chart below by filling in your calculated values from the prelab, then setting the function generator to each frequency and measuring the resistor's V_{pp}.

	-1 decade	-3 dB	f_0	-3 dB	+1 decade
Frequency in KHz					
Resistor V_{pp}					

7) Fill in the chart below by sweeping through the frequency range to find the actual values for the frequencies below. (for example, sweep the frequency of the sinusoid higher and lower until you find the frequency at which the resistor's Vpp is higher than anywhere else. This is the resonance frequency)

	Resistor V_{pp}	Frequency (KHz)
Lower half-power frequency		
Resonance frequency		
Higher half-power frequency		

Using the values you just found for the table above, find the Bandwidth (B) and Quality Factor (Q). Compare these to your calculated values from the prelab.

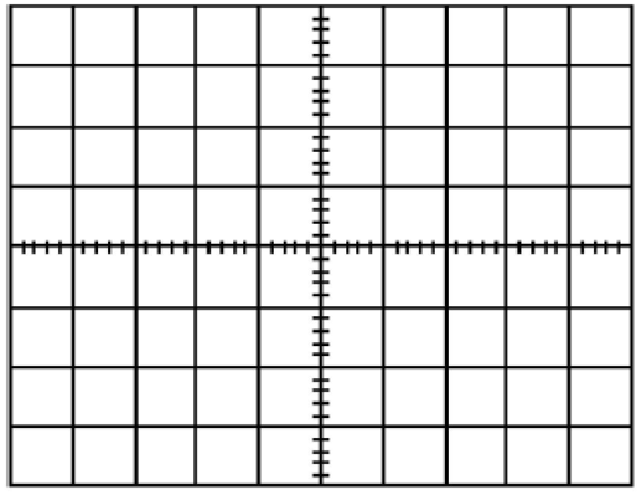
8) If there where discrepancies between your calculated and measured values, what do you think caused them? How effective is this circuit as a bandpass filter?

9) Fill in the following with determined values, and plot the observed waveforms. (Remember to label the axes). For V_f, determine the final voltage that the wave decays to.

Values	**Waveform**

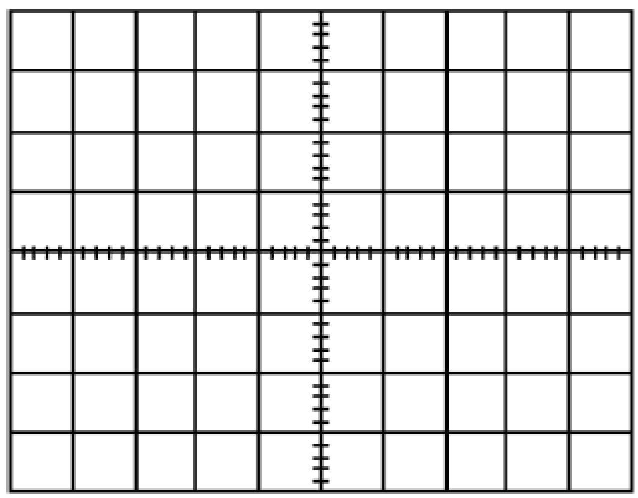
Overdamped

R : _____________
α : _____________
V_f: _____________



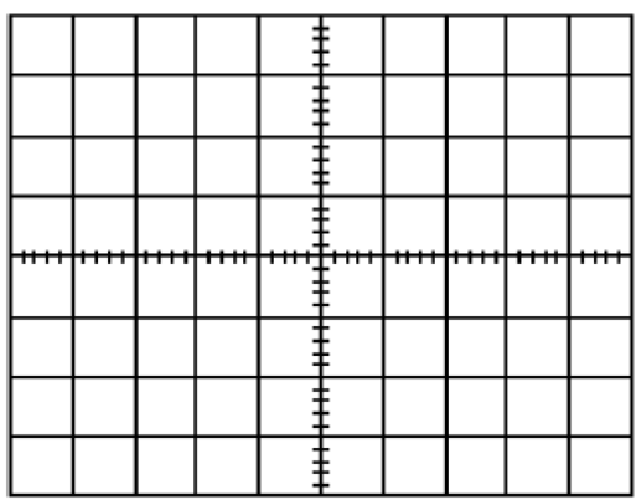
Critically damped

R : _____________
α : _____________
V_f: _____________



Underdamped

R : _____________
α : _____________
ω_n : _____________
V_f: _____________



10) For the underdamped case, what is the measured observed oscillation frequency in Hz and rad/s? (Show your calculations) How does this compare to the resonant frequency, ω_0? How does it compare to the natural frequency, ω_n?

11) According to the 3 observed peaks in voltage, do the consecutive values decay as predicted? List your observed values and predicted values based on the first reference value. Explain why or why not the predictions are observed.