Phy 415/515 Lab #3 2009 Bandpass circuits

1. Bandpass Filter A

1.1. Wire

Wire the low pass filter to the high-pass filter using R1a=1 kΩ and C1a=0.47 μF (0.5 μF drawer) R2=4.7 kΩ and C2=0.01 μF, with the Wavetek supplying the input voltage. Turn Wavetek Amplitude to maximum.

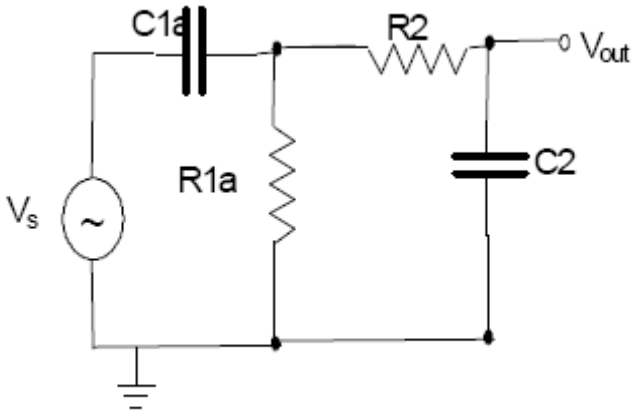

Figure 1. Band Pass Filter

1.2. Low Frequency Response

Observe the output on the oscilloscope. Turn the frequency down to 10 Hz. **What is the amplitude of the response as measured on the scope?**

1.3. High Frequency Response

Turn the frequency up to 100 kHz. **What is the amplitude of the response?**

1.4. Midrange Frequency Response

At what frequency is the amplitude about the highest and what is the amplitude?

1.5. Low cut off frequency

At what lower frequency is the amplitude approximately 70% of maximum? What is the ratio of that frequency to the frequency at maximum?

1.6. High Cut off frequency

At what higher frequency is the amplitude approximately 70% of maximum? What is the ratio of that frequency to the frequency at maximum?

2. Bandpass Filter B

2.1. Wire

Change the resistor and capacitor in the high-pass part of the bandpass circuit to R1b=100 kΩ and C1b=0.0047 μF =4700pF (0.005μF drawer).

2.2. Low Frequency Response

Turn the frequency down to 10 Hz. **What is the amplitude of the response as measured on the scope?**

2.3. High Frequency Response

Turn the frequency up to 100 kHz. **What is the amplitude of the response?**

2.4. Midrange Frequency Response

At what frequency is the amplitude about the highest and what is the amplitude?

Why is the midrange amplitude so much smaller than for the other bandpass circuit? (hint: what is the Thevenin equivalent impedence (reactance) for each system?)

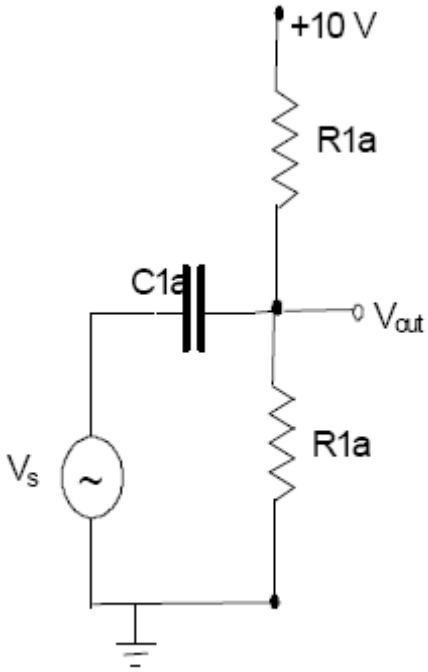

Figure 2. Bias Network

3. Bias Network

3.1. Wire

Wire the bias network at right using R1a=2 kΩ and C1a=0.47 μF, but don't connect the 10 V power supply.

3.2. Jumpered Cap

Short the capacitor (jumper it with a wire). Observe the output on the oscilloscope, and adjust the Wavetek to have 3 Volts dc bias, 1 kHz frequency and 1 V amplitude.

3.3. Blocking Cap

Remove the jumper wire shorting the capacitor. Observe the output and the oscilloscope. **Is there any dc bias?** (Note that if you turn the dc bias knob too far, the output of the Wavetek clips--this has nothing to do with your circuit, but if the output of the Wavetek is not sinusoidal, neither is your signal. It should still be centered at 0 volts, with no dc bias.)

3.4. DC Only

Disconnect the Wavetek temporarily, and connect the 10 V power supply. **What is the output voltage?**

3.5. Both Power Supplies

Reconnect the Wavetek. **What is the effect of changing the dc bias? The sinewave amplitude? The power supply voltage?** Reset the Wavetek to the previous settings (3.2).

3.6. Frequency

At what frequency is the amplitude 70% of the amplitude at 1 kHz?

4. RLC Bandpass

4.1. Wire

Wire the RLC bandpass at right and set the Wavetek amplitude to maximum.

4.2. Pass frequency

At what frequency is the amplitude at maximum? How does it compare to the computed value from the prelab problem?

4.3. Rapid roll off

At what frequencies is the amplitude approximately 70% of maximum? What is the ratio of those frequencies to the frequency at maximum? How does that ratio compare to the RC bandpass circuit? Is the maximum broader or narrower than for the RC bandpass?

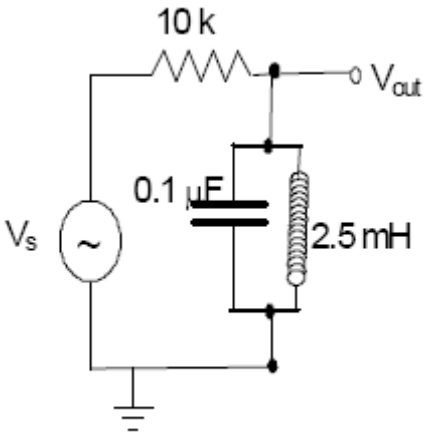

Figure 3. RLC Bandpass

Name: _____

Partner's Name: _____

Results

1. Band Pass Filter A

1.2. Low Frequency Response

What is the amplitude of the response as measured on the scope? _____

1.3. High Frequency Response

What is the amplitude of the response? _____

1.4. Midrange Frequency Response

At what frequency is the amplitude about the highest? _____

What is the amplitude? _____

1.5. Low cut off frequency

At what lower frequency is the amplitude approximately 70% of maximum? _____

What is the ratio of that frequency to the frequency at maximum? _____

1.6. High Cut off frequency

At what higher frequency is the amplitude approximately 70% of maximum? _____

What is the ratio of that frequency to the frequency at maximum? _____

2. Band Pass Filter B

2.2. Low Frequency Response

What is the amplitude of the response as measured on the scope? _____

2.3. High Frequency Response

What is the amplitude of the response? _____

2.4. Midrange Frequency Response

At what frequency is the amplitude about the highest? _____

What is the amplitude? _____

Why is the midrange amplitude so much smaller than for the other bandpass circuit?

_____

3. Bias Network

3.3. Blocking Cap

Is there any dc bias? _____

3.4. DC Only

What is the output voltage? _____

3.5. Both Power Supplies

What is the effect of changing the dc bias? _____

The sinewave amplitude? _____

The power supply voltage? _____

3.6. Frequency

At what frequency is the amplitude 70% of the amplitude at 1 kHz? _____

4. RLC Bandpass

4.2. Pass frequency

At what frequency is the amplitude at maximum? _____

How does it compare to the computed value from the prelab problem?

_____

4.3. Rapid roll off

At what frequencies is the amplitude approximately 70% of maximum?

_____

What are the ratios of these frequencies to the frequency at maximum?

_____

How do these ratios compare to the RC bandpass circuit?

_____

Is the frequency range between cut-off frequencies broader or narrower than for the RC bandpass? _____