ECEN 3714--------Network Analysis
Cover Sheet for Lab 3 to 11

Spring 2022

Lab #__9__

Topic: Active Band Pass Filter

Final Report (Pre-lab + Post-lab)

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TA Signature:	

1. Introduction

1.1. In this lab we constructed a 2nd Order Band-Pass Filter and compared them to the 1st Order Low-Pass for High-Pass filters from the previous labs. A band-Pass filter shows frequency within a certain range and rejects the frequencies outside of that range. We achieved an active Band-Pass filter by passing a Low-Pass and High-Pass filter together using a Dual Op-Amp such as LM358 to build and pass the two filters.

2. Pre-Lab Assignment:

2.1. Find the frequency-response of the designed BPF circuit using PSPICE

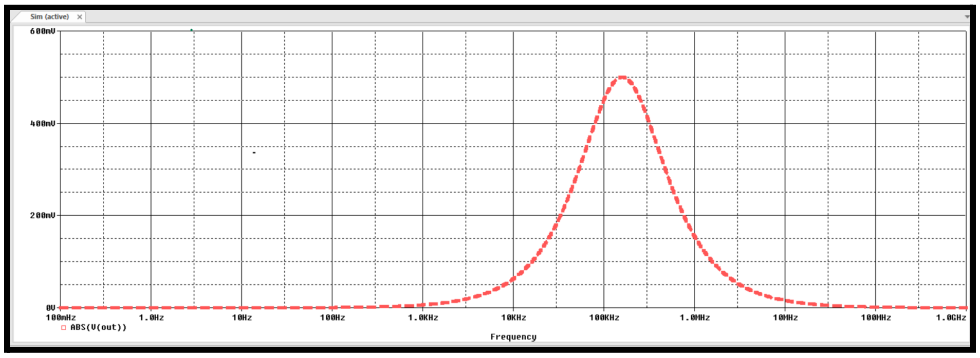

Figure 1: Magnitude Response of Circuit in Volts

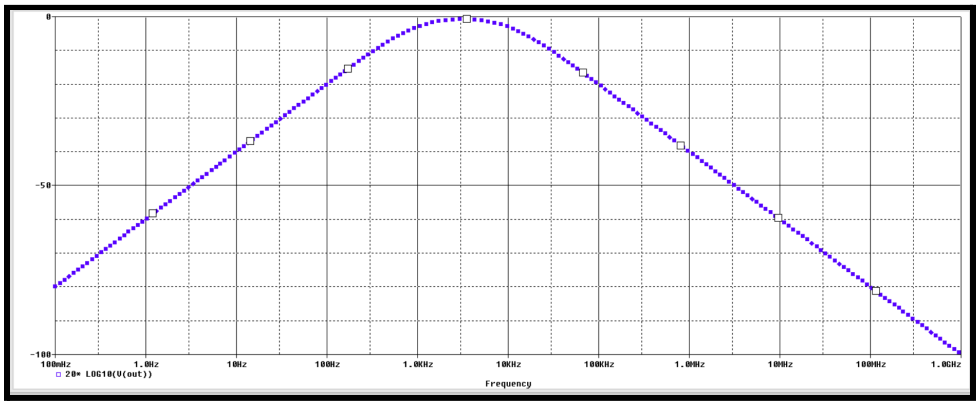

Figure 2: Magnitude Response of Circuit in dB

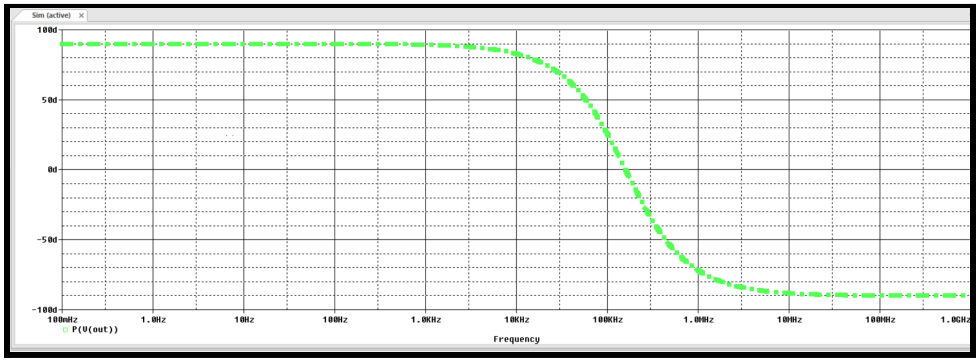

Figure 3: Phase Response of Circuit in degrees

2.2. Measurements:

Measurement	Value
Maximum **Pspice formula:** Max(V(out))	0.909 V
Lower Cutoff Frequency **Pspice formula:** Cutoof_Lowpass_3dB(V(out))	11.824 kHz
Higher Cutoff Frequency **Pspice formula:** Cutoof_Highpass_3dB(V(out))	846.322 Hz
Bandwidth **Pspice formula:** Bandwidth_Bandpass_3dB(V(out))	10.978 kHz
Center Frequency **Pspice formula:** SQRT(Cutoff_Highpass_3dB(V(out))*Cutoff_ Lowpass_3dB(V(out)))	3.163 kHz
Gain at the Center Frequency **Pspice formula:** Max_XRange(V(out),3160,3170) *The center frequency is between that range*	0.909
Q Factor **Pspice formula:** SQRT(Cutoff_Highpass_3dB(V(out))*Cutoff_ Lowpass_3dB(V(out))) / (Cutoff_Lowpass_3dB(V(out))- Cutoff_Highpass_3dB(V(out)))	288.16m or 0.28816

Evaluate	Measurement	Value
☑	Max(V(out))	909.09436m
☑	Cutoff_Lowpass_3dB(V(out))	11.82401k
☑	Cutoff_Highpass_3dB(V(out))	846.32178
☑	Bandwidth_Bandpass_3dB(V(out))	10.97769k
☑	SQRT(Cutoff_Highpass_3dB(V(out))*...	3.16337k
☑	SQRT(Cutoff_Highpass_3dB(V(out))*...	288.16363m
☑	Max_XRange(V(out),3160,3170)	909.09436m

Figure 4: Measurements from Pspice

3. Assignments:

3.1. Assignment 1:

Measured lower cut-off frequency of the HPF taken separately of the HPF taken separately	1.1kHz
Measured higher cut-off frequency of the LPF taken separately	16kHz

Table 1

3.2. Assignment 2:

Frequency	**Magnitude response** ($V_{out\ (peak-to-peak)}$ / $V_{in\ (peak-to-peak)}$)	**Magnitude response in dB (by taking** $20log_{10}$	**Phase Differences in degrees**
100Hz	112mV	-19.016dB	170.1
250Hz	252mV	-11.972dB	77.84
500Hz	448mV	-6.974dB	60.64
800Hz	624mV	-4.096dB	46.61
1kHz	704mV	-3.049dB	37.75
2.5kHz	940mV	-0.537dB	6.5
5kHz	900mV	-0.915dB	-18.49
8kHz	820mV	-1.724dB	-48.11
10kHz	712mV	-2.950dB	-56.65
25kHz	480mV	-6.375dB	-67.47
50kHz	464mV	-6.670dB	-76.61
80kHz	480mV	-6.375dB	-179.3
100kHz	464mV	-6.670dB	178.3

Table 2

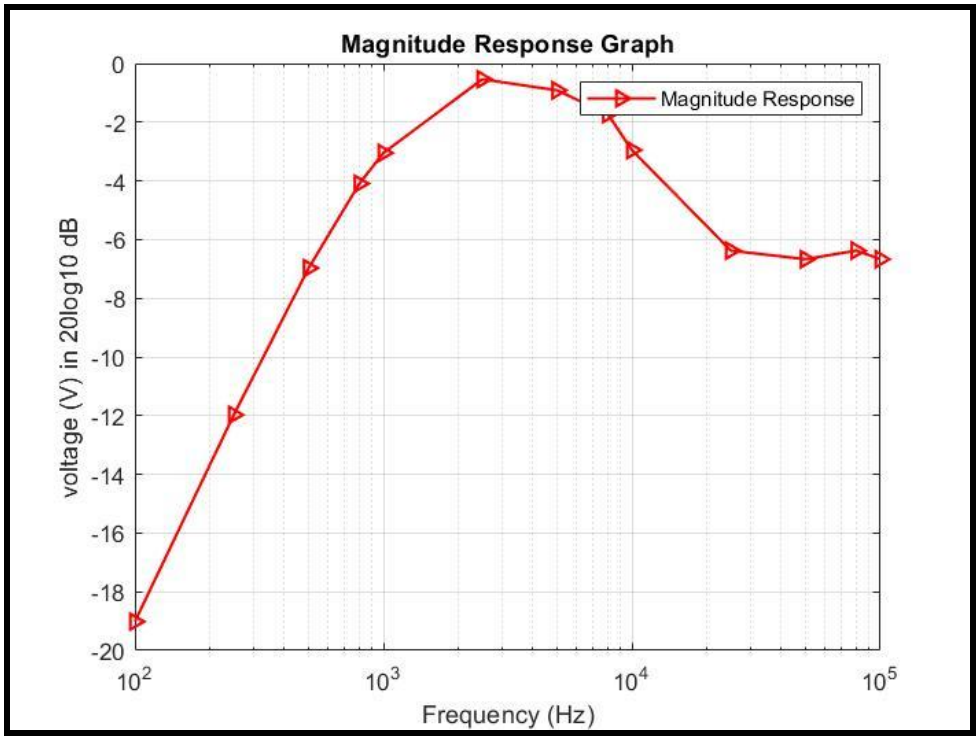

Figure 5: Magnitude Response Graph in dB from Table 2

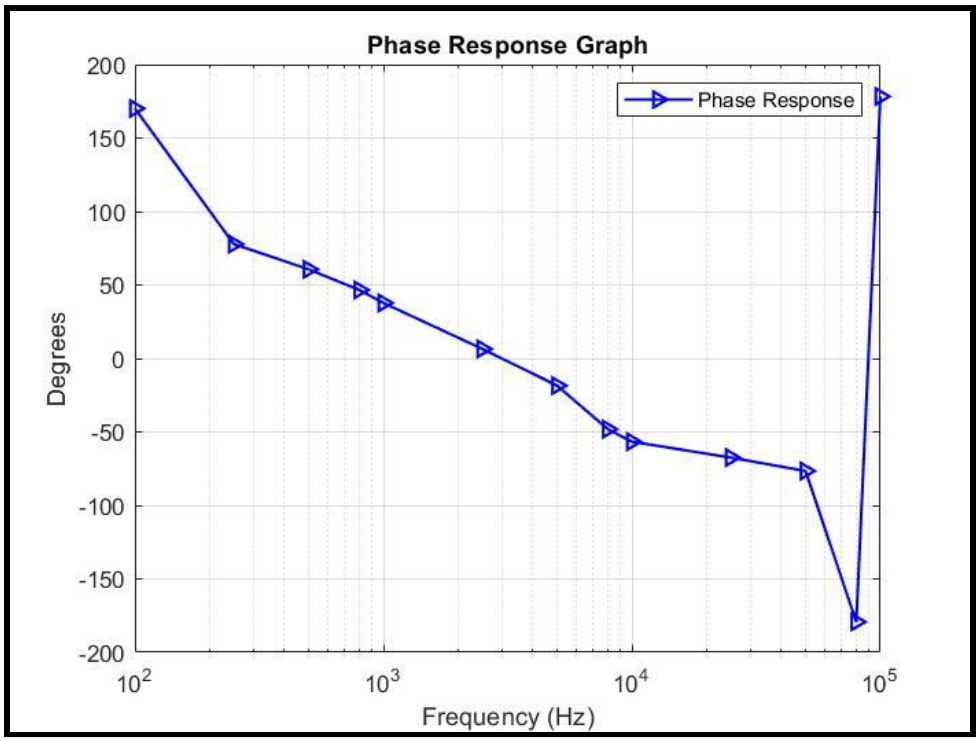

Figure 6: Phase Response Graph in Degrees from Table 2

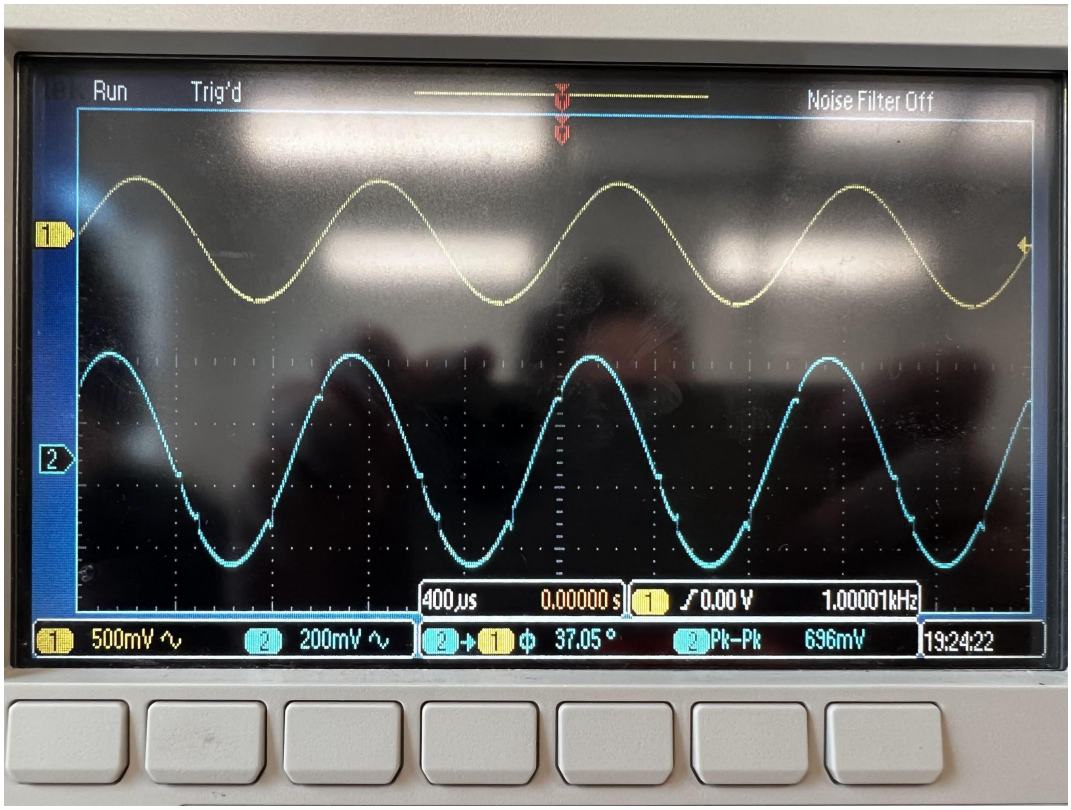

Figure 7: Band Pass Filter - 1kHz

Figure 8: Band Pass Filter - 10kHz

3.3. Assignment 3:

Center frequency	4195.24 Hz
Gain at Center frequency	940mV so 0.94 gain
Lower cut-off frequency of BPF	10.5 kHz
Higher cut-off frequency of BPF	950 Hz

Table 3

4. Discussion

4.1. In this lab we reinforced our knowledge on Low Pass Filter and High Pass Filters by making each on their own. We then took our knowledge of these filters and put them together. Cascading the Low Pass Filter over the High Pass Filter using a Dual Op-Amp IC. We also noticed that real life circuits will not resemble ideal situations due to many different factors. Because of this, our plotted points look somewhat different from the simulation. This is interesting because it shows how relying on simulations is not an accurate way of modeling all situations when it comes to precise electrical needs.