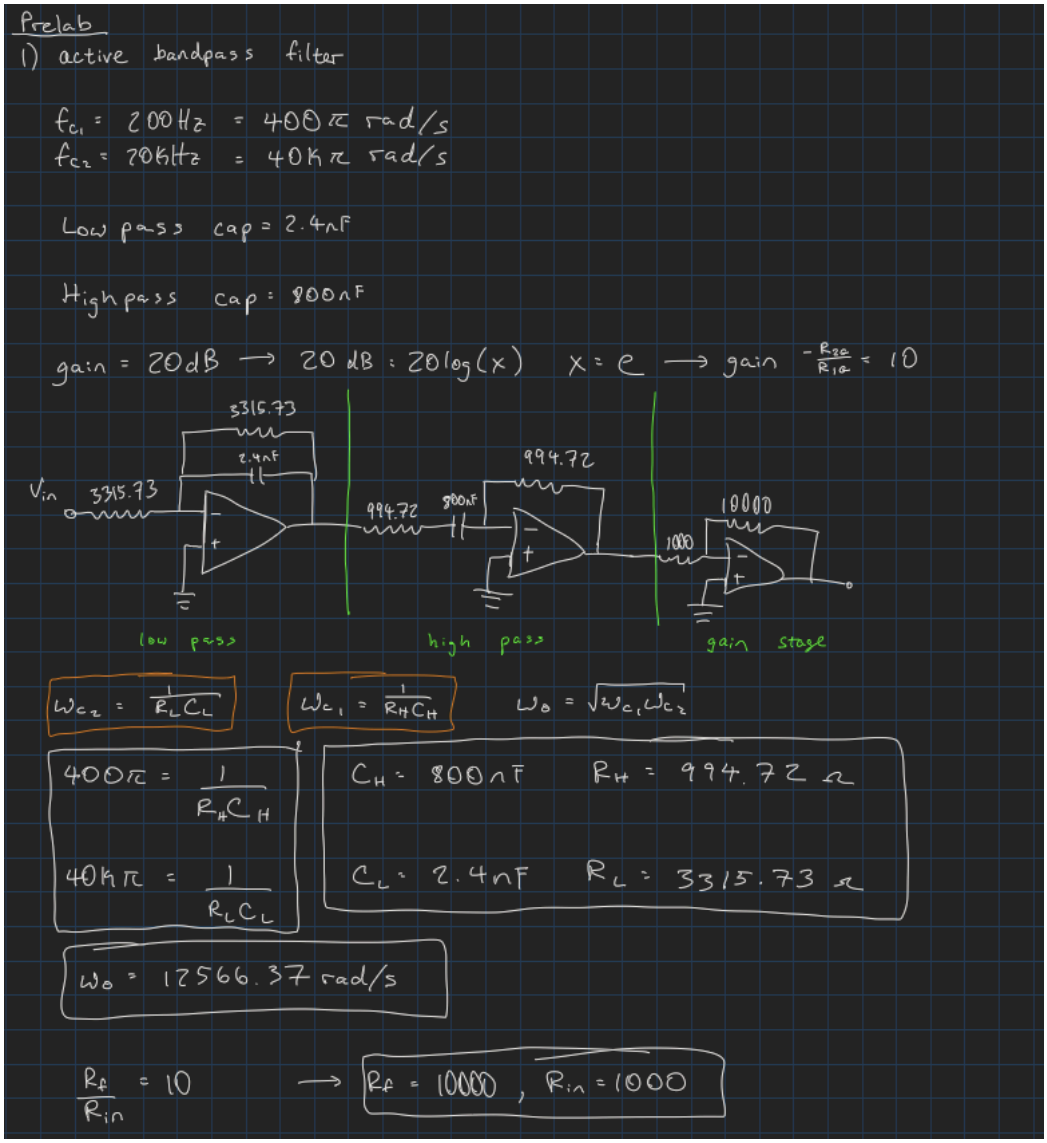
Justin Hsu
EEC 100 Lab 6
11/13/24

(1) Objective: Learn how to calculate, build, and simulate an active bandpass filter. Then using the function generator see how the signal is attenuated or passed at certain frequencies. Finally creating a bode plot to easily interpret at what frequencies are the signals being attenuated.

(2) Prelab:



2)

$$H(j\omega) = \left(\frac{-1}{1+j\omega R_L C_L}\right)\left(\frac{-R_H C_H (j\omega)}{1+j\omega R_H C_H}\right)\left(\frac{-R_f}{R_{in}}\right)$$

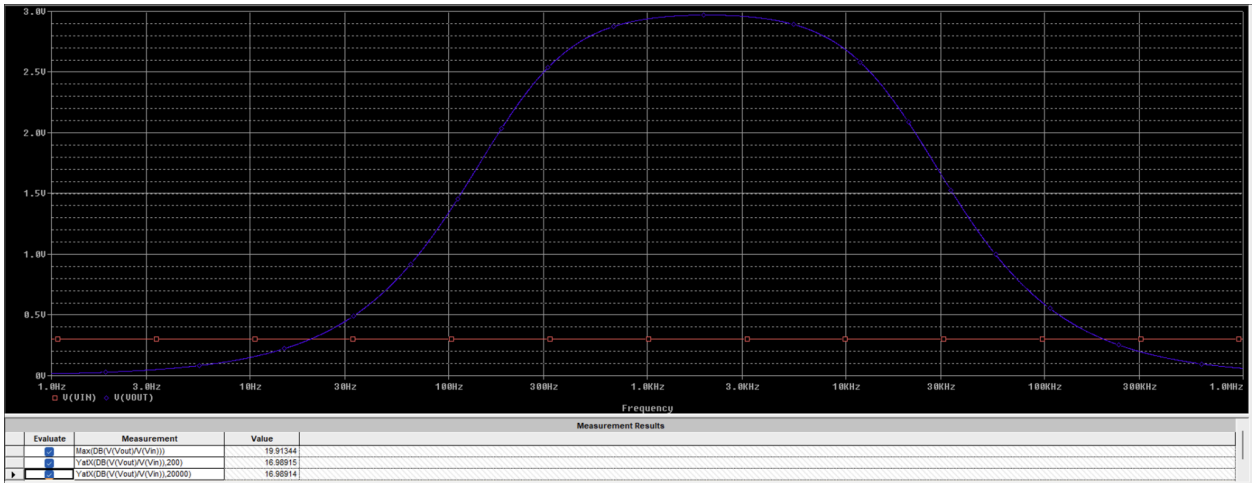
$$H(j\omega_{c_1}) = 7.07 \angle -135.57^\circ$$

$$H(j\omega_{c_2}) = 7.07 \angle 95.767$$

$$H(j\omega_o) = 9.9 \angle 180^\circ$$

Max gain = 10

(3) Simulation:



@ ω_0, gain = 19.913 dB

$20\log(x) = 19.913\,dB$

$x = 9.9$

gain of 9.9 @ ω_0 agrees with my initial calculations from part 2

@ ω_{c_1}, gain = 16.99 dB

$20\log(x) = 16.99$

$x = 7.07$

gain of 7.07 @ ω_{c_1} agrees with my initial calculations from part 2

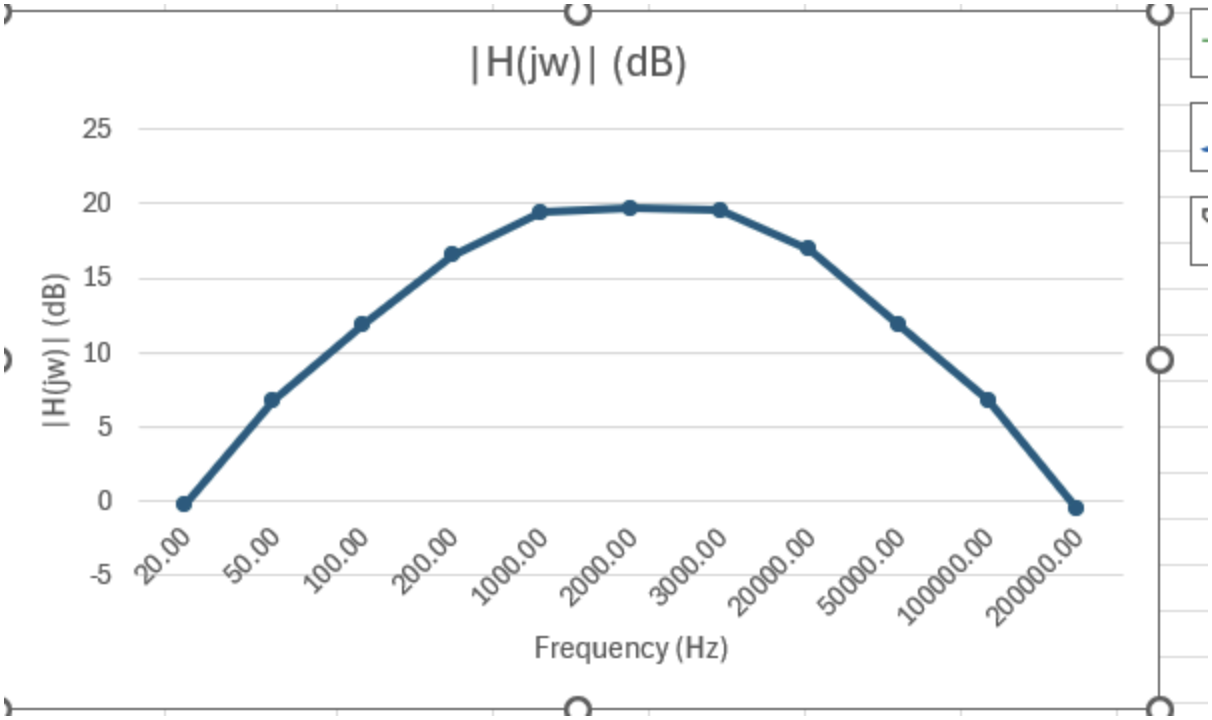
@ ω_{c_2}, gain = 16.99 dB

$20\log(x) = 16.99$

$x = 7.07$

gain of 7.07 @ ω_{c_1} agrees with my initial calculations from part 2

(4) Experiment:



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	f(Hz)	Ain (Vpp)	Aout(Vpp)	|H(jw)|	|H(jw)| (dB)			f(Hz)	|H(jw)| (dB)									
2	20	0.64	0.62	1.03226	-0.27577			20	-0.27577									
3	50	0.64	1.4	0.45714	6.79896			50	6.79896									
4	100	0.64	2.52	0.25397	11.9044			100	11.9044									
5	200	0.64	4.3	0.14884	16.5458			200	16.5458									
6	1000	0.64	6	0.10667	19.4394			1000	19.4394									
7	2000	0.64	6.2	0.10323	19.7242			2000	19.7242									
8	3000	0.64	6.1	0.10492	19.583			3000	19.583									
9	20000	0.64	4.5	0.14222	16.9407			20000	16.9407									
10	50000	0.64	2.5	0.256	11.8352			50000	11.8352									
11	100000	0.64	1.4	0.45714	6.79896			100000	6.79896									
12	200000	0.64	0.6	1.06667	-0.56057			200000	-0.56057									
13																		
14																		
15																		
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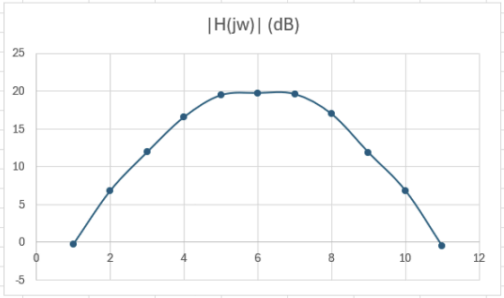
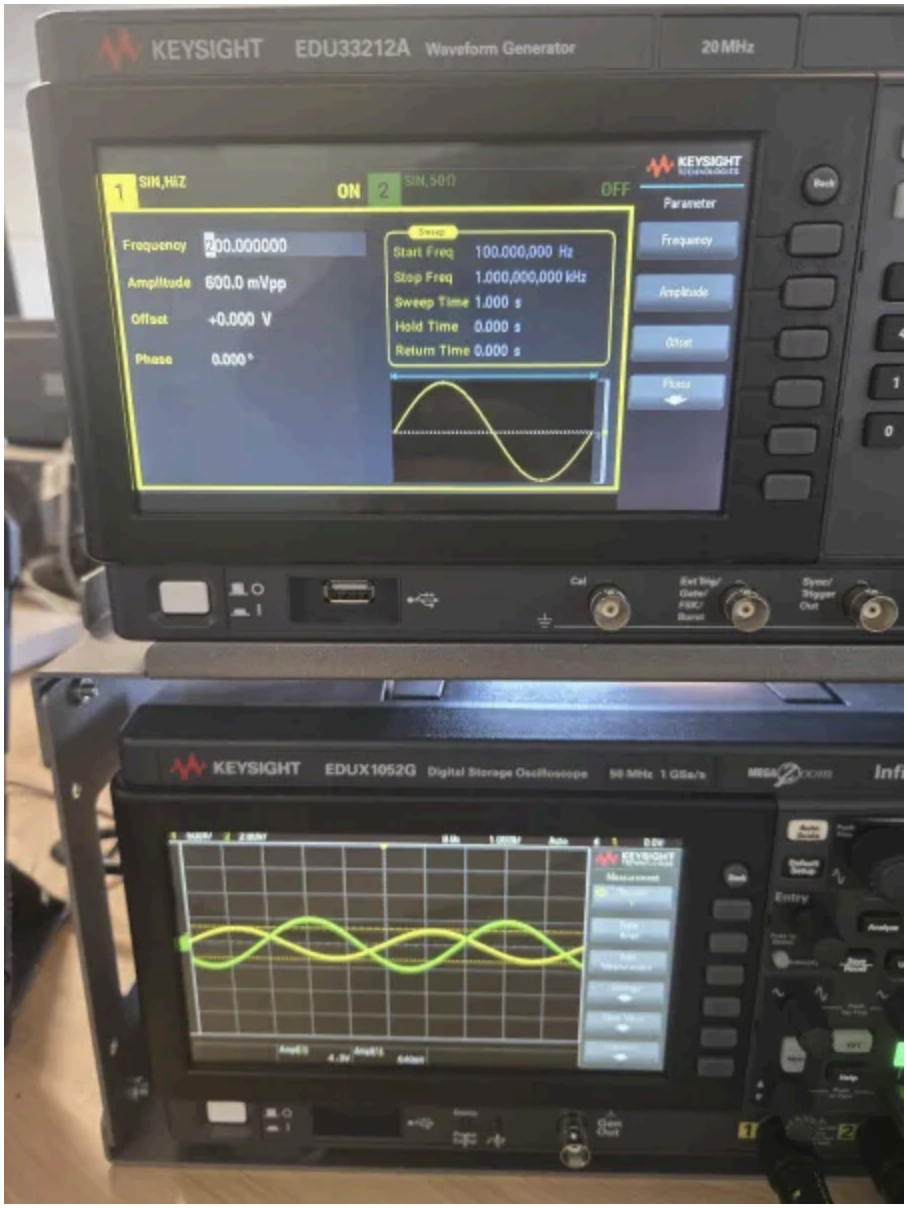
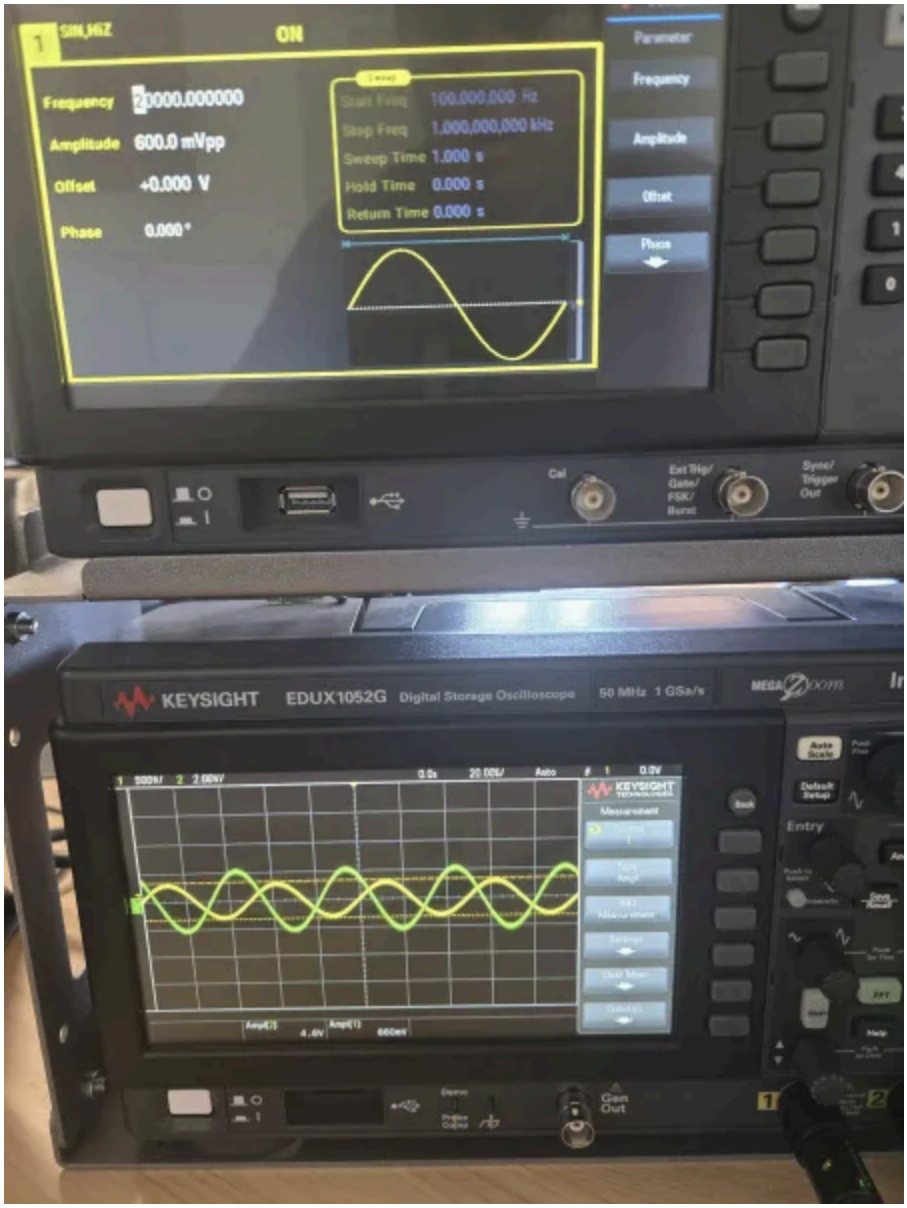
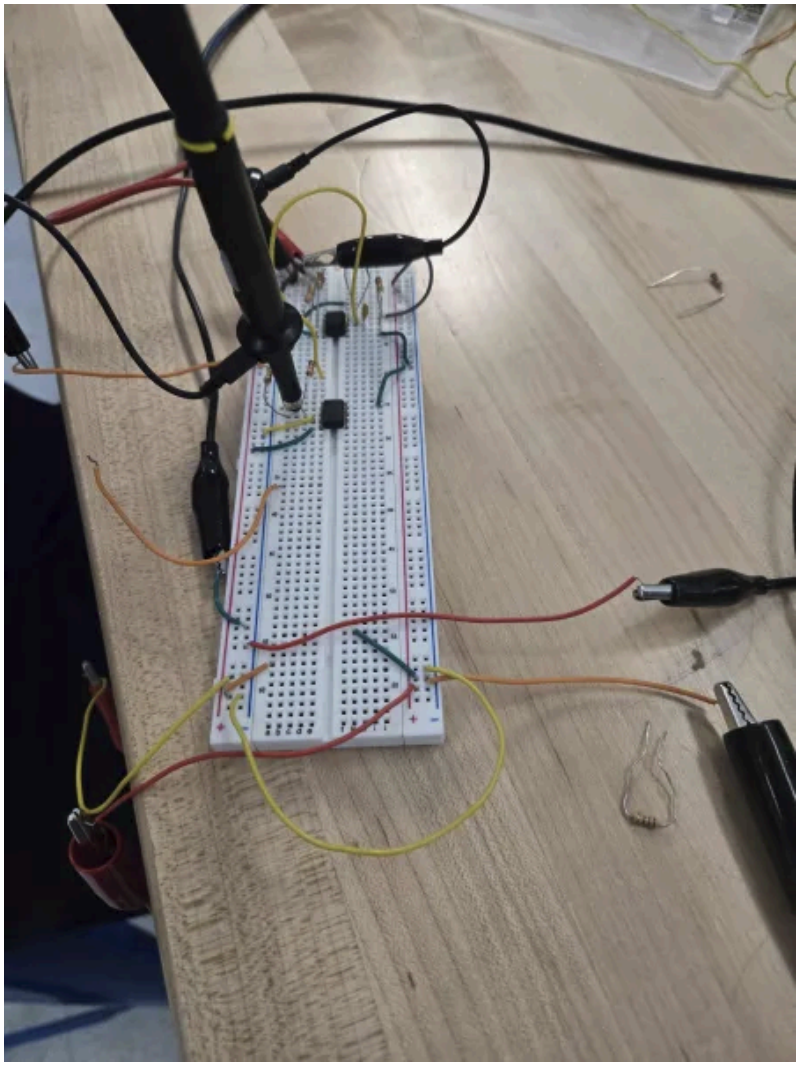



1 SIN,HiZ
ON
2 SIN,50Ω
OFF
KEYSIGHT
Parameter
Frequency
Amplitude
Offset
Phase
Frequency 200.000000
Amplitude 600.0 mVpp
Offset +0.000 V
Phase 0.000°
Start Freq 100.000,000 Hz
Stop Freq 1.000,000,000 kHz
Sweep Time 1.000 s
Hold Time 0.000 s
Return Time 0.000 s
KEYSIGHT EDUX1052G Digital Storage Oscilloscope 50 MHz 1 GSa/s


KEYSIGHT
EDU33212A
Waveform Generator
20 MHz
SIN,HiZ
ON
SIN,50Ω
OFF
Parameter
Frequency
Amplitude
Offset
Phase
200.000000
600.0 mVpp
+0.000 V
0.000°
Sweep
Start Freq 100.000,000 Hz
Stop Freq 1.000,000,000 kHz
Sweep Time 1.000 s
Hold Time 0.000 s
Return Time 0.000 s
KEYSIGHT
EDUX1052G
Digital Storage Oscilloscope
50 MHz 1 GSa/s
Entry


SIN_HZ
ON
Frequency 2000.000000
Amplitude 600.0 mVpp
Offset +0.000 V
Phase 0.000 °
Start Freq 100.000,000 Hz
Stop Freq 1,000,000,000 kHz
Sweep Time 1.000 s
Hold Time 0.000 s
Return Time 0.000 s
Parameter
Frequency
Amplitude
Offset
Phase
Cal
Ext Trig/ Gate/ FSK/ Burst
Sync/ Trigger Out
KEYSIGHT
EDUX1052G
Digital Storage Oscilloscope
50 MHz 1 GSa/s
MEGAZoom
Entry
Gen Out

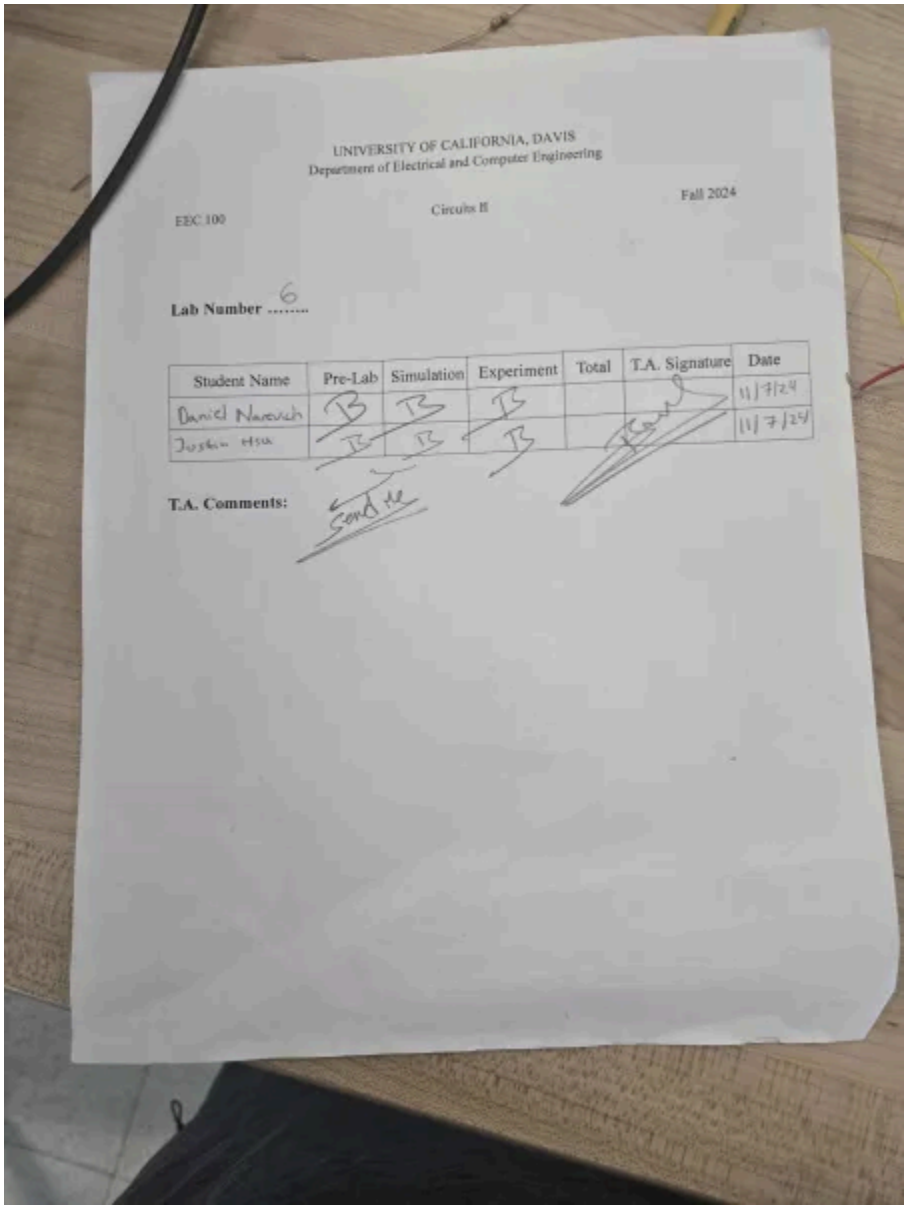


Our results meet the landline telephone specifications.

(5) Conclusion:

Our calculated values and simulated values matched the experimental values found in lab. While there is deviation due to the deviation in resistance and capacitance values, the general shape of the bode plots matched, and the cut off values were within an acceptable margin of error. By inputting a signal of various frequencies into the filter circuits, we were able to see just how the various frequencies were manipulated by the filter-whether they were let through or attenuated. Through this experiment my understanding of how active bandpass filter circuits work improved, and I can intuitively predict how a certain input signal will be affected by the filter circuit given its specifications.

(6) Checkoff:



UNIVERSITY OF CALIFORNIA, DAVIS
Department of Electrical and Computer Engineering

EEC 100 Circuits II Fall 2024

Lab Number 6

Student Name	Pre-Lab	Simulation	Experiment	Total	T.A. Signature	Date
Daniel Navarro	B	B	B			11/7/24
Justin Hsu	B	B	B			11/7/24

T.A. Comments: Good job