PHYS 605 Lab#5

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I. BACKGROUND

II. METHODOLOGY

For the low pass filer:

$$|G| = \frac{1}{(1 + (\omega RC))^{\frac{1}{2}}} \tag{1}$$

For the High pass filter:

$$|G| = \frac{\omega RC}{(1 + (\omega RC)^2)^{\frac{1}{2}}} \tag{2}$$

$$\phi = arctan(\frac{1}{\omega RC}) \tag{3}$$

Gain of a casacde is $G_1 * G_2$

III. RESULTS AND ANALYSIS

LOW PASS FILTER: C=0.510nF, R=54.7kOhm expected characteristic f=5705.1Hz
The data collected for the low pass filter is shown below:

frequency	$V_{in}(mV)$	$V_{out}(V)$	$\phi(degrees)$
10.33Hz	4.56	4.32	0
66.67Hz	4.6	4.40	0
100.7Hz	4.6	4.40	3
520.8Hz	4.6	4.32	7
1.111kHz	4.6	4.24	16
3.205kHz	4.6	3.44	41
5.682kHz	4.6	2.72	57
8.197kHz	4.6	2.08	64
10.42kHz	4.6	1.76	73
60.24kHz	4.6	312mV	77
108.7kHz	4.6	180mV	86

The calculated data for the low pass filter is shown below:

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log(f)	Gain (dB)	$Gain_{expected}$ (dB)	% error
1.014	-0.4696	-0.0079	
1.824	-0.3861	-0.0505	
2.003	-0.3861	-0.0760	
2.717	-0.5455	-0.3793	
3.046	-0.7078	-0.7727	
3.506	-2.5240	-1.936	
3.755	-4.5638	-3.002	
3.914	-6.9691	-3.868	
4.018	-8.4201	-4.512	
4.780	-23.3721	-10.63	
5.036	-28.1497	-13.02	

HIGH PASS FILTER: C=1.526nF, R=55.0kOhm expected characteristic f=1896.3Hz
The data collected for the high pass filter is shown below:

frequency	$V_{in}(mV)$	$V_{out}(V)$	$\phi(degrees)$
10.37Hz	4.48	36mV	-80
60.24Hz	4.6	152mV	-86
106.4Hz	4.6	248mV	-90
257.9Hz	4.6	1.44	-71
862.1Hz	4.6	1.8	-60
1.894kHz	4.6	3.04	-43
5.618kHz	4.6	3.92	-20
6.494kHz	4.6	4.00	-18
10.31kHz	4.6	4.00	-7
46.30kHz	4.6	4.00	-3
108.7kHz	4.6	4.00	0

The data calculated for the high pass filter is shown below:

log(f)	Gain (dB)	$Gain_{expected}$ (dB)	% error
1.016	-41.8995	-45.24	
1.780	-29.6183	-29.96	
2.027	-25.3661	-25.03	
2.411	-10.0879	-17.4	
2.936	-8.1497	-7.663	
3.277	-3.5977	-3.016	
3.750	-1.3894	-0.4686	
3.813	-1.2140	-.3554	
4.013	-1.2140	-0.1445	
4.666	-1.2140	-0.0073	
5.036	-1.2140	-0.0013	

BAND PASS FILTER (out of low pass to in of high pass):
The data collected for the band pass filter is shown below:

frequency	$V_{in}(mV)$	$V_{out}(V)$	$\phi(degrees)$
10.33Hz	4.6	29.6mV	
68.49Hz	4.6	168mV	
108.7Hz	4.6	248mV	
625.0Hz	4.6	1.24	
1.020kHz	4.6	1.60	-29
3.425kHz	4.6	1.84	-25
8.197kHz	4.6	1.44	41
13.16kHz	4.6	1.12	53
60.24kHz	4.6	272mV	82
108.7kHz	4.6	163mV	89

The data calculated for the band pass filter is shown below:

log(f)	Gain (dB)	$Gain_{expected}$ (dB)	% error
10.33Hz	-43.8293	29.6mV	
68.49Hz	-28.7490	168mV	
108.7Hz	-25.3661	248mV	
625.0Hz	-11.3867	1.24	
1.020kHz	-9.1728	1.60	
3.425kHz	-7.9588	1.84	
8.197kHz	-10.0879	1.44	
13.16kHz	-12.2708	1.12	
60.24kHz	-24.5638	272mV	
108.7kHz	-28.9583	163mV	

NEED TO SAY THAT WHEN THE VOLTAGE GETS LOW, THE MEASURMENTS GO TO SHIT, HAPPENED BEFORE TOO

IV. CONCLUSION

V. REFERENCES