B O Ğ A Z İ Ç İ U N I V E R S I T Y
ELECTRICAL&ELECTRONIC ENGINEERING DEPARTMENT

EE327-NETWORKS LAB. REPORT

Number of The Experiment :***10-11***
Name of The Experiment :***Computer Simulations***

Name of The Student: ***Çağdaş Kayra Akman***

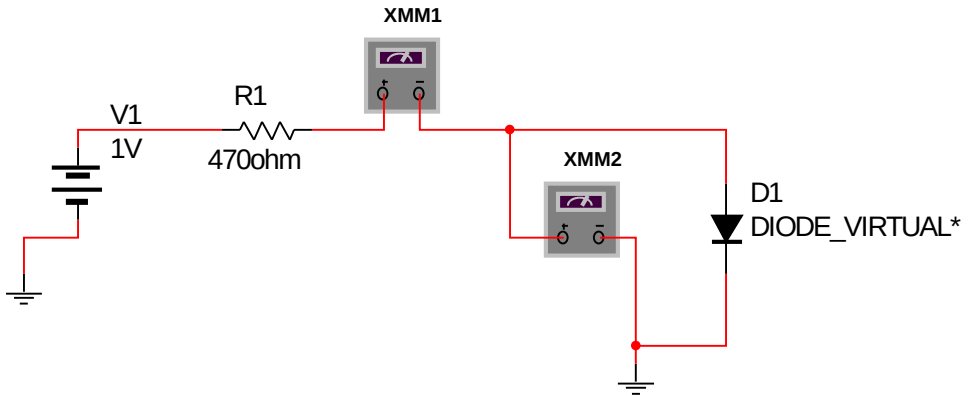
Dadline for The Submmission of the Report	10.01.2003
Date of The Submmission of the Report:	10.01.2003

Delay

EXPERIMENT 10

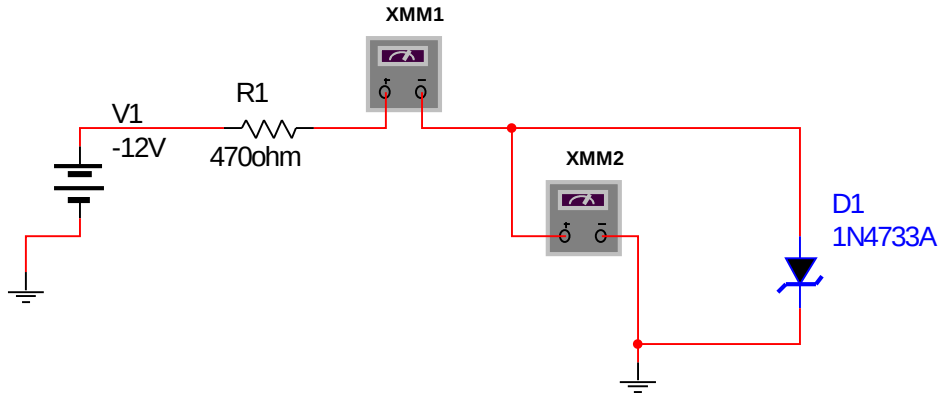
Experiment 1:

Part 4:



	1	2	3	4	5	6	7	8	9	10	11
$V_{supply}(V)$	0	0.4	0.5	0.6	1	1.2	-2	-4	-5	-10	-12
$V_{Diode}(V)$	0	0.4	0.49	0.58	0.65	0.66	-2	-4	-5	-10	-12
$I_{Diode}(mA)$	0	0	0.02	0.05	0.75	1.15	0	0	0	0	0

Part 5:



	1	2	3	4	5	6	7	8	9	10	11
$V_{supply}(V)$	0	0.4	0.5	0.6	1	1.2	-2	-4	-5	-10	-12
$V_{Diode}(V)$	0	0.4	0.44	0.46	0.50	0.50	-2	-4	-4.94	-5.06	-5.07
$I_{Z\text{-}diode}(mA)$	0	0.02	0.13	0.29	1.07	1.48	0	0	-0.12	-10.5	-14.75

Experiment 2

Part 4:

```
Exp2 Part 4
V1 1 0 ac 0.5 dc 5
r1 1 2 10k
c2 2 0 10n
.op
.ac dec 200 1 100meg
.PROBE
.END
```

Frequency(kHz)	0.2	0.5	1	2	5	10	20
Output(V)(RMS)	0.496	0.476	0.423	0.310	0.150	0.078	0.030
Ouput(dB)							

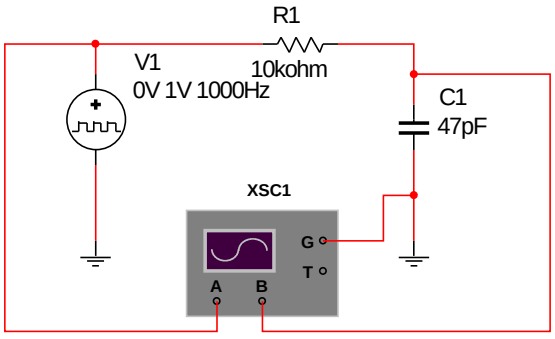
Part 9:

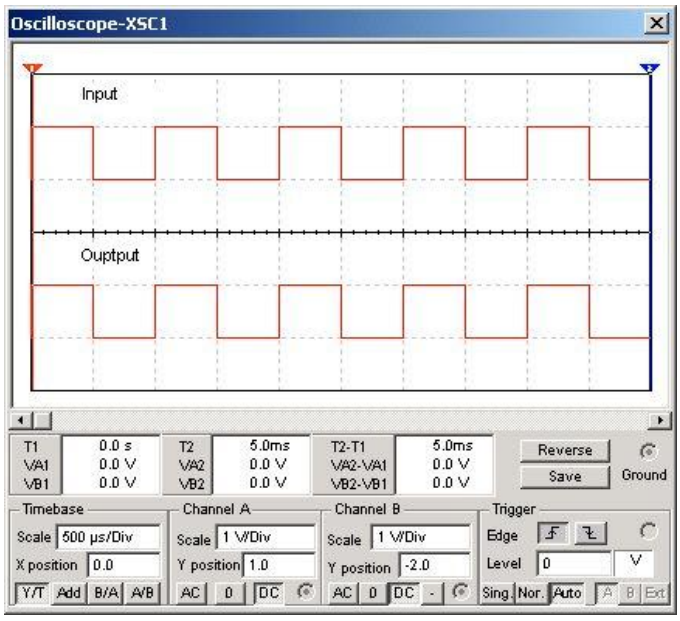
```
Exp2 Part 9
V1 1 0 ac 0.5 dc 5
r1 2 0 10k
c2 1 2 10n
.op
.ac dec 200 1 100meg
.PROBE
.END
```

Frequency(kHz)	0.2	0.5	1	2	5	10	20
Output(V)(RMS)	0.063	0.150	0.270	0.391	0.475	0.494	0.498
Ouput(dB)							

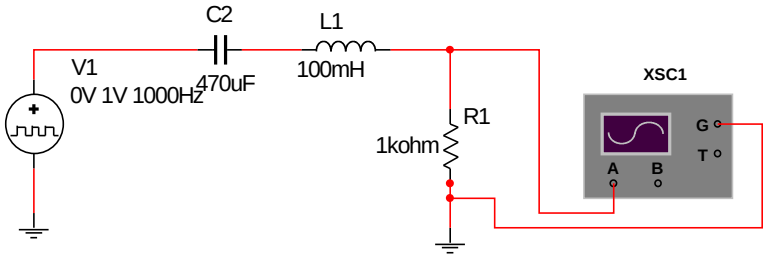
Experiment 3:

Part 3:

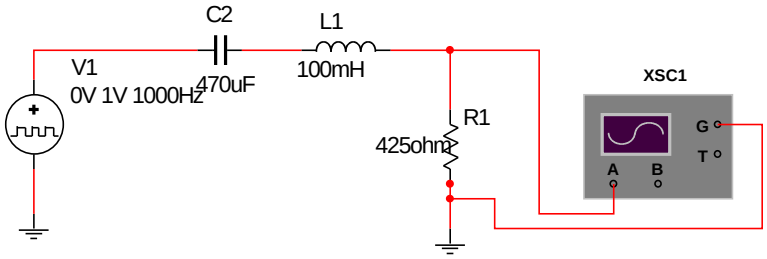




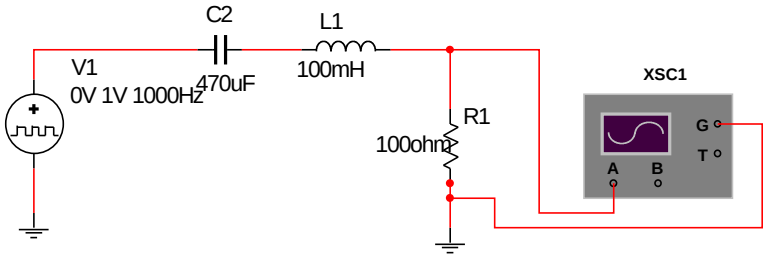
Part 14:



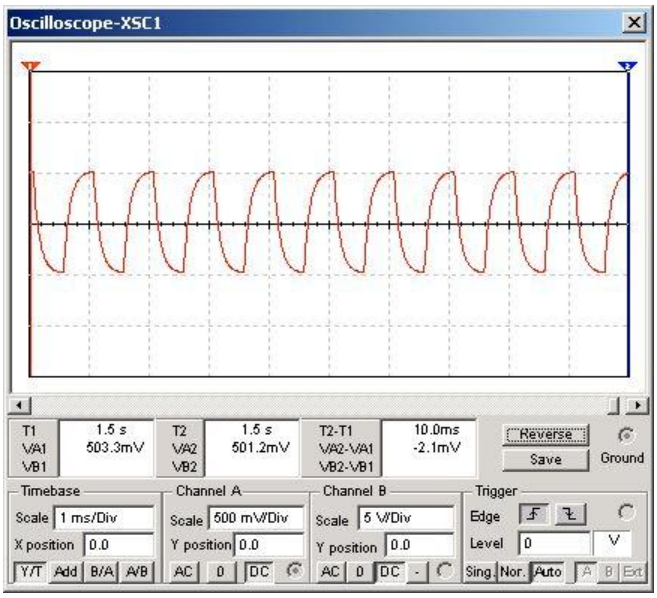
(RC/2L)=2.35>1

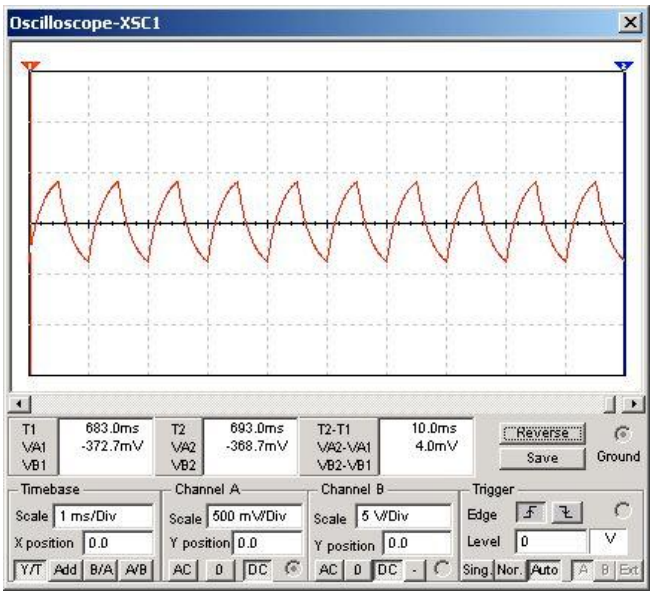


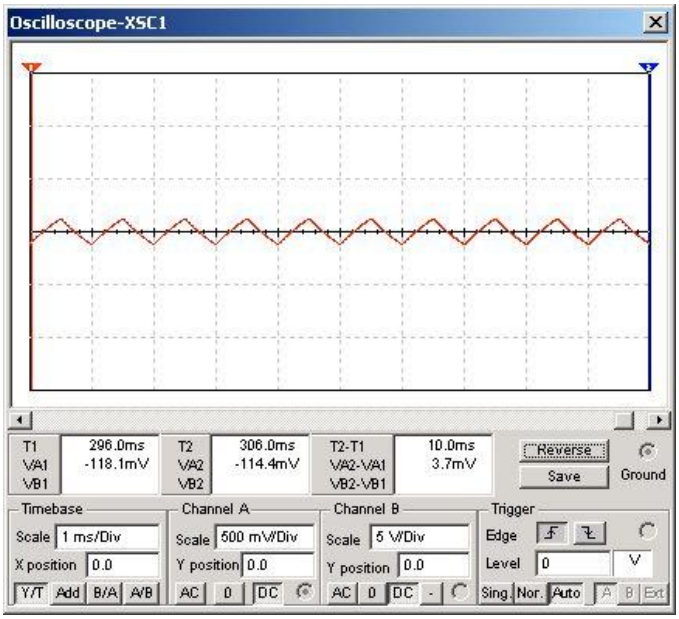
With R=425Ω, (RC/2L)≅1



With R=100Ω, (RC/2L)<1

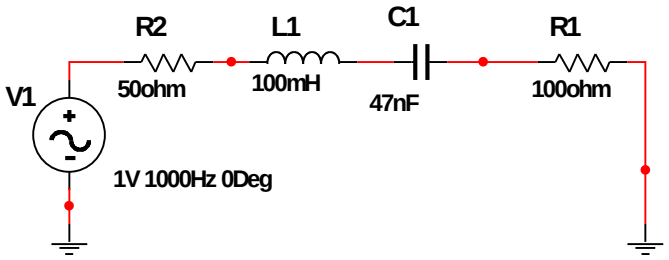


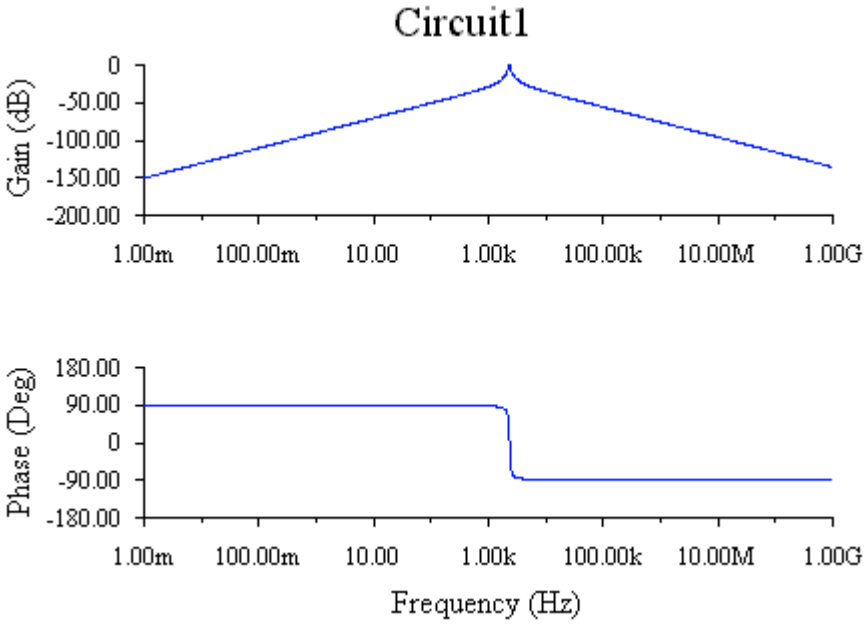




Experiment 4:

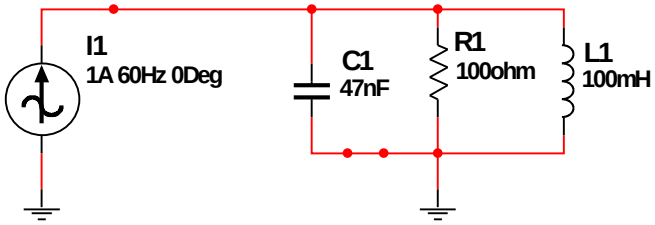
Series RLC Circuit and its bode plot: The bode plot is obtained with Multisim using the Bode Plotter tool.

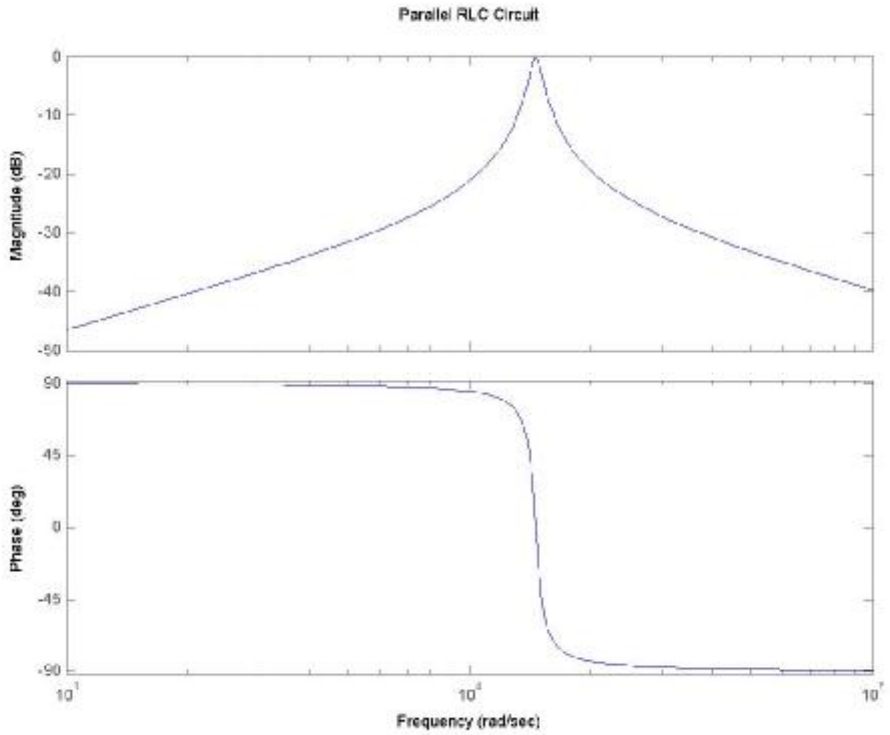




Parallek RLC Circuit and its bode plot: In the experiment a high resistance was conected in series with the voltage source to obtain a current source. The bode plot of the circuit is obtained with MATLAB using the transfer function

$$H(jw) = \frac{R}{R + jwL + \frac{1}{jwC}}$$





Experiment 5:

Bode plots for the 3rd order Butterworth filters are obtained from the transer functions below:

1. A 3rd order Butterworth low pass filter of has the transfer function:

$$H(s) = \frac{\omega^3 / 2}{s^3 + 2\omega s^2 + 2\omega^2 s + \omega^3},$$

where ω is the cut-off frequency in rad/sec.

A 3rd order Butterworth high-pass filter has the transfer function:

$$H(s) = \frac{s^3 / 2}{s^3 + 2\omega s^2 + 2\omega^2 s + \omega^3},$$

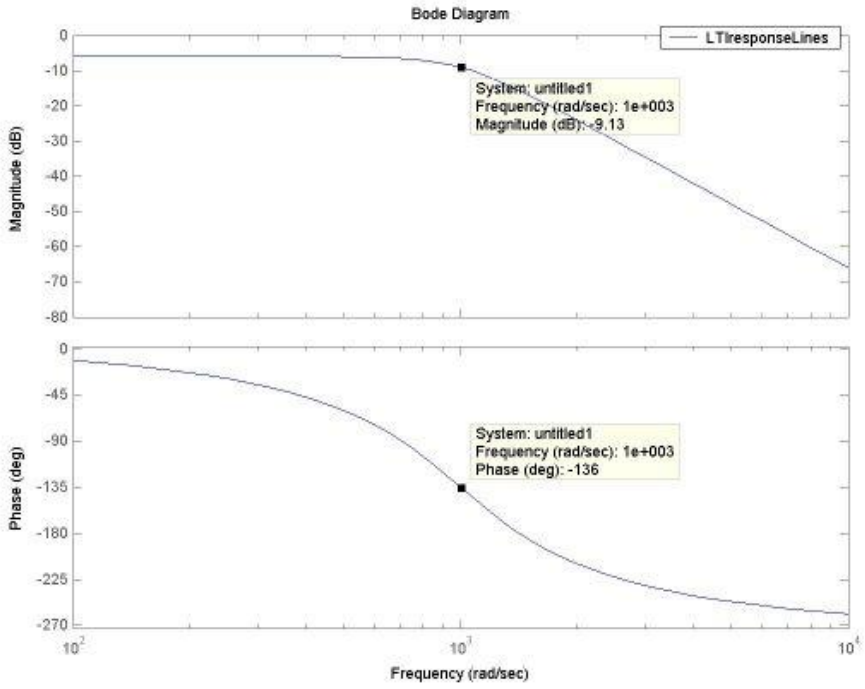
where ω is the cut-off frequency in rad/sec.

A 3rd order Butterworth band-pass filter has the transfer function:

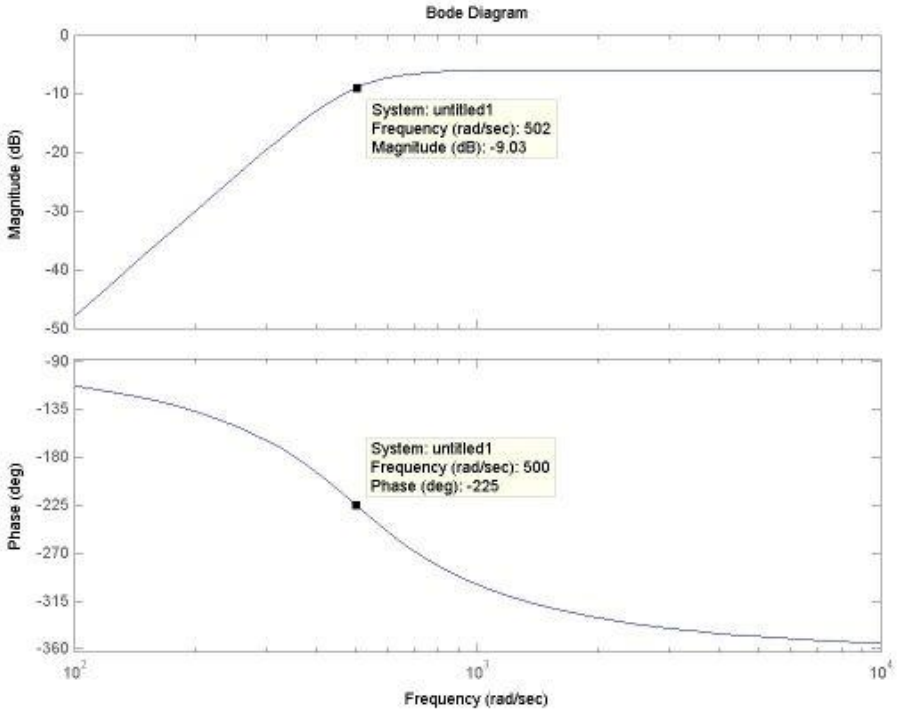
$$H(s) = \frac{1}{2}\frac{B^3 s^3}{s^6 + 2Bs^5 + 2B^2 s^4 + B^3 s^3 + 3\omega^2 s^4 + 4B\omega^2 s^3 + 2B^2\omega^2 s^2 + 3\omega^4 s^2 + 2B\omega^4 s + \omega^6},$$

These transfer functions are obtained using MATLAB:

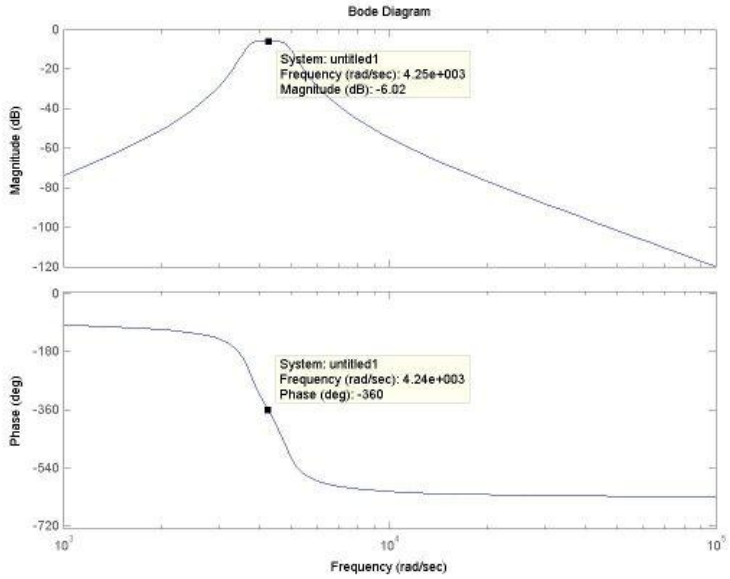
Butterworth LPF (f_c=159Hz ω_c=1000rad/sec)



Butterworth HPF (f_c=159Hz ω_c=1000rad/sec)

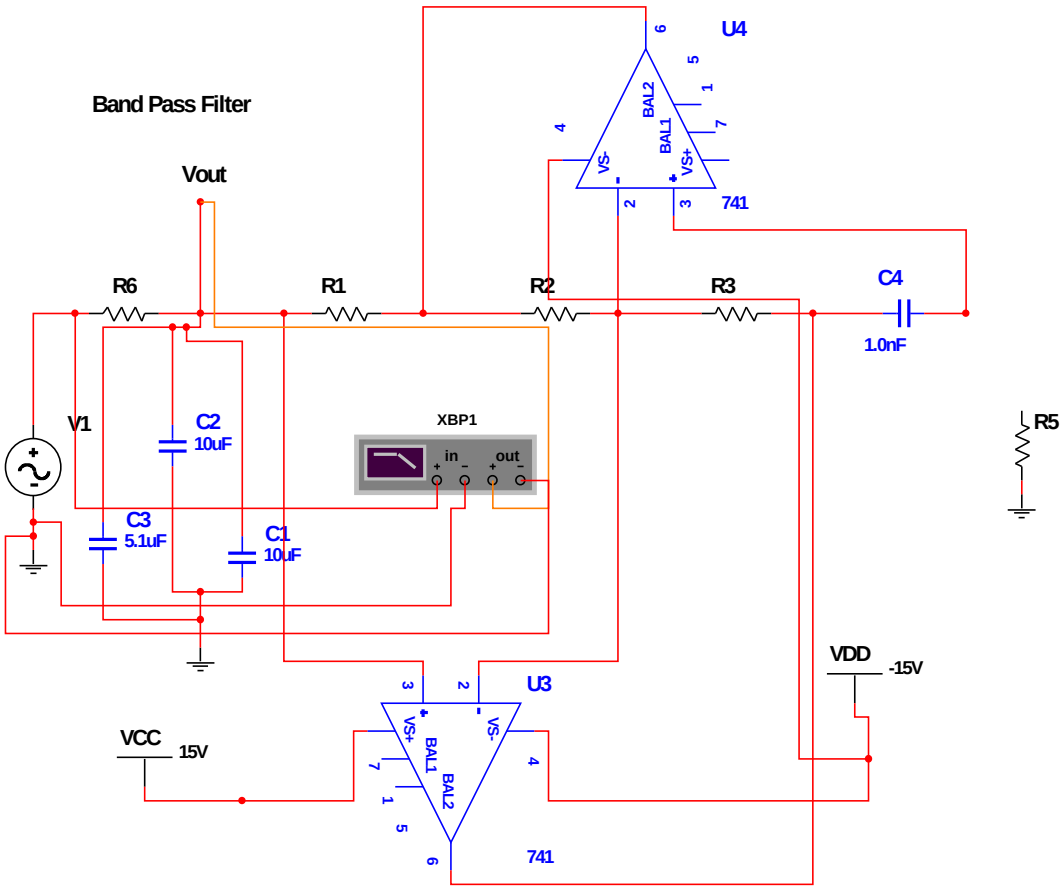


Butterworth BPF (f_c=675Hz ω_c=4240rad/sec, BW=200Hz B=1260rad/sec)

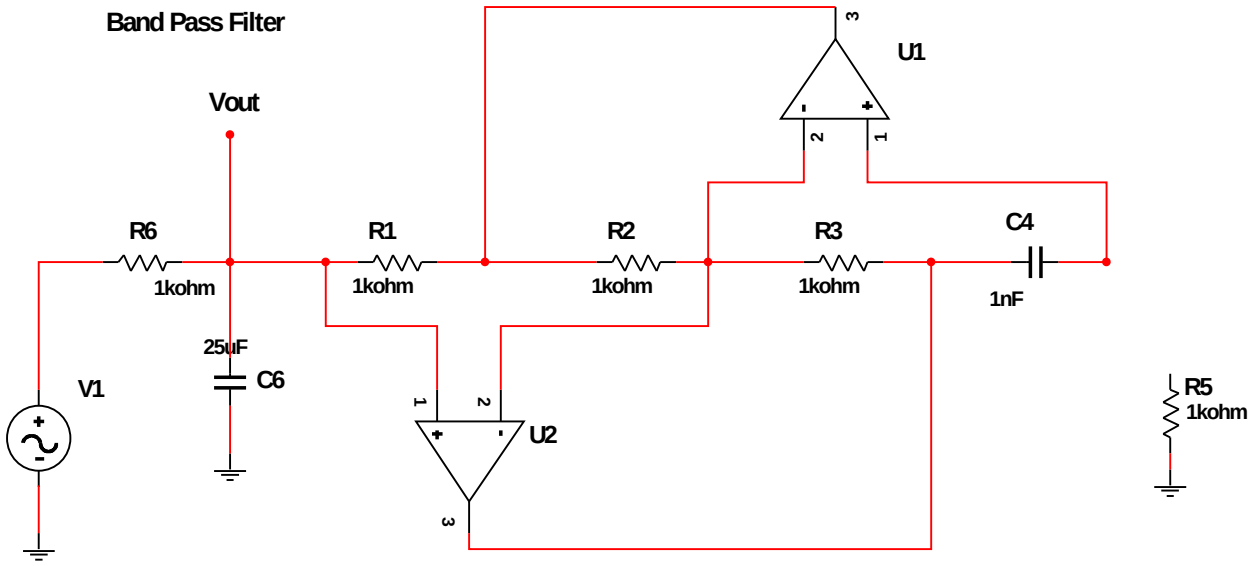


Experiment 9:

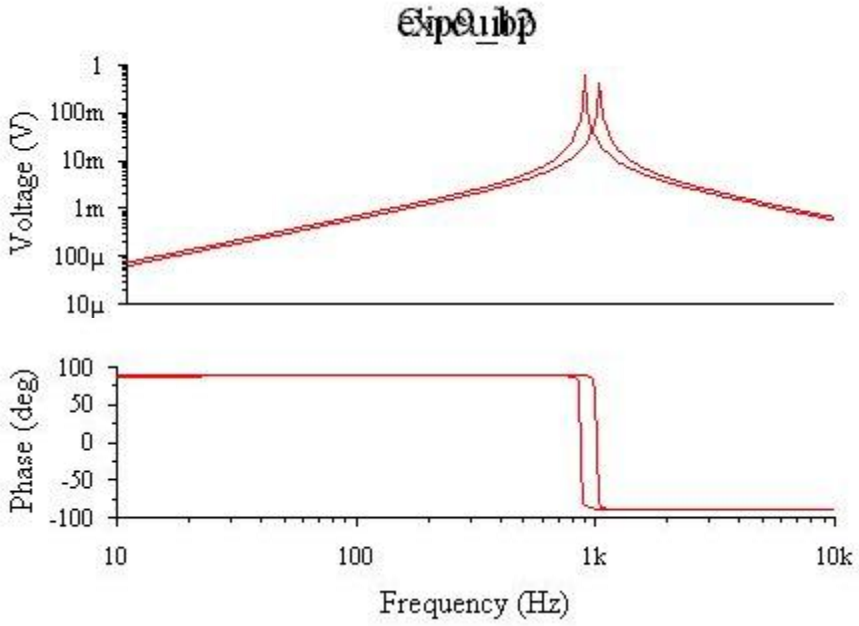
The circuit to simulate the band pass filter. The capacitors and op-amps are substituted with actual models.



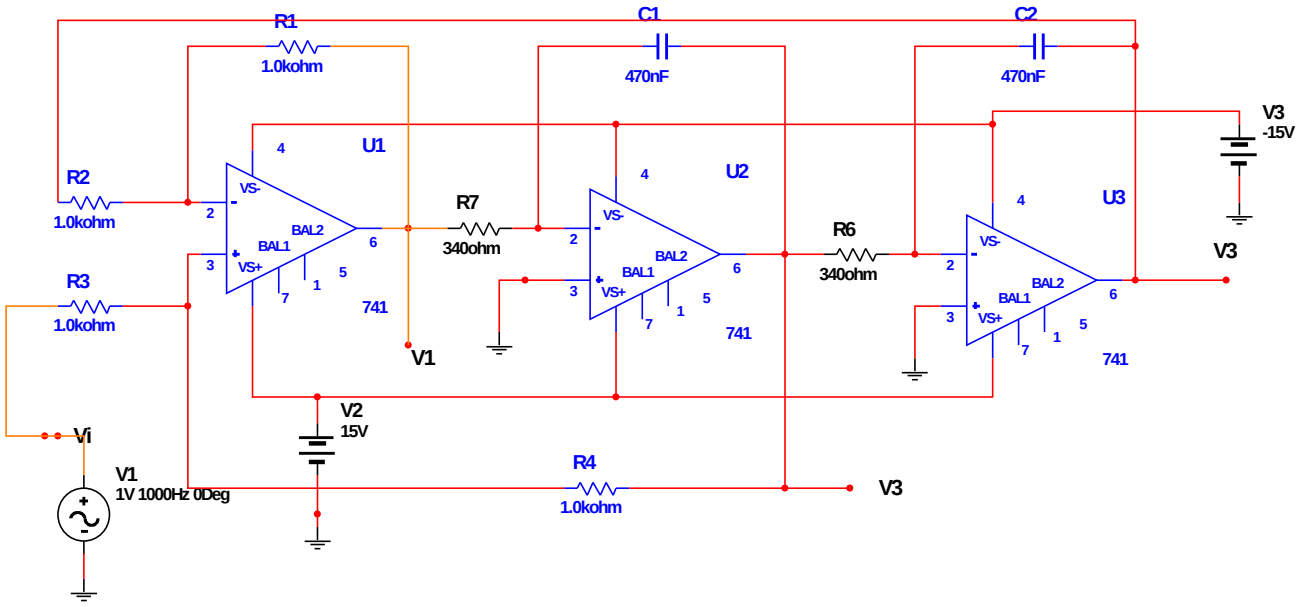
The circuit with ideal models:



The bode plots obtaine from these circuits are put on top of each other to observe the differences:
The center frequencies are somwhat different. Moreover, the pick values in magnitude plots are slightly different.

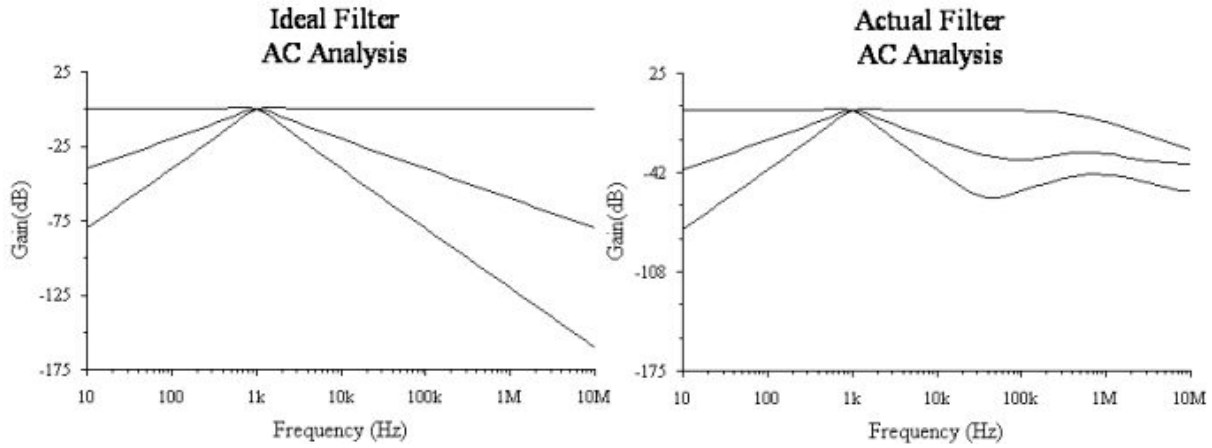


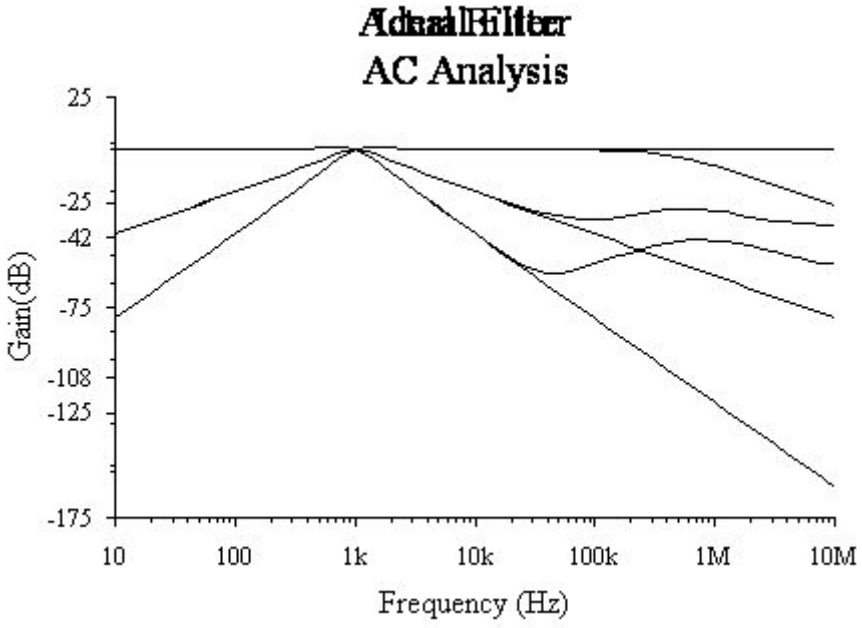
EXPERIMENT 11

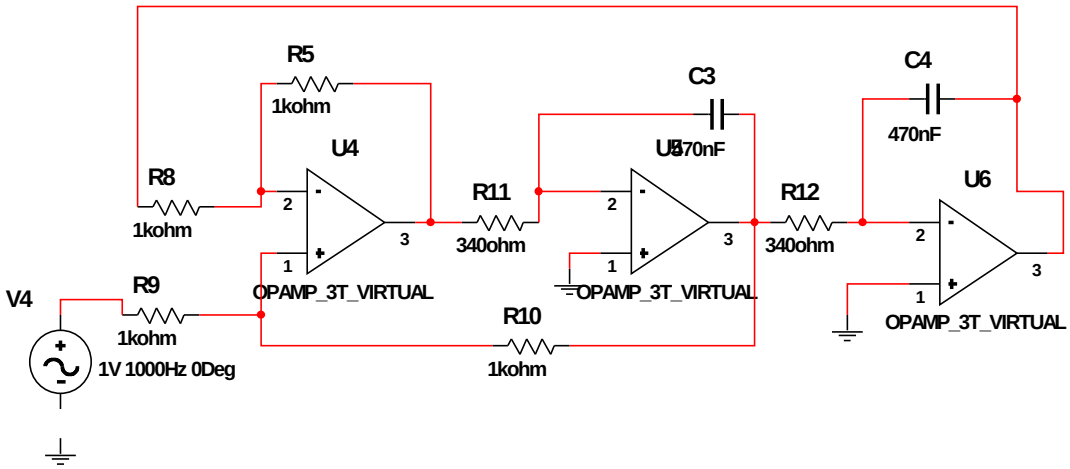


Actual Filter (f_0=1kHz)

For f_0=1kHz and Q=1: $R_0=R_1=R_2=R_3$=1kΩ, R=340Ω, C=470nF

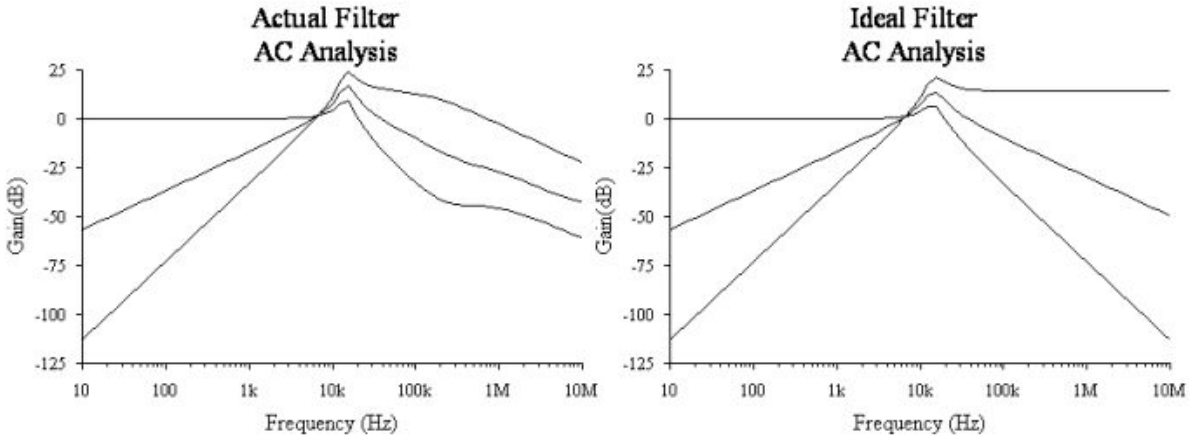


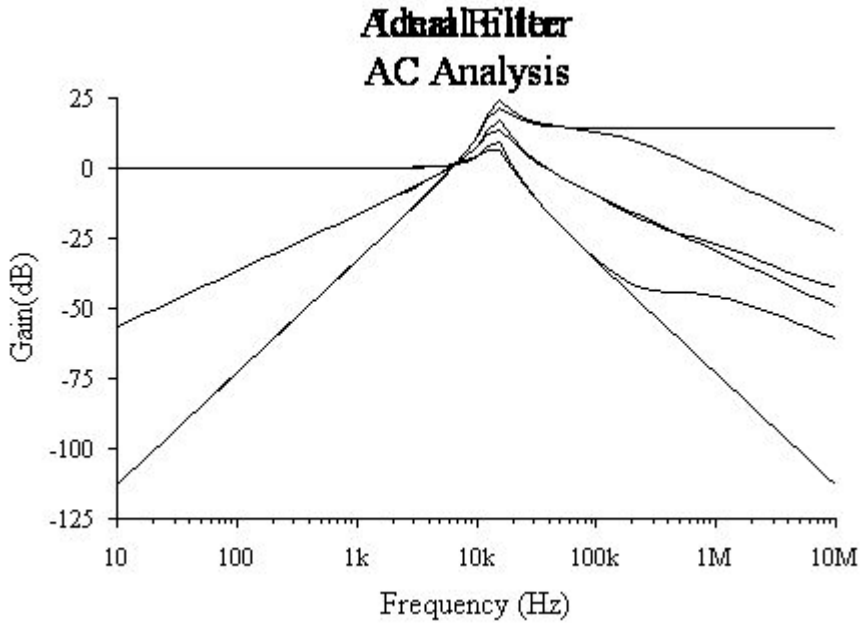




Ideal Filter (f_o=1kHz)

For f_o=10kHz and Q=5: R_0=R_3=5.1kΩ, R_1=R_2=1kΩ, R=470Ω, C=51nF.





Usage of three op-amps is the main reason that the ideal and actual results differ. Unlike the ideal op-amp, actual op-amps have finite input resistance, draw current, have finite gain. Therefore, after a certain frequency, the responses of actual filters become distorted.