J. Sargeant Reynolds Community College

Electric Circuit Laboratory

EGR 255

Final Lab

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Objective

Summarize labs worked on throughout the semester. The main objective of this report is to tell what you have learned during this semester.

Scientific Background

Lab 1 - ***Fundamentals***

Lab 2 - ***MultiSim, Voltage & Current Division***

Lab 3 ***- Loop & Node Analysis***

Lab 4 - ***Transformation using Delta -Wye Mesh & Node Analysis***

Lab 6 - ***Operational Amplifiers***

Experimental procedure

Lab 1 - ***Fundamentals***

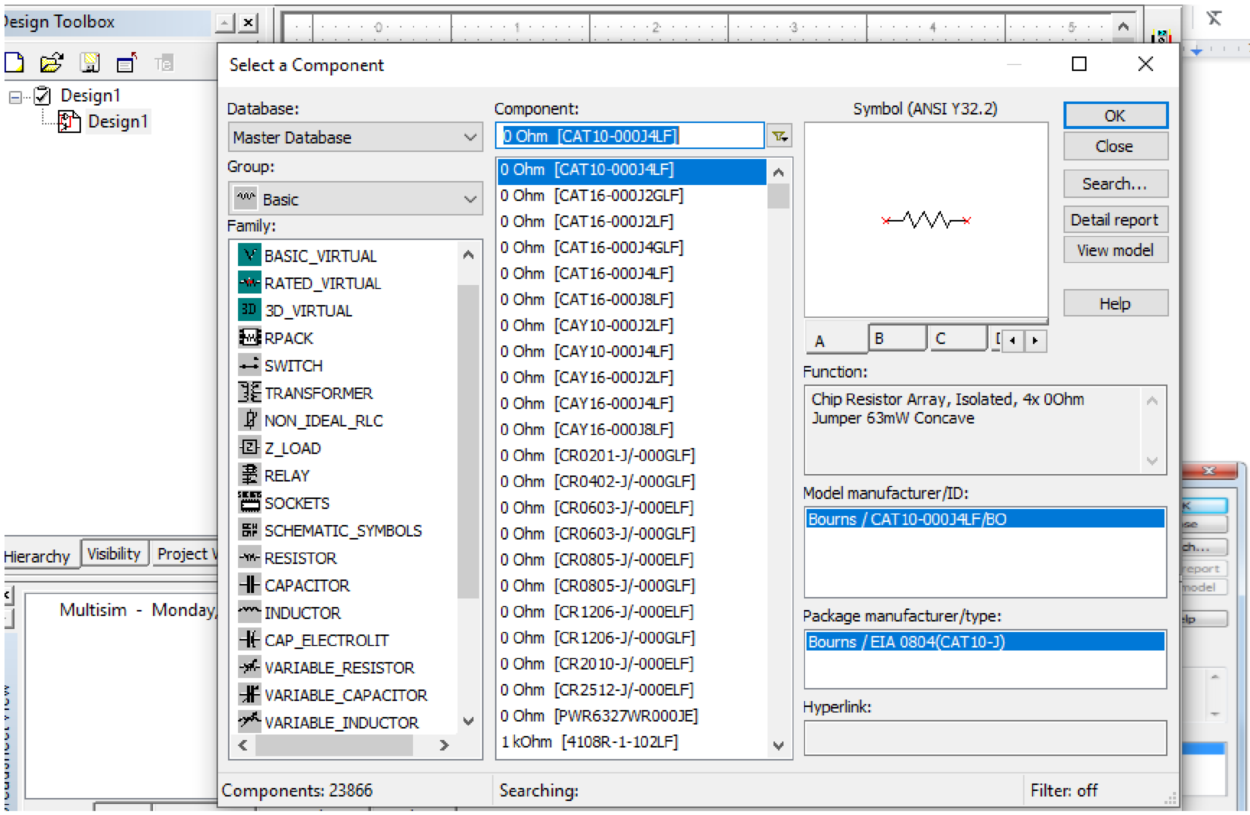
Learning how to measure the voltage across in a resistor is equivalent to current.

Lab 2 - ***MultiSim, Voltage & Current Division***

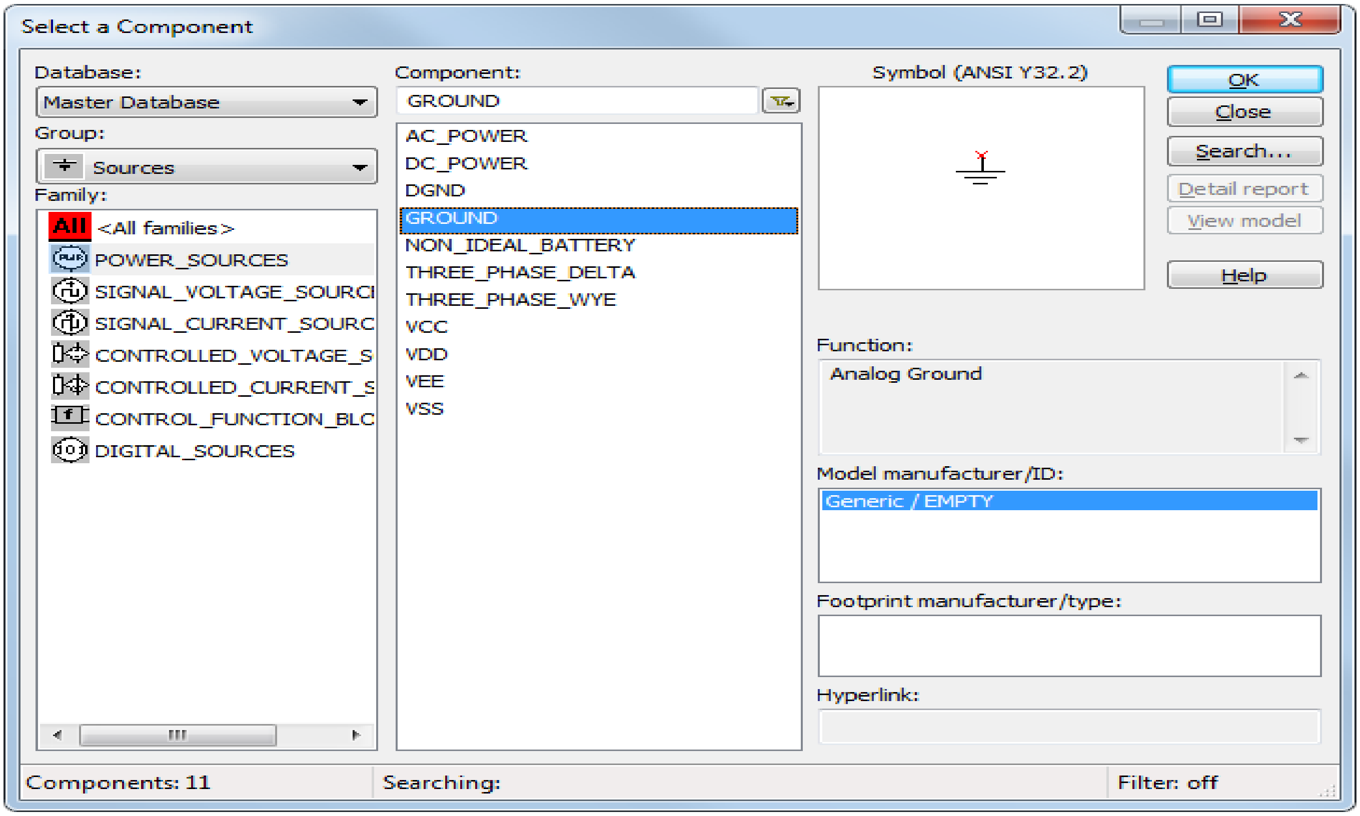
MultiSim

How to build a circuit on Multisim

Resistor



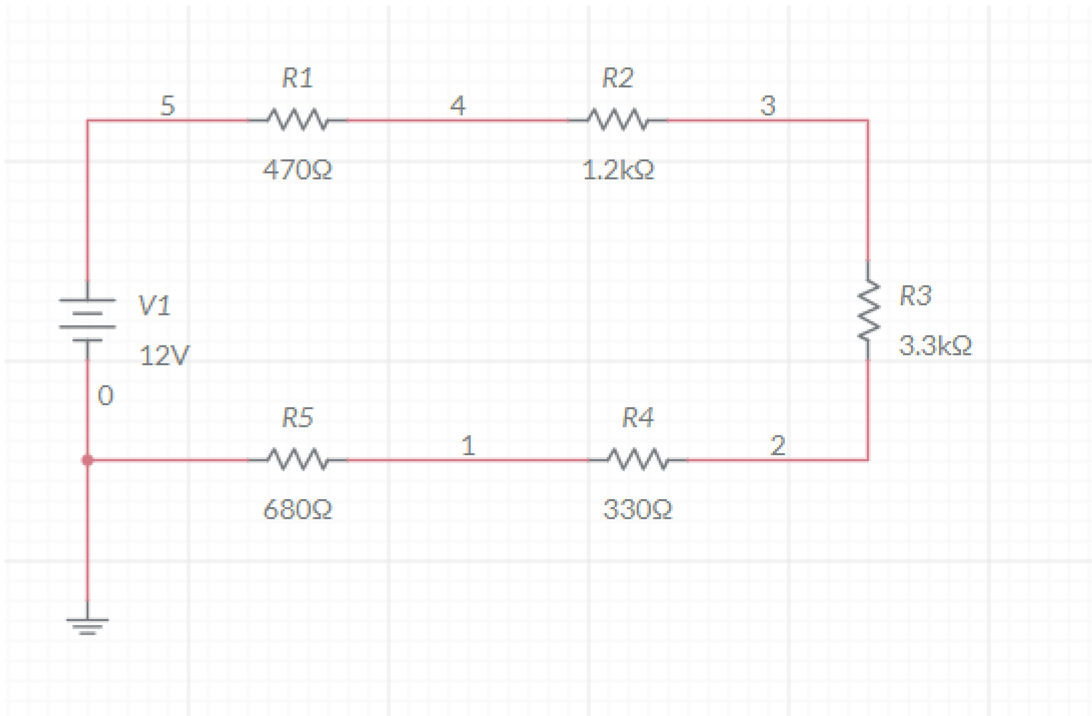
Ground



Lab 3 - *Loop & Node Analysis*

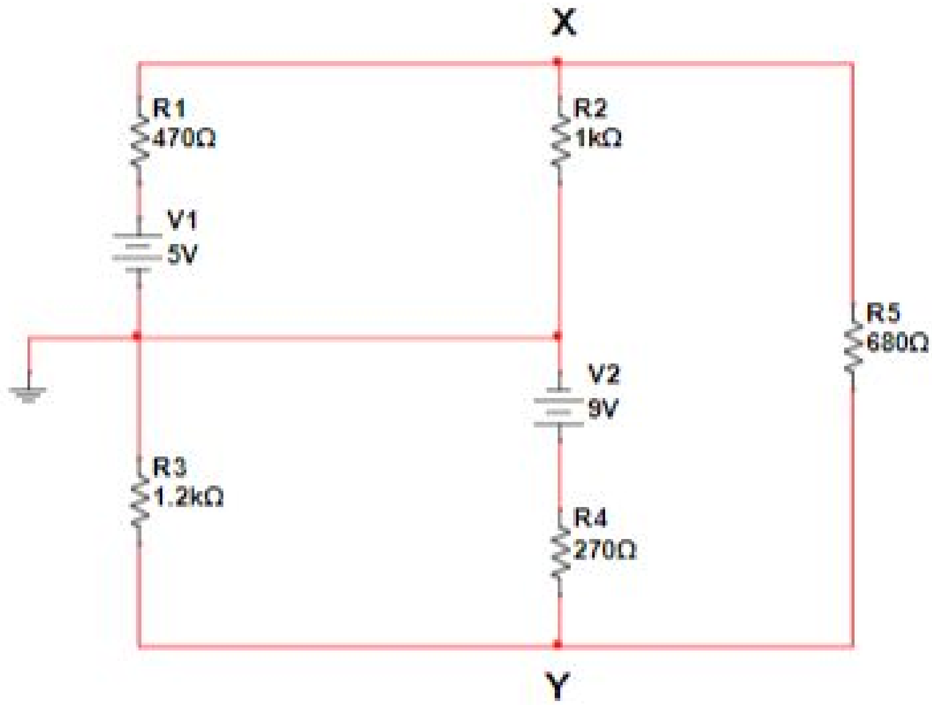
Using the data that was collected, a table was constructed that allows for the computation of the voltage across, the current through, and the power dissipated in each resistor. Then loop analysis was used to compute the current in the loop and Ohm's law and Watts Law for the voltage and power.

Series Circuit



Lab 4 -*Transformation using Delta -Wye Mesh & Node Analysis*

This part of this experiment was mesh current and node voltage analysis. The objective of this lab is to use loop current analysis and node voltage analysis to calculate the current and voltage. MultiSim was used to simulate the circuits to provide values for comparison with the measured and calculated values.



Lab 6 - ***Operational Amplifiers***

For each configuration MultiSim was used to simulate the configuration and to build each amplifier choosing various values of Rs and Rf. For this lab 20k Ohms and 40k Ohms were used. The input and output voltages and gain for each configuration was recorded. The power supplies were then set at +/- 12 volts and an input signal of approximately 1 volt peak and 1000 hz (AC input). Non-inverting configuration was changed to the difference configuration, the final configuration. Signal was connected to both inputs and the difference was zero. The “weight” of one input was changed to see the effect on the output. Since Ra = Rb = Rc = Rd , V0 = Vb -Va so Va = Vb and V0 = 0. Therefore, 0 volts was used as in input for Va and Vb.

Results

Lab 1 - *Fundamentals*

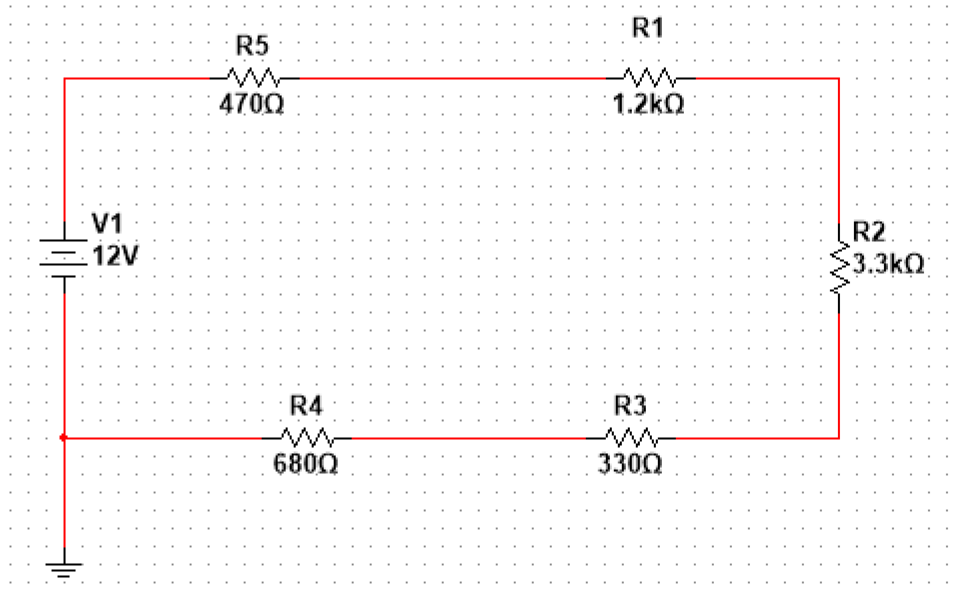
Ohm’s Law V=RI

V is the voltage in volts

R is the resistance in Ohms

I is the current in Amps

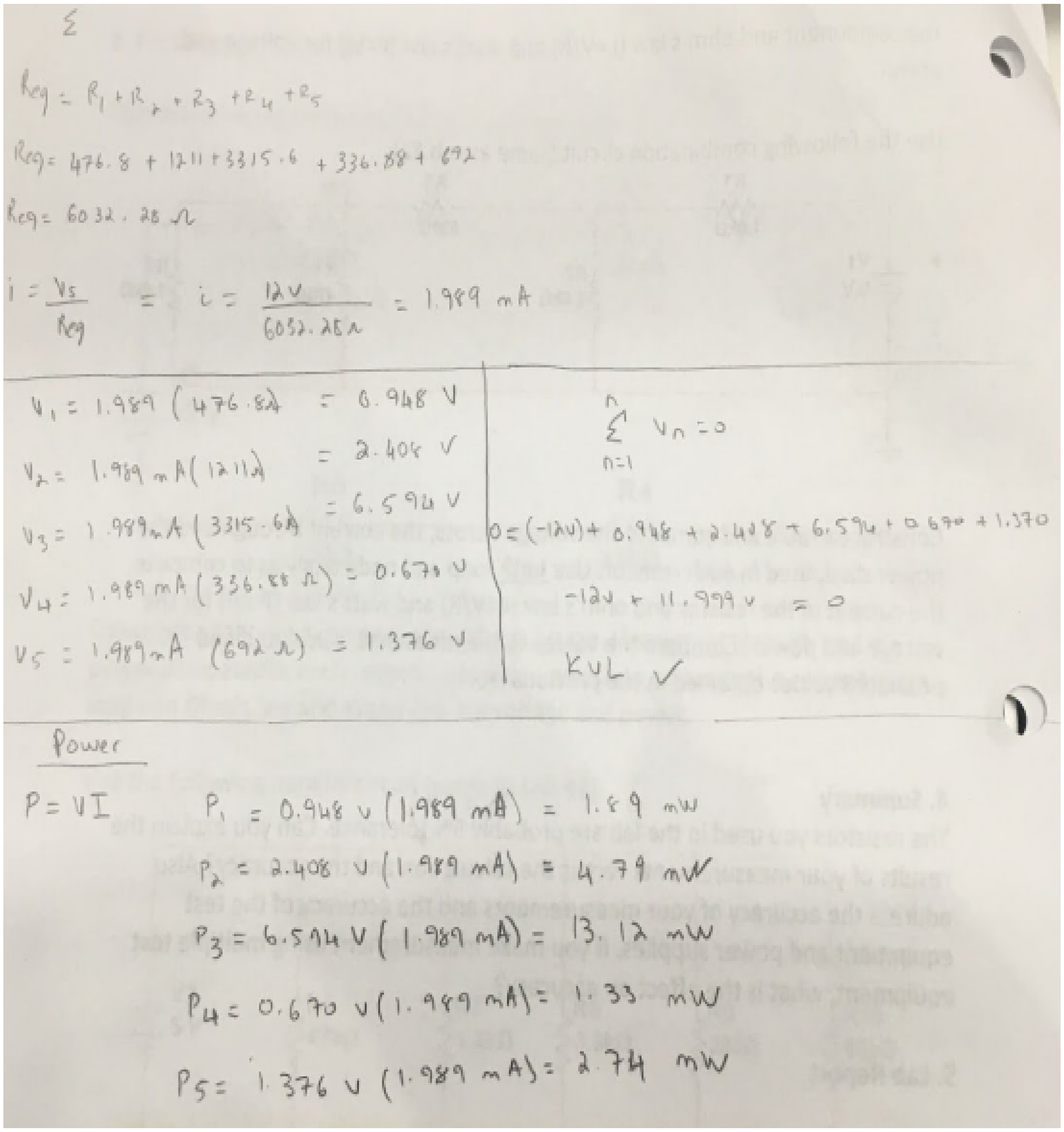
Lab 2 - *MultiSim, Voltage & Current Division*



Lab 3 - *Loop & Node Analysis*

Table 1: Series Circuit

Series Circuit									
Componen	Standard Value (Ω)	Actual Value (Ω)	Simulated		Calculated Standard Value		Measured		
			Voltage (V)	Current (ma)	Voltage (V)	Current (ma)	Voltage (V)	Current (mA)	Power (mW)
R1	470	476.8	0.943	2.007	0.943	2.007	0.9402	1.9869	1.868083
R2	1200	1211	2.408	2.007	2.408	2.007	2.4261	1.9869	4.820418
R3	3300	3315.6	6.622	2.007	6.622	2.007	6.697	1.9869	13.30627
R4	330	336.88	0.662	2.007	0.662	2.007	0.6628	1.9869	1.316917
R5	680	692	1.365	2.007	1.365	2.007	1.376	1.9869	2.733974
Req	5980	6032.28	12	2.007	12	2.007	12	1.9869	23.8428



Σ

$R_{eq} = R_1 + R_2 + R_3 + R_4 + R_5$

$R_{eq} = 476.8 + 1211 + 3315.6 + 336.88 + 692$

$R_{eq} = 6032.28\ \Omega$

$i = \frac{V_s}{R_{eq}} = i = \frac{12V}{6032.28\Omega} = 1.989\ mA$

$V_1 = 1.989(476.8\Omega) = 0.948\ V$

$V_2 = 1.989\ mA(1211\Omega) = 2.408\ V$

$V_3 = 1.989\ mA(3315.6\Omega) = 6.594\ V$

$V_4 = 1.989\ mA(336.88\ \Omega) = 0.670\ V$

$V_5 = 1.989\ mA\ (692\ \Omega) = 1.376\ V$

$\sum_{n=1}^{n} V_n = 0$

$0 = (-12V) + 0.948 + 2.408 + 6.594 + 0.670 + 1.370$

$-12V + 11.999\ V = 0$

KVL ✓

Power

$P = VI$

$P_1 = 0.948\ V(1.989\ mA) = 1.89\ mW$

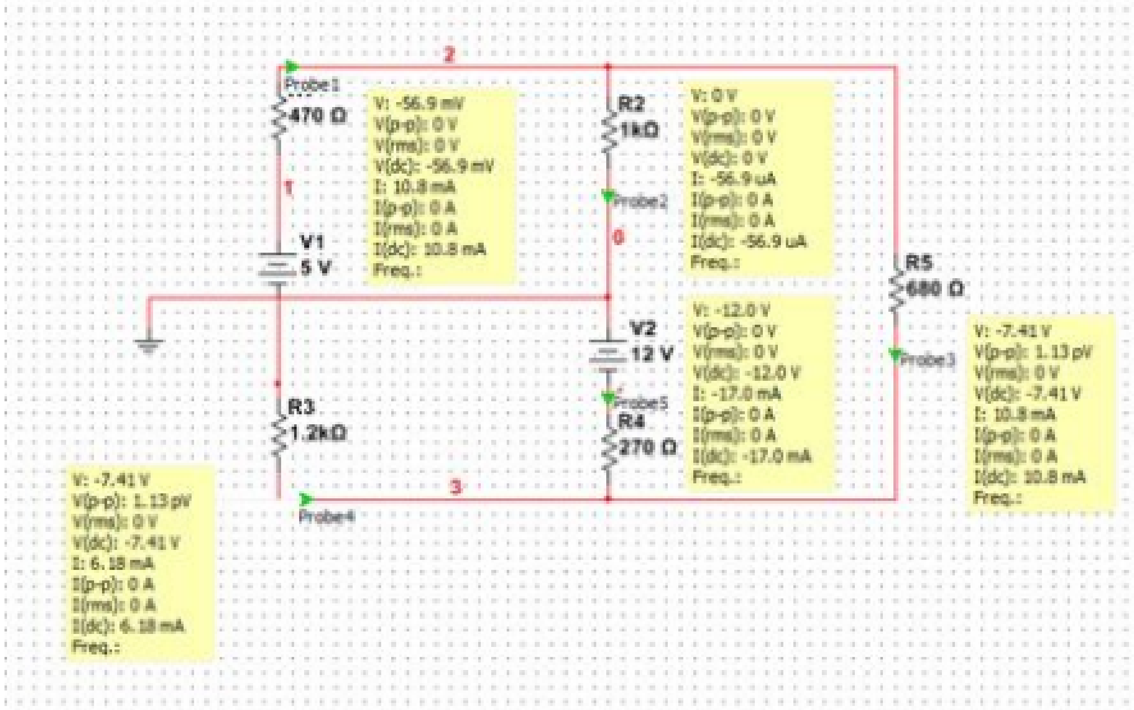
$P_2 = 2.408\ V(1.989\ mA) = 4.79\ mW$

$P_3 = 6.594\ V(1.989\ mA) = 13.12\ mW$

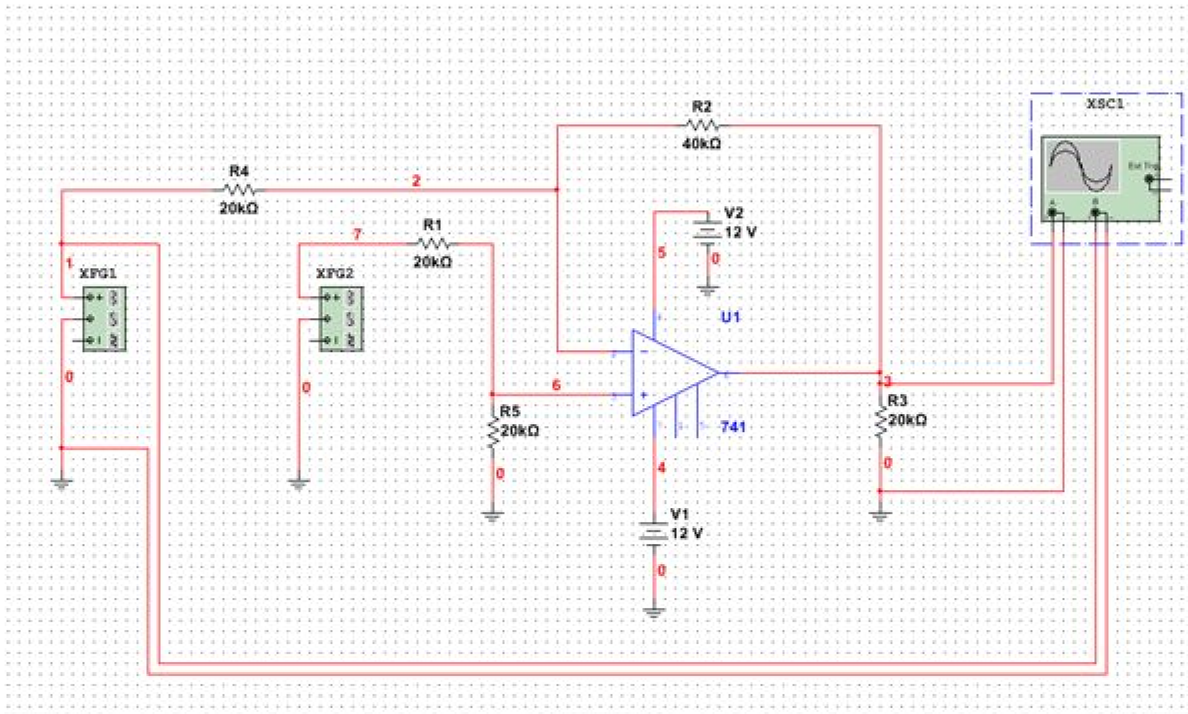
$P_4 = 0.670\ V(1.989\ mA) = 1.33\ mW$

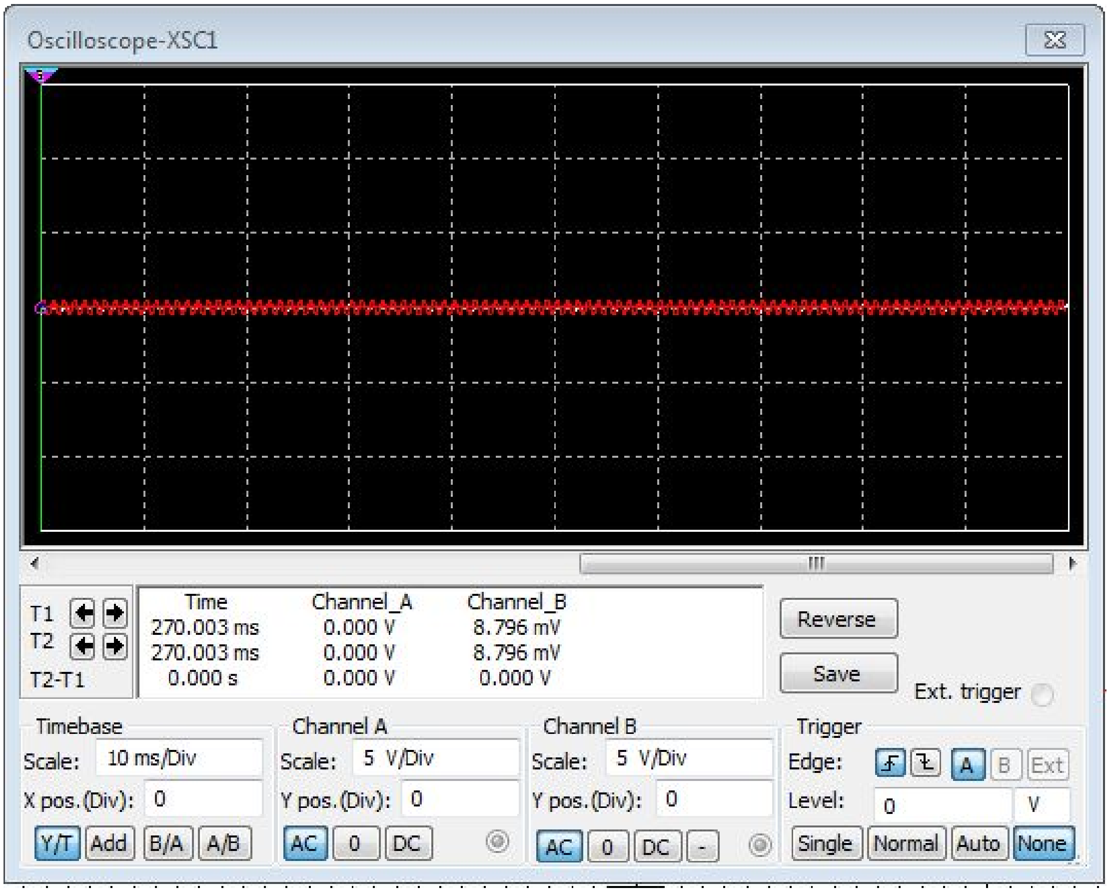
$P_5 = 1.376\ V(1.989\ mA) = 2.74\ mW$

Lab 4 -*Transformation using Delta -Wye Mesh & Node Analysis*



Lab 6 - *Operational Amplifiers*


XSC1
R2
40kΩ
R4
20kΩ
2
V2
12 V
7
R1
20kΩ
1
XFG1
XFG2
5
0
U1
0
6
3
R3
20kΩ
R5
20kΩ
741
0
0
4
V1
12 V
0



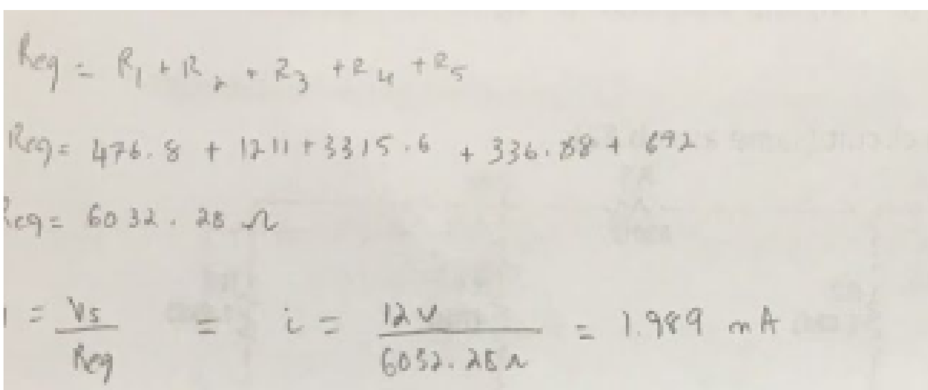
Oscilloscope-XSC1
T1
T2
T2-T1
Time
270.003 ms
270.003 ms
0.000 s
Channel_A
0.000 V
0.000 V
0.000 V
Channel_B
8.796 mV
8.796 mV
0.000 V
Reverse
Save
Ext. trigger
Timebase
Scale: 10 ms/Div
X pos.(Div): 0
Y/T Add B/A A/B
Channel A
Scale: 5 V/Div
Y pos.(Div): 0
AC 0 DC
Channel B
Scale: 5 V/Div
Y pos.(Div): 0
AC 0 DC -
Trigger
Edge: A B Ext
Level: 0 V
Single Normal Auto None

Conclusion

Lab 1 - ***Fundamentals***

Ohm's Law : relationship between voltage and current in a resistor. V=RI

Lab 2 - ***MultiSim, Voltage & Current Division***



Lab 3 - ***Loop & Node Analysis***

For the series circuit the currents continued to be the same throughout. The resistance, the current and voltage across is given by using Ohm's law.

Lab 4 -*Transformation using Delta -Wye Mesh & Node Analysis*

Mesh Current Analysis we separated into 3 loops and solved for I1, I2, I3, I4, & I5 usings.

Loop 1 : - VS1 + R1I1+ R2 (i1-i2) =0

Loop 2 : Vs2+R2 (i2+i1) +R5i2+R4 (i2-i3)=0

Loop 3 : -V2+R4 (i3-i2)+ R3i3=0

For the Node Voltage Analysis we solved for 2 nodes V1 and V2 using.

Node V1 : I1+I2+I5 = 0

(V1-Vs1/R1) + (V1-0/R2) +(V1-V2/R5) = 0

Node V2 : I3+I4+I6=0

(V2-0/R3)+(V2-Vs2/R4)+(V2-V1/R5) = 0

Lab 6 - *Operational Amplifiers*

Non inverting to difference configuration was confirming the output. In order for the difference to equal zero we connected the same signal to both inputs. The output generated is different when we change the weight of an input. This semester we have learned how to use the proper formulas to measure the voltage across and current in a circuit. How to compare Multisim with Breadboard making sure that the end results are close or accurate.