LAB NOTEBOOK

MUSTAFA SMAILI

EECT-111

MRS ALBA

EECT111 – 51C

Lab 1 –Resistor Variability

Names: Mustafa Smaili
Date: _____

The purpose of this lab is to:
Learn the how resistors vary using 20 resistors with the same color code.

Select a set of 20, 1 kohm resistors.
Measure and record the resistance of each resistor.

Equipment needed:

1 – Digital Multimeter
1 – 20 resistors with the same color code.

Resistor color code = Brown, Black, Red, Gold
Resistor value = 1k
Resistor tolerance = +/-5

Using Microsoft Excel plot the resistor values and determine:

Smallest resistance = .9762
Largest resistance = .995
Average resistance = .9841
Standard Deviation = .0073

Sample	Measured Value
1	.9999
2	.9930
3	.9930
4	.9775
5	.9672
6	.9994
7	.9849
8	.9765
9	.9767
10	.9824
11	.9806
12	.9826
13	.9840
14	.9775
15	.9824
16	.9882
17	.9786
18	.9900
19	.9770
20	.9784

Do any of your resistor values exceed the part tolerance?
-**NO**

Observations: The resistor could be the same, But it is not constant when we measure it, we could get different values.

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Lab 2 – Reading and Sorting Resistors

Names: Mustafa Smaili
Date: _____

The purpose of this lab is to:
Learn the resistor color code using 15 resistors which must be sorted from smallest to largest value.
Build a resistor kit that includes 15 resistors and, sort resistors based on color code from smallest to largest and measure the resistance of each resistor and verify sorting

Equipment needed:

1 – Digital Multimeter
1 – 15 unique resistors

	Color Code	Measured Value
100 =	Brown, Black, Brown	98.17
220 =	Red, Red, Brown	219.03
330 =	Orange, Orange, Brown	325.73
470 =	Yellow, Violet, Brown	462.13
1K =	Brown, Black, Red	.992E+3
2.2K =	Red, Red, Red	2.192E+3
3.3K =	Orange, Orange, Red	3.268E+3
4.7K =	Yellow, Violet, Red	4.654E+3
10K =	Brown, Black, Orange	9.802E+3
22K =	Red, Red, Orange	22.152E+3
33K =	Orange, Orange, Orange	33.108E+3
47K =	Yellow, Violet, Orange	47.115E+3
100K =	Brown, Black, Yellow	99.92E+3
1M =	Brown, Black, Green	1.0041E+6
10M =	Brown, Black, Blue	10.826E+6

Observations: All resistors had gold band tolerance all were within tolerance

Lab 3 – Series Resistors

Names: Mustafa Smaili
Date: _____

The purpose of this lab is to:
Experiment with series circuits and verify that the simulation, analysis (calculations) and test results all agree.

From the resistor kit select 3 resistors (10K, 2.2K, 4.7K)

Measure and record the value of each resistor. Connect the resistors as shown in Figure 1. Measure and record the total resistance, RT. Then connect the resistors as shown in Figure 2, the 9V come from the Elvis II (Modular Engineering Educational Laboratory Platform). Then measure and record with the Digital Multimeter the current and voltages of the series circuit.

Equipment needed:

1 – Digital Multimeter
1 – Elvis II
3 – resistors.

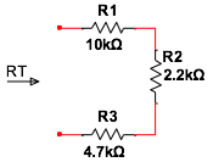

Figure 1

	Measured	Calculated	Simulated
R1 =	10.1E+3	10.0E+3	10.0E+3
R2 =	2.2E+3	2.2E+3	2.2E+3
R3 =	4.7E+3	4.7E+3	4.7E+3
RT =	17.0E+3	16.9E+3	16.9E+3

Measured = using Digital Multimeter
Calculated = based on color code and Excel values
Simulated = Multisim simulation

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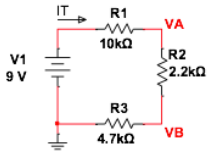

Figure 2

	Measured	Calculated	Simulated
IT =	505.7E-6	532.5E-6	532.99-6
V1 =	9.002	9	9
VA =	3.670	3.675	3.675
VB =	2.517	2.503	2.503

Measured = using Digital Multimeter
Calculated = based on color code and Excel values
Simulated = Multisim simulation

Observations: _Workstation #6 DMM GwInstek Model# GDM-8245, Ser. #CL860237

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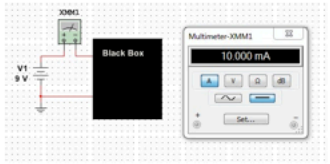
Lab 4 – Black Box Design

Names: Mustafa Smaili
Date: _____

The purpose of this lab is to:
Learn about series circuits

The voltage applied to a Black Box is 9V and the measured current draw is 10mA. Design a 3 resistor series circuit that meets the voltage and current requirements using "standard" resistor value.



Equipment needed:

1 – Digital Multimeter
1 – Elvis II
3 – Standard Resistors

	Design	Measured	Calculated	Simulated
V1 =	9.146	9.146	9	9
IT =	10.26mA	10.26mA	10mA	10.00mA
RT =	888 Ω	888Ω	900Ω	900Ω
R1 =	464.35 Ω	464.35Ω	470Ω	470Ω
R2 =	326.15 Ω	326.15Ω	330Ω	330Ω
R3 =	97.98 Ω	97.98Ω	100Ω	100Ω

Observations: Unable to adjust voltage on Elvis ran calculation with voltage at a little over simulated and calculated. All resistors had gold band tolerance all were within tolerance.

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Lab 6 – Black Box Design

Names: Mustafa
Date: _____

The purpose of this lab is to:
Learn about parallel circuits

The voltage applied to a Black Box is 9V and the measured current draw is 18mA. Design a 2 resistor series circuit that meets the voltage and current requirements using "standard" resistor value.

Equipment needed:

1 – Digital Multimeter
1 – Elvis II
3 – Standard Resistors

	Design	Measured	Calculated	Simulated
V1 =	9	8.994	9	9
IT =	18	17.687	18	18.002
RT =	2.8	.4963k	.5k	.5k
R1 =	1k	.995k	1k	1k
R2 =	1k	.989 k	1k	1k

Observations: all resistors had gold band tolerance all were within tolerance

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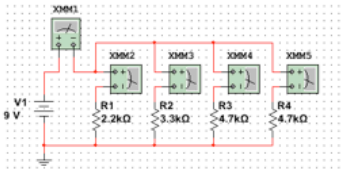
Lab 7 – 4 Resistor Parallel Circuit

Names: Mustafa
Date: _____

The purpose of this lab is to:
Learn about parallel circuits

The voltage applied to 4 parallel resistors x is 9V. Measure all the resistor values, total current and all the branch currents.



Equipment needed:

1 – Digital Multimeter
1 – Elvis II
3 – Standard Resistors

	Design	Measured
R1 =	2.2kΩ	2.1976kΩ
R2 =	3.3kΩ	3.2757kΩ
R3 =	4.7kΩ	4.7193kΩ
R4 =	4.7kΩ	4.688kΩ

	Measured	Calculated	Simulated
V1 =	9.006	9	9
RT =	843.5E+0Ω	845.2E+0Ω	845.232Ω
I1 =	4.076mA	4.1E-3	4.091E-3
I2 =	2.739mA	2.7E-3	2.727E-3
I3 =	1.902mA	1.9E-3	1.915E-3
I4 =	1.914mA	1.9E-3	1.915E-3
IT =	10.537mA	10.65E-3	10.64E-3

Observations: All Resistors had gold tolerance bands, were 1/4 watt and within tolerance.

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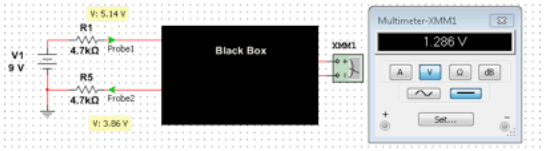
Lab8 – Black Box 3 Design

Names: Mustafa Smaili
Date: _____

The purpose of this lab is to:
Learn about building a circuit that produces exactly 1.3V

Using at least 3 equal value resistors (in the Black Box) design a circuit that produces an output voltage of 1.3V. Then adjust R1 so that the output voltage is exactly 1.3V.



Equipment needed:

1 – Digital Multimeter
1 – Elvis II
5 – Standard Resistors
1 – 5 Kohm pot

	Design	Measured
R1 =	4.7kΩ	4.68kΩ
R2 =	4.7kΩ	4.59kΩ
R3 =	4.7kΩ	4.65kΩ
R4 =	4.7kΩ	4.64kΩ
R5 =	4.7kΩ	4.64kΩ
R(Black Box) =	1.566k	1.567k
R1adj =	5k	5k

	Measured	Calculated	Simulated
V1 =	9V	9V	9V
VA =	3.85V	3.85V	3.857V
VB =	3.91V	3.85V	3.857V
VA - VB =	1.24V	1.29V	1.286V
(VA - VB) adj =	1.28V	1.29V	1.286V

Observations Step 1 Performed Calculation and Simulation only. Step 2 Lab work done at Station 4. Jeff and Roman worked on Simulated while I tackled the Calculated.

Lab 9 – Series/Parallel Resistors

Names: Mustafa Smaili

Date: _____

The purpose of this lab is to:
Experiment with series circuits and verify that the simulation, analysis (calculations) and test results all agree.

From the resistor kit select 8 resistors: 2 each 470Ω, 2 each 1kΩ, and 1 each of the following: 2.2kΩ, 3.3kΩ, 4.7kΩ, 10kΩ

Measure and record the value of each resistor. Connect the resistors as shown in Figure 1. Measure and record the total resistance, RT. Then connect the resistors as shown in Figure 2, the 9V come from the Elvis II (Modular Engineering Educational Laboratory Platform). Then measure and record with the Digital Multimeter the current and voltages of the series circuit.

Equipment needed:

1 – Digital Multimeter
1 – Elvis II
8 – resistors.

	Expected	Measured
R1 =	470Ω	463
R2 =	470Ω	462
R3 =	1kΩ	.99k
R4 =	1kΩ	.98k
R5 =	2.2kΩ	2.17k
R6 =	3.3kΩ	3.27k
R7 =	4.7kΩ	4.62k
R8 =	10kΩ	9.7k

Expected = value you expect it to be
Measured = using Digital Multimeter

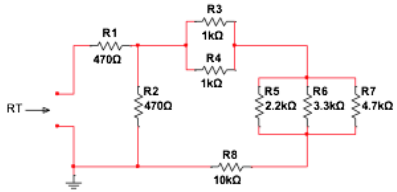


Figure 1
Series/Parallel Circuit

	Calculated	Simulated	Measured
R34 =	500	500	370
R567 =	1030.56	1031	1018
R345678 =	11530.6	11530	11.24k
R2345678 =	451.593	451.592	446.24
RT =	921.593	921.595	927

Calculated = using Excel calculations
Simulated = Multisim simulation
Measured = using Digital Multimeter

	Calculated	Simulated	Measured
V1 =	4.59V	9	4.53
IT =	9.766mA	9.777mA	
VA =	4.41V	4.41	4.50
VB =	4.22V	4.22	
VC =	3.82V	3.83	

Calculated = using Excel calculations
Simulated = Multisim simulation
Measured = using Digital Multimeter

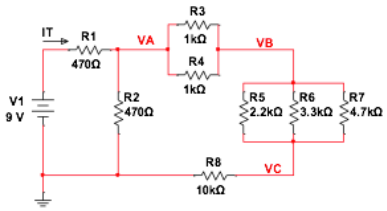


Figure 2
Series/Parallel Circuit

Adjust R2 so that the VA voltage is equal to 4.5V. Then measure the value of the new R2 and calculate and simulate a value that would produce the 4.5V.

	Measured	Simulated	Calculated
VA =			4.5
R2 =			489.972

Calculated = using Excel calculations
Simulated = Multisim simulation
Measured = using Digital Multimeter

Observations Adjust R2 so that the VA voltage is equal to 4.5V. Then measure the value of the new R2 and calculate and simulate a value that would produce the 4.5V. All Resistances are in ohms, Voltages and DC an current is amperes. Due to time constrains this lab was changed to Calculation and Simulation.

Lab 10 – Series/Parallel Capacitors

Names: Mustafa Smaili, Bailey Thompson, Evan Wilson

Date: 4/20/17

The purpose of this lab is to:
Experiment with series circuits and parallel combinations of capacitors.

The following capacitors are needed (1 each of the following): 10uF, 22uF and 47uF

Measure and record the capacitance of each capacitor using the LCR meter. Connect the capacitors as shown in Figure 1 and measure and record the total capacitance, CT. Then connect the capacitors as shown in Figure 2 and measure and record the total capacitance, CT.

Equipment needed:

1 – LCR Meter
1 – Elvis II
3 – capacitors

	Expected	Measured
C1 =	10uF	10.925uF
C2 =	22uF	21.445
C3 =	47uF	44.337uF
CT =	6uF	4.8514uF

Expected = value you expect it to be
Measured = using LCR Meter

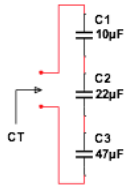


Figure 1
Series Circuit

	Expected	Measured
C1 =	10 uF	10.925uF
C2 =	22 uF	21.445uF
C3 =	47uF	44.337uF
CT =	79uF	78.410uF

Expected = value you expect it to be
Measured = using LCR Meter

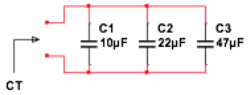


Figure 2
Parallel Circuit

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Observations LCR (Bench 6), SPD=Slow, Dis=Value, Mode=C/D, Circuit=Para (except for CT in series), Lf to Neg. Record of Hundredths Resolution Series Circuit

Lab 11 – RC Lab

Names: Mustafa Smaili

Date: _____

The purpose of this lab is to:
Experiment with RC (Resistor & Capacitor) circuits.

The following capacitors are needed (1 each of the following): 0.47uF, 1uF and 2.2uF

Measure and record the resistor value using the DMM and measure and record the capacitor values using the LCR meter in Table 1. Connect the resistor and capacitor as shown in Figure 1. Connect the Function Generator to the input at V1 and connect Channel 1 of the Oscilloscope to the input and Channel 2 to the output. Adjust the voltage of the Function Generator to 1Vpp at the frequencies shown in Table 2. Measure the input and output voltages using the Oscilloscope. Record the results in Table 2. Change the capacitor and retest.

Equipment needed:

1 – Digital Multimeter
1 – LCR Meter
1 – Oscilloscope
1 – Function Generator
1 – Elvis II
3 – capacitors
1 – resistor

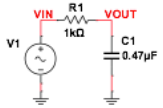

Figure 1
RC Circuit

	Capacitance or Resistance	
	Expected	Measured
C1 =	.47uF	.49uf
C2 =	1uF	.98uf
C3 =	2.2uF	2.18uF
R1 =	1k uF	997uF

Table 1 – Resistance and Capacitances
Expected = value you expect it to be
Measured = using LCR Meter or DMM

	Output Voltage C = .47uF			Output Voltage C = 1uF			Output Voltage C = 2.2uF		
	Expected	Measured		Expected	Measured		Expected	Measured	
Frequency	Output Voltage	Input Voltage	Output Voltage	Output Voltage	Input Voltage	Output Voltage	Output Voltage	Input Voltage	Output Voltage
10	999.5mV	1.13V	.024V	997.8mV	1.02 V	.2123V	990.3mV	1.1V	.3334V
50	989.2mV	1.05V	810mV	953.8mV	1.14 V	1.08V	822.4mV	1.13V	862mV
100	958.8mV	1.15V	778mV	846.7mV	1.12 V	935mV	586.1mV	1.18V	595mV
200	860.3mV	1.15V	807mV	622.6mV	1.12 V	674mV	340.1mV	1.19V	345mV
300	747.4mV	1.12 V	612mV	468.6mV	1.15V	508mV	234.4mV	1.14V	245mV
400	644.9mV	1.02 V	533mV	369.7mV	1.10V	403mV	177.9mV	1.05V	190mV
500	559.5mV	1.11 V	468mV	303.3mV	1.08V	333mV	143.2mV	1.06V	154mV
600	490.3mV	1.03 V	416mV	256.4mV	1.08V	282mV	119.7mV	1.06V	130mV
700	434.3mV	1.05 V	373mV	221.7mV	1.05V	246mV	102.8mV	1.12V	114mV
800	388.7mV	1.09 V	339mV	195.1mV	1.07V	218mV	90.1mV	1.06V	101mV
900	351.1mV	1.07 V	310mV	174.1mV	1.01V	195mV	80.1mV	1.04V	90.5mV
1,000	319.8mV	1.06 V	286mV	157.2mV	1.02V	173mV	72.2mV	1.06V	81.9mV
2,000	166.4mV	1.04 V	163mV	79.3mV	1.16V	68.5mV	76.1mV	1.02V	44.4mV
3,000	111.8mV	1.02 V	123mV	52.9mV	1.17V	63.1mV	24.1mV	1.06V	31.8mV
4,000	84.1mV	1.02 V	103mV	39.7mV	1.19V	49.1mV	18.1mV	1.11V	24.4mV
5,000	67.3mV	1.03 V	91.5mV	31.8mV	1.15V	40mV	14.5mV	1.10V	20.4mV
6,000	56.2mV	1.09 V	85.5mV	26.5mV	1.10V	33.8mV	12.1mV	1.13V	17.5mV
7,000	48.1mV	1.06 V	81.2mV	22.7mV	1.07V	29.1mV	10.3mV	1.02V	16.2mV
8,000	42.15mV	1.07 V	76.6mV	19.9mV	1.06V	27.1mV	9.0mV	1.06V	16.4mV
9,000	37.5mV	1.05 V	75.1mV	17.6mV	1.09V	25mV	8.0mV	1.04V	16.2mV
10,000	33.7mV	1.04 V	74.0mV	15.8mV	1.08V	22.3mV	7.2mV	1.06V	14.8mV

RC Frequency Response
Expected = value you expect it to be

Observations : Our first run of measurements were a failure due to a bad 10x switch on the probe measuring the Vout. After a second measuring session our numbers proved compatible with the calculated results. We could have gotten higher resolution if we had continuously adjusted the amplitude for Vout signal on the scope. Bench 6 was used on the first test but results were scrapped. Bench 5 LCR was used for Capacitor measurements, Bench 8 scope was used with bench 5 Elvis for second and final test run.

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Lab 12 – Series/Parallel Inductors

Names: Mustafa Smaili

Date: _____

The purpose of this lab is to:
Experiment with series circuits and parallel combinations of inductors.

The following inductors are needed (1 each of the following): 1mH, 2.2mH and 4.7mH

Measure and record the inductance of each inductor using the LCR meter. Connect the inductors as shown in Figure 1 and measure and record the total inductance, LT. Then connect the inductors as shown in Figure 2 and measure and record the total inductance, LT.

Equipment needed:

1 – LCR Meter
1 – Elvis II
3 – Inductors

	Expected	Simulated	Measured
L1 =	1mH	1mH	1.01mH
L2 =	2.2mH	2.2mH	2.19mH
L3 =	4.7mH	4.7mH	4.32mH
LT =	7.9mH	7.9mH	7.58mH

Expected = value you expect it to be
Simulated = using Multisim
Measured = using LCR Meter

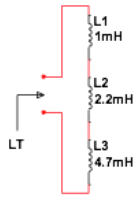

Figure 1
Series Circuit

	Expected	Simulated	Measured
L1 =	1mH	1mH	1.01mH
L2 =	2.2mH	2.2mH	2.19mH
L3 =	4.7mH	4.7mH	4.32mH
LT =	.59mH	.59mH	.593mH

Expected = value you expect it to be
Simulated = using Multisim
Measured = using LCR Meter

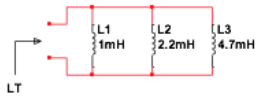

Figure 2
Parallel Circuit

Lab 13 – RL Lab

Names: Mustafa Smaili

Date: 4-13-17

The purpose of this lab is to:
Experiment with RL (Resistor & Inductor) circuits.

The following inductors are needed (1 each of the following): 1mH, 2.2mH and 4.7mH

Measure and record the resistor value using the DMM and measure and record the inductor values using the LCR meter in Table 1. Connect the resistor and inductor as shown in Figure 1. Connect the Function Generator to the input at V1 and connect Channel 1 of the Oscilloscope to the input and Channel 2 to the output. Adjust the voltage of the Function Generator to 1Vpp at the frequencies shown in Table 2. Measure the input and output voltages using the Oscilloscope. Record the results in Table 2. Change the inductor and retest.

Equipment needed:

1 – Digital Multimeter
1 – LCR Meter
1 – Oscilloscope
1 – Function Generator
1 – Elvis II
3 – Inductors
1 – Resistor, 100 ohm

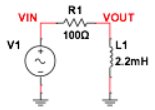

Figure 1
RL Circuit

	Inductance or Resistance	
	Expected	Measured
L1 =	2.2mH	2.12mH
L2 =	1mH	.98mH
L3 =	4.7mH	4.67mH
R1 =	100mH	99.99mH

Table 1 – Resistance and Inductances
Expected = value you expect it to be
Measured = using LCR Meter or DMM

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	Output Voltage L = 2.2mH			Output Voltage L = 1mH			Output Voltage L = 4.7mH		
	Expected	Measured		Expected	Measured		Expected	Measured	
Frequency	Output Voltage	Input Voltage	Output Voltage	Output Voltage	Input Voltage	Output Voltage	Output Voltage	Input Voltage	Output Voltage
10	166mV	451mV	4.3mV	75mV	640mV	21mV	355mV	642mV	96mV
50	832mV	451mV	18.8 mV	378mV	655mV	86mV	1.7v	675mV	116mV
100	1.6v	453mV	19.6mV	7 56mV	658mV	101mV	3.5v	678mV	150mV
200	3.3V	452mV	22.1mV	1.5v	656mV	101mV	7.1v	681mV	152mV
300	4.9v	452mV	43.3mV	2.2v	659mV	114mV	10.6v	684mV	187mV
400	6.6V	450mV	44.1mV	3.0V	661mV	120mV	14.1v	688mV	214mV
500	8.3v	451mV	44.7mV	3.7v	662mV	114mV	17.5v	695mV	232mV
600	9.9v	452mV	45.3mV	4.5v	660mV	160mV	21V	696mV	271mV
700	11.5v	454mV	47.7mV	5.2v	662mV	137mV	24.3v	700mV	290mV
800	13.2v	453mV	49.8mV	6v	663mV	150mV	27.6v	705mV	302mV
900	14.8v	454mV	55.2mV	6.7v	664mV	160mV	30.9v	708mV	310mV
1,000	16.4v	456mV	60.8mV	7.5v	665mV	172mV	34v	701mV	401mV
2,000	32v	462mV	116mV	15v	676mV	230mV	61.1v	750mV	463mV
3,000	46v	465mV	168mV	22.2v	683mV	278mV	79.78v	769mV	579mV
4,000	58.2v	477mV	217mV	29.3v	688mV	305mV	91.7v	808mV	629mV
5,000	68.3v	489mV	263mV	36v	697mV	347mV	99.4v	851mV	722mV
6,000	76.5v	502mV	308mV	42.4v	707mV	384mV	104.5v	860mV	740mV
7,000	83.5v	516mV	346mV	48.4v	718mV	417mV	108vv	892mV	814mV
8,000	89.1v	527mV	379mV	54.1v	726mV	440mV	110.5v	894mV	818 mV
9,000	93.6v	536mV	406mV	59.2v	730mV	491mV	112.3v	908mV	855mV
10,000	97.3v	544mV	427mV	63.9v	736mV	490mV	113.6v	909mV	857mV

RL Frequency Response
Expected = value you expect it to be
Measured = Using Oscilloscope

Observations: Numbers were not as expected

PICTURES