CPE 1140

Circuits / DC Circuit Fundamentals Lab

Fall 2021

Laboratory Report
Lab# 4
Lab Series and Parallel DC Circuit Analysis

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Part A:

Predicted values	Measured values	Tolerance
R_p = 1.421 kΩ	R_p = 1.411 kΩ	R_p = 1349.950 – 1492.050 Ω
R_t = 3.021 kΩ	R_t = 3.002 kΩ	R_t = 2869.950 – 3172.050 Ω
V_S = 15.000 V Note: set to 15V	V_S = 15.001 V	Null

$$R_4 + R_5 = 3.0\text{k}\Omega$$

$$R_p = 1/(1/+2.7\text{k}\Omega+1/3.0\text{k}\Omega) = 1.421\text{k}\Omega$$

$$R_t = 1421+470+510+620 =3.021\text{k}\Omega$$

Values are within tolerance ranges. Note: power supply was reporting 14.9 when the multimeter measured 15.001 V I took the value of the more accurate tool. Methods of calculating resistance parallel and series of resistance are accurate.

Part B:

Voltage drops Simulated (V)	Voltage drops Predicted (V)	Voltage drops measured (V)
V_1 = 2.334	V_1 = 2.333	V_1 = 2.333
V_2 = 3.079	V_2 = 3.078	V_2 = 3.095
V_3 = 7.054	V_3 = 7.055	V_3 = 7.055
V_4 = 2.352	V_4 = 2.351	V_4 = 2.339
V_5 = 4.702	V_5 = 4.702	V_5 = 4.710
V_6 = 2.532	V_6 = 2.532	V_6 = 2.515
V_{input} = 14.996	$V_{Sum\ loop}$ = 14.996	$V_{Sum\ loop}$ = 14.992

$$V_{sum\ loop} = V_1 + V_2 + V_4 + V_5 + V_6$$

Measure and predicted values are nearly identical. I don’t have extraneous values in my measurements. I did have an extraneous value during the lab when the resistors 4 and 5 were not connected to each other. Which resulted in resistor 6 reading at 3.5 ish.

The voltages chosen for the loop was for $V_{sum\ loop} = V_1 + V_2 + V_4 + V_5 + V_6$ for no reason in the prelab and later recalculated here as well. But in the future, I would use the loop with the least elements. Since it would be a better time save. I should have used V_3 rather than $V_4 + V_5$.

Part C:

Current simulated (mA)	Current predicted (mA)	Current measured (mA)
I_a = 4.967	I_a = 4.965	I_a = 4.999
I_c = 2.613	I_c = 2.613	I_c = 2.630
I_d = 2.351	I_d = 2.351	I_d = 2.368

Current divider, simulation, and the lab measurements agree. No extraneous differences.

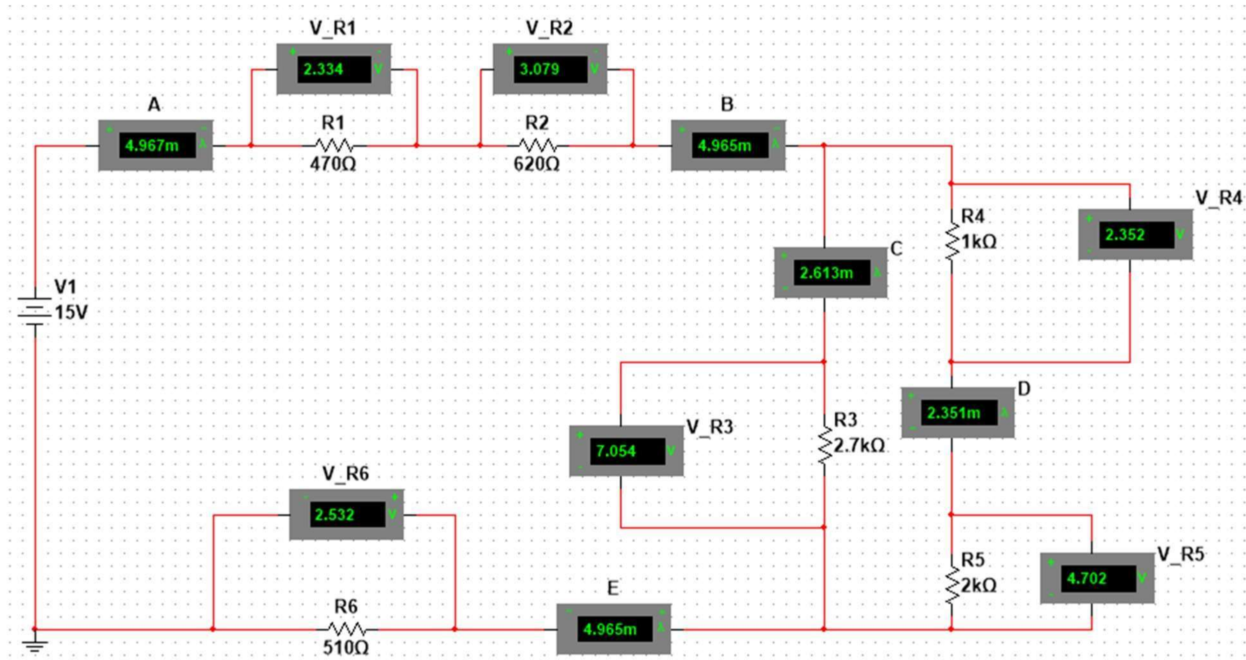
Part D:

I found that computing resistors from the farthest from the source seems to be easiest. I started to do the calculations mostly by hand for this lab. Since pushing an intermediate calculation to an array was going to be more work that it was worth.

The resistance of the series, parallel, and total values are accurate. The voltage drops are also accurate in between the simulated, calculated, and lab measured.

Appendix:

Multisim Simulation:



Prelab calculation code:

```
#include <stdio.h>

void resistance_tolernaces()
{
  double set_of_resistors[] = {470.0,
                               620.0,
                               2700.0,
                               1000.0,
                               2000.0,
                               510.0,
                               1421.0,
3021.0};
  double resistor_low = 0.0,
resistor_high = 0.0,
toleranace_value = 0.0; printf("\n\n");
for(int count = 0; count < 8; count++)
{
  toleranace_value = set_of_resistors[count] *5/100;   resistor_low
= set_of_resistors[count] - toleranace_value;   resistor_high =
set_of_resistors[count] + toleranace_value;

  printf("The tolerance range of %.4lf resistor is %.4lf - %.4lf \n\n",
set_of_resistors[count], resistor_low, resistor_high);
}
/*note you need to make a library file .h and a main function to use this.

in anaconda powershell I used gcc -O3 main.c functions.h functions.c -o lab_4

you also need to install gcc to use this command  run
lab_4.exe
*/
```