Circuits And System 1

CSE103L Circuits & Systems-I Lab

LAB REPORT # 4

2020

Submitted to:

Engr. Faiz Ullah

Submitted by:

TAYYABA

Registration No:

19PWCSE1854

Semester: **2nd**

Class Section: **C**

"On my honour, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work."

Student Signature: _______________

Thursday, March 12, 2020

Department of Computer Systems Engineering

University of Engineering and Technology, Peshawar

Rubrics of lab

Complex Circuit Analysis using PSPICE

LAB REPORT ASSESSMENT				
Criteria	**Excellent**	**Average**	**Nill**	**Marks Obtained**
1. Objectives of Lab	All objectives of lab are properly covered [Marks 0.5]	Objectives of lab are partially covered [Marks 0.25]	Objectives of lab are not shown [Marks 0]	
2. Kirchoff's Voltage Law, Kirchoff's Current Law, Ohm's Law. (Statement, Mathematical Expression, Circuit Diagram)	Correct KVL, KCL and Ohm's Law statement and mathematical expression is written. Circuit diagram shown is correct and properly labeled [Marks 1]	KCL statement or mathematical expression or circuit diagram is missing or circuit diagram is not properly labeled [Marks 0.5]		
3. PSPICE Simulator	Brief introduction of PSPICE simulator [Marks 1]	Brief introduction of PSPICE simulator Is not shown [Marks 0]		
4. Procedure	All experimental steps are shown in detail [Marks 1.5]	Some of the experimental steps are missing [Marks 1]	Experimental steps are missing [Marks 0]	
5. Observations & Calculations **a) Verification of KCL** **b) Verification of KVL** **c) Verification of Ohm's Law**	All experimental results are completely shown in form of table for all given laws. [Marks 3]	Experimental results are partially shown and some of the observations are missing [Marks 1.5]	No experimental results are shown [Marks 0]	
6. Analysis **a) Analysis about KVL** **b) Analysis about KCL** **c) Analysis about Ohm's Law**	Analysis and discussion about all experimental results are shown [Marks 3]	Analysis and discussion about experimental results are partially shown [Marks 1.5]	Analysis is not shown [Marks 0]	

Total Marks Obtained:__________

Instructor Signature: ______________________

Experiment # 7

Complex Circuit Analysis using PSPICE

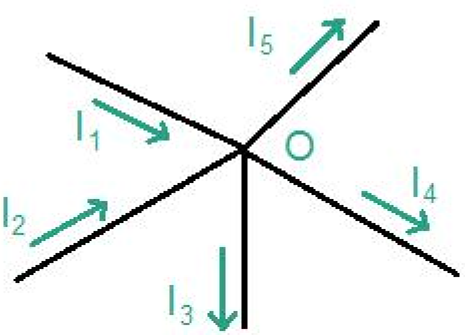
Objectives:

To verify all basic laws of circuits and systems on complex circuit using PSPICE and to do comprehensive analysis from observations.

Kirchhoff's Current Law:-

Kirchhoff's Current Law states that the sum of current into a junction is equal to the sum of current out of junction. The junction is a point where two or more then current paths joins together.

Circuit Diagram:-



Mathematical Expression:-

According to above diagram:

$$I_{in} = I_{out}$$

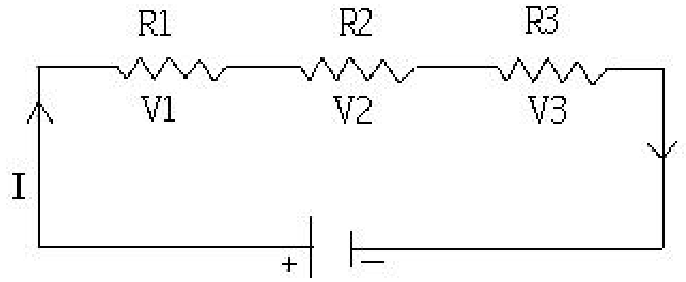
$$I_1+I_2 = I_3+I_4+I_5$$

$$I_1+I_2 - I_3 - I_4 - I_5 = 0$$

Kirchhoff's Voltage Law:-

Kirchhoff's Voltage law states that "the **algebraic sum** of all voltages (source voltage and voltage drop) is equal to **zero** along the closed path".

Circuit Diagram:-



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Mathematical Expression:-

$$V + (-V1) + (V2) + (-V3) = 0$$

$$V - V1 - V2 - V3 = 0$$

$$V = V1 + V2 + V3$$

<u>Ohm's Law</u>:-

Ohm's law state that electric current is directly proportional to voltage (**V**) supplied to circuit and inversely proportional to Resistance (**R**) in the circuit.

i.e. **I α V**

or **I α 1/R**

Mathematical Form:-

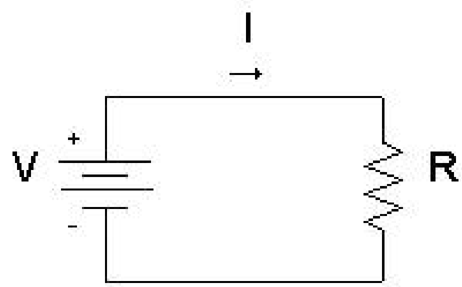
I=V/R.

V=IR.

Circuit Diagram:-

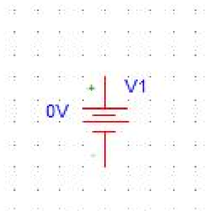
PSPICE Software:-

PSPICE is a computer-aided simulation program that enables you to design a circuit and then simulate the design on a computer. As this is one of its main purposes, it is used extensively by electronic design engineers for building a circuit and then testing out how that circuit will simulate. There are a lot of things we can do with **PSPICE**, but the most important things for you to learn are



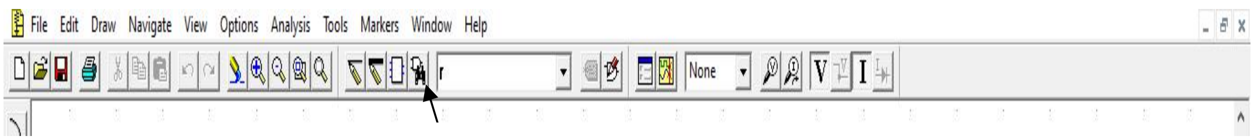
1. Design and draw circuits.

2. Simulate circuits.
3. Analyze simulation results.



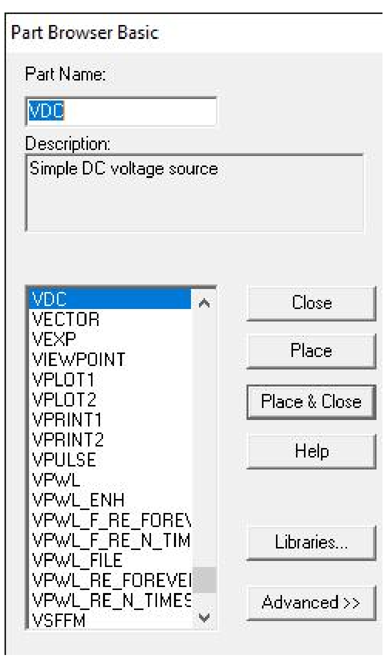
Procedure:-

1. Run the **PSPICE** software. A blank window will be opened.
2. Click on "**Get New Part**" from toolbar.



GET NEW PART

3. Type on **part name** and name part we want. Suppose we want **DC Voltage** so we will type **VDC**

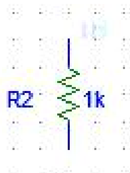


4. Place it and assign its name and set the voltage.

5. Now again click on "**Get New Part**" and type **r**. place 5 resistors in such a

way that resistor is connected to each other. Assign the resistance to each resistors.

6. Connect the whole circuit using "**Draw wire**" from toolbar. Connect all resistor to DC battery.



Draw Wire

7. Then again click on "**Get New Part**" and type **GND** and place ground at the end of circuit.

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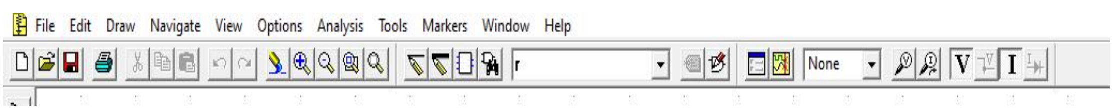
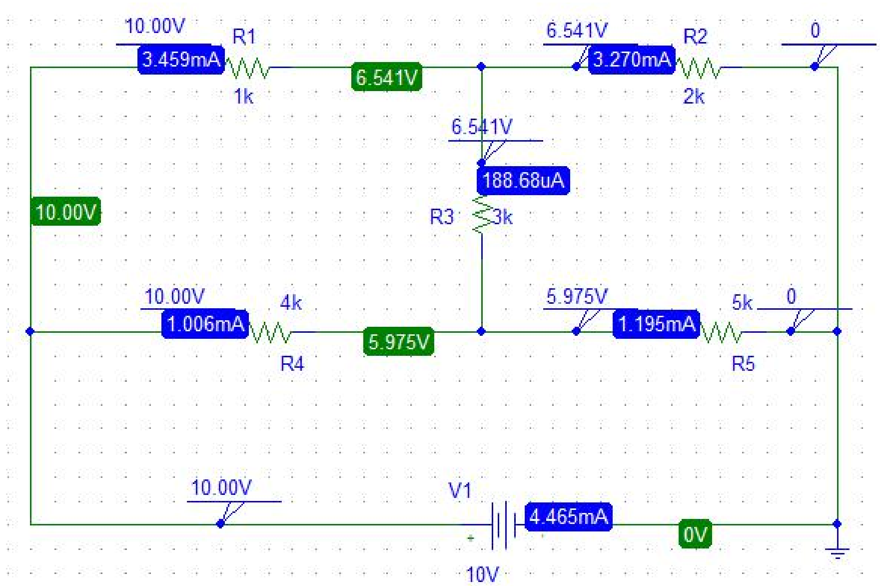


component according to this diagram:



Observation and calculation (Ohm's Law):-

Case 1 (For resistor R1):

Sr. No.	Voltage	Current	Resistor (R1)
1	5V	1.730 mA	1k Ω
2	10 V	3.459 mA	1k Ω
3	15 V	5.189 mA	1k Ω

Case 2 (For resistor R4):

Sr. No.	Voltage	Current	Resistor (R4)
1	5 V	503.15 uA	4k Ω
2	10 V	1.006 mA	4k Ω
3	15 V	1.509 mA	4k Ω

Case 3 (For resistor R2):

Sr. No.	Voltage	Current	Resistor (R2)
1	5 V	1.635 mA	2k Ω
2	10 V	3.270 mA	2k Ω
3	15 V	4.906 mA	2k Ω

Observation and calculation (KCL):-

Case 1 (For current I_v ,I_1 & I_4):-

Name	Resistance	Current
I_V	Nill	4.465 mA
I_1	1k Ω	3.459 mA
I_4	4k Ω	1.006 mA

Calculations:

$I_V = I_1 + I_4$.

4.465 mA = 3.459 mA + 1.006 mA .

4.465 mA = 4.465 mA

Case 2 (For I_1 , I_2 & I_3):-

Sr. No.	Resistance	Current

Calculations:

$I_1 = I_2 + I_3$.

3.459 mA = 3.270 mA + 188.68 uA .

3.459 mA = 3.459 mA

I_1	1k Ω	3.459 mA
I_2	2k Ω	3.270 mA
I_3	3k Ω	188.68 uA

Case 3 (For I_3 , I_4 & I_5):-

Sr. No.	Resistance	Current
I_4	4k Ω	1.006 mA
I_5	5k Ω	1.195 mA
I_3	3k Ω	188.68 uA

Calculations:

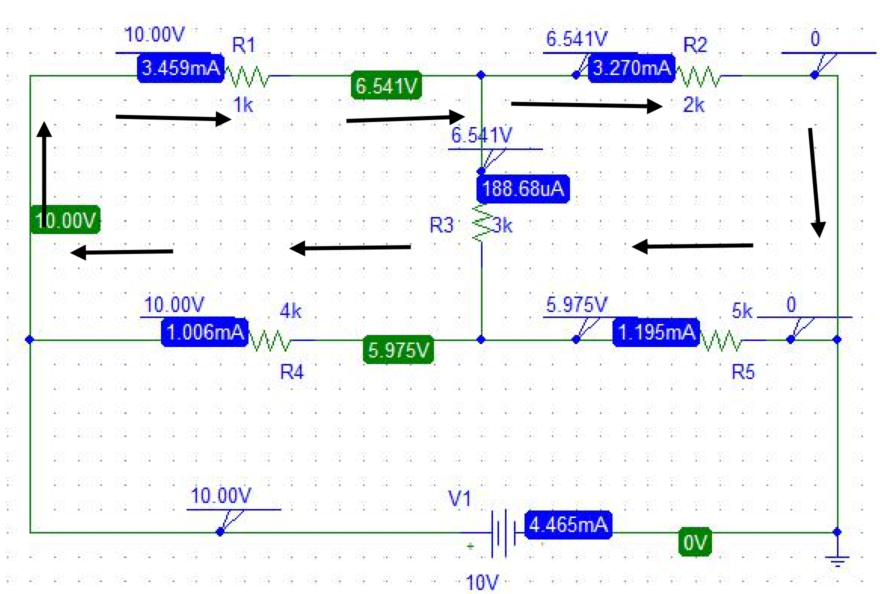
$I_5 = I_4 + I_3$.

1.195 mA = 1.006 mA + 188.68 uA .

1.195 mA = 1.195 mA

Observation and calculation (KVL):-

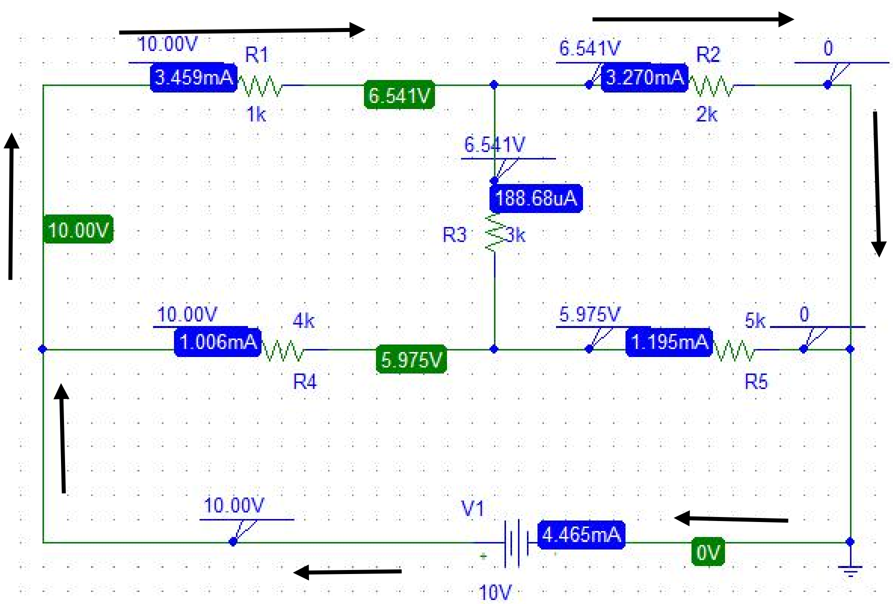
Case 1 (For loop 1):-



Calculations:

Sr. no.	R4	R5	Vs	V4	V5	Vs= V4 +V5
1	4k Ω	5k Ω	5 V	2.013 V	2.987 V	5 = 2.013 + 2.987 => 5 V
2	4k Ω	5k Ω	10	4.025 V	5.975 V	10 = 4.025 + 5.975 => 10 V
3	4k Ω	5k Ω	15	6.038 V	8.962 V	15 = 6.038 + 8.962 => 15 V

Case 2 (For loop 2):-

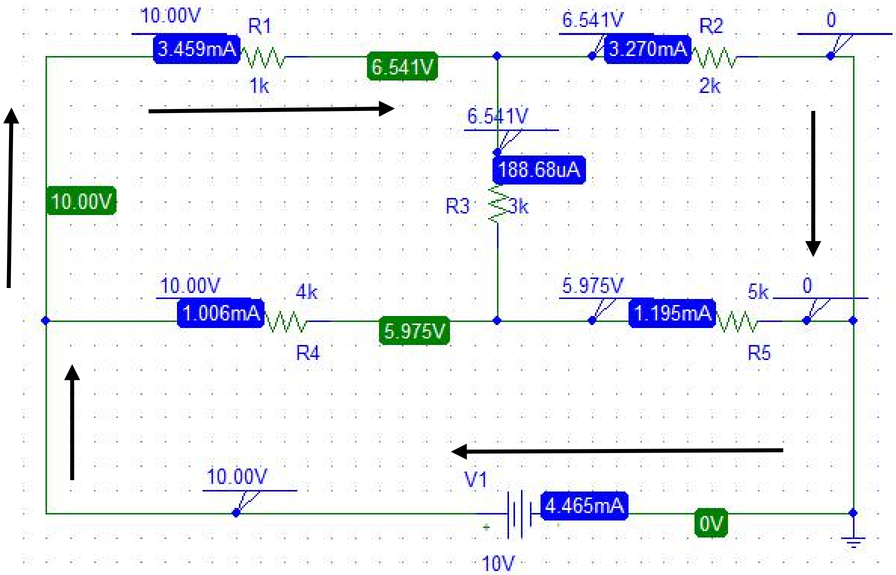


Calculations:-

Sr. no.	R1	R2	Vs	V1	V2	Vs= V1 +V2
1	1k Ω	2k Ω	5 V	1.73 V	3.270 V	5 = 1.73 + 3.270 => 5 V

2	1k Ω	2k Ω	10	3.459 V	6.541 V	10 = 3.459 + 6.541 => 10 V
3	1k Ω	2k Ω	15	5.19 V	9.81 V	15 = 5.19 + 9.81 => 15 V

Case 3 (For loop 3):-



Calculations:-

Sr. no.	R1	R3	R5	Vs	V1	V3	V5	Vs= V1 + V3 + V5
1	1k Ω	2k Ω	5k Ω	5 V	0.732 V	1.69 V	2.578 V	5 = 0.732 + 1.69 + 2.578 => 5 V
2	1k Ω	2k Ω	5k Ω	10 V	2.654 V	1.556 V	5.79 V	10 = 2.654 + 1.556 + 5.79 => 10 V
3	1k Ω	2k Ω	5k Ω	15 V	4.179 V	5.12 V	5.701 V	15 = 4.179 + 5.12 + 5.701 => 15 V

Analysis:-

For Ohm's law:-

In all cases of ohm's law we learnt that by **increasing voltage** (keeping Resistance constant), the **current also increases**. Thus voltage and current are **directly proportional**.

i.e

$$V \alpha I$$

For KCL:-

In all cases we found that current entering **into** a node is **equal** to current going **out** from a node.

i.e

$I_{in} = I_{out}$.

For KVL:-

In all cases of KVL we found that sum of all voltages in a closed loop is equal to **zero**. For example by taking values of **case 1**:

$5 + (-2.013) + (-2.987) = 0$

$0 = 0$