Verification of Superposition Theorem

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CIRCUIT DIAGRAM:

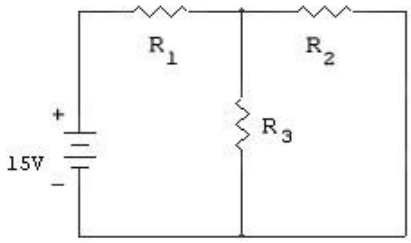


Figure 1

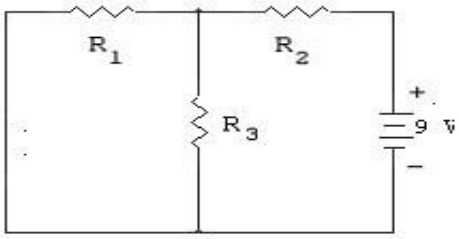


Figure 2

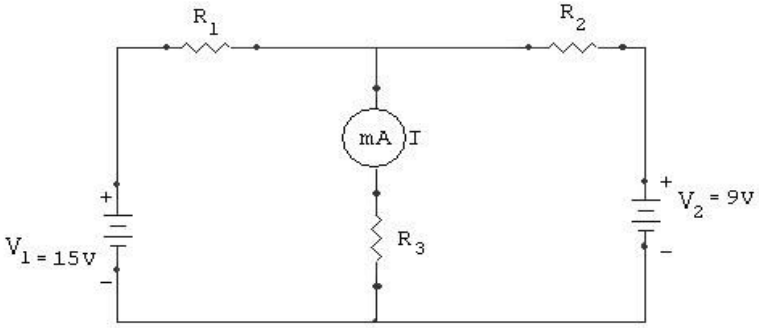
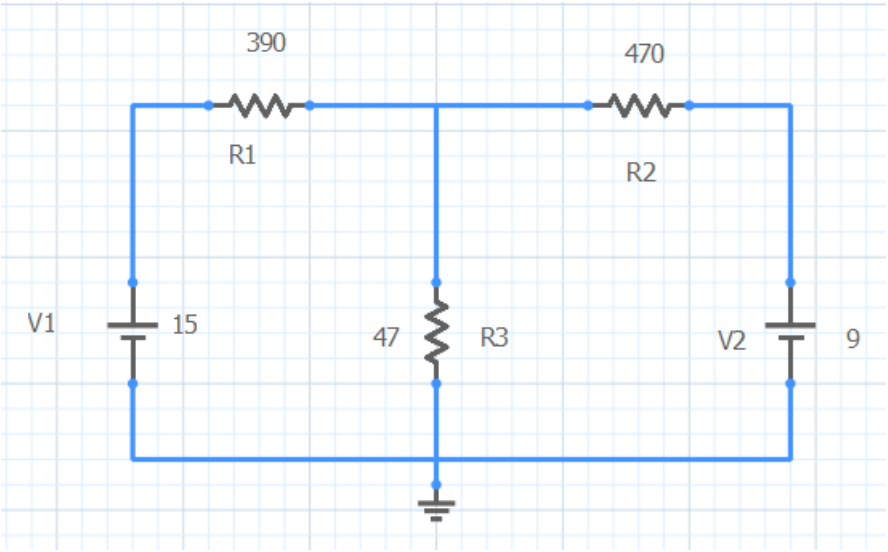
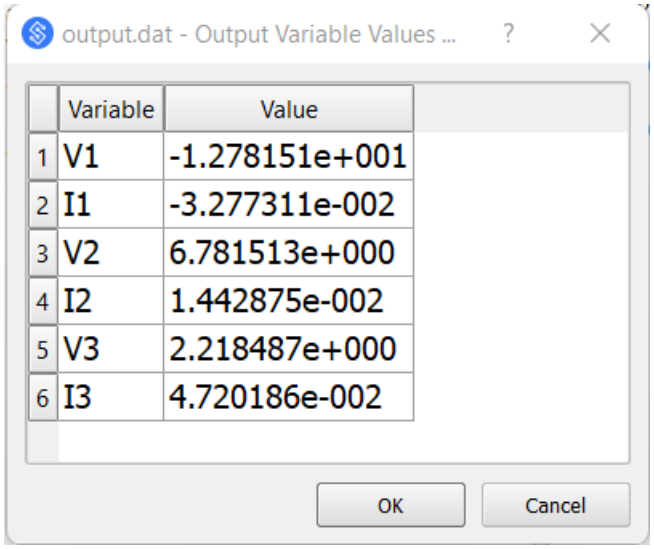


Figure 3



Sequel Implementation



Sequel Output

OBSERVATION TABLE:

R_1 = 390 , R_2 = 470 , R_3 = 47

V_1 (V)	V_2 (V)	Current through R_1 (A)	Current through R_2 (A)	Current through R_3 (A)
15	-	-0.032	-0.0032	0.031
-	**9**	0.002	0.017	0.016
15	**9**	-0.03	0.014	0.047

EXPERIMENT No: 2 **DATE: 30 / 5 / 2022**

Verification of Superposition Theorem

AIM: To verify Superposition theorem using circuit implementation on breadboard and using simulator.

APPARATUS & COMPONENTS REQUIRED:

Resistors (values), Power supply(rating), DMM, connecting wires, breadboard, Sequel Simulator

THEORY: Write theory related with following questions.

1) Define linear, bilateral, active element
2) Write statement of Superposition theorem.

PROCEDUCE:

1) Connect the circuit as shown in the circuit diagram.
2) Apply voltage V1=15V and remove voltage V2 and short the path.
3) Note down the current reading through R1, R2 and R3 due to voltage source V1=15V.
4) Now remove V1 and replace it by short path. Connect V2=9V and measure the current through R1, R2 and R3 due to V2=9V
5) 5) Again, connect both the supply V1=15V and V2=9V and measure the current through R1, R2 and R3.
6) Find the theoretical reading of current through R1, R2 and R3 using superposition theorem and verify it with the practical reading.
7) Repeat steps 2 to 6 by changing the voltage V1 and V2.
8) Implement the given circuit using Sequel simulator.
9) Simulate the circuit, find currents, and verify them with theoretical values.

Linear elements: These are elements in which the constituent relation, the relation between voltage and current, is a linear function. They obey the superposition principle.

Examples of linear elements are resistances, capacitances, inductances, and linear dependent sources.

Bilateral elements: Bilateral elements are defined as the elements through which magnitude of current is independent of polarity of supply voltage. This means, the V-I characteristics of such type of element does not get affected by the polarity of voltage. A resistor, inductor, capacitors are example of bilateral circuit elements.

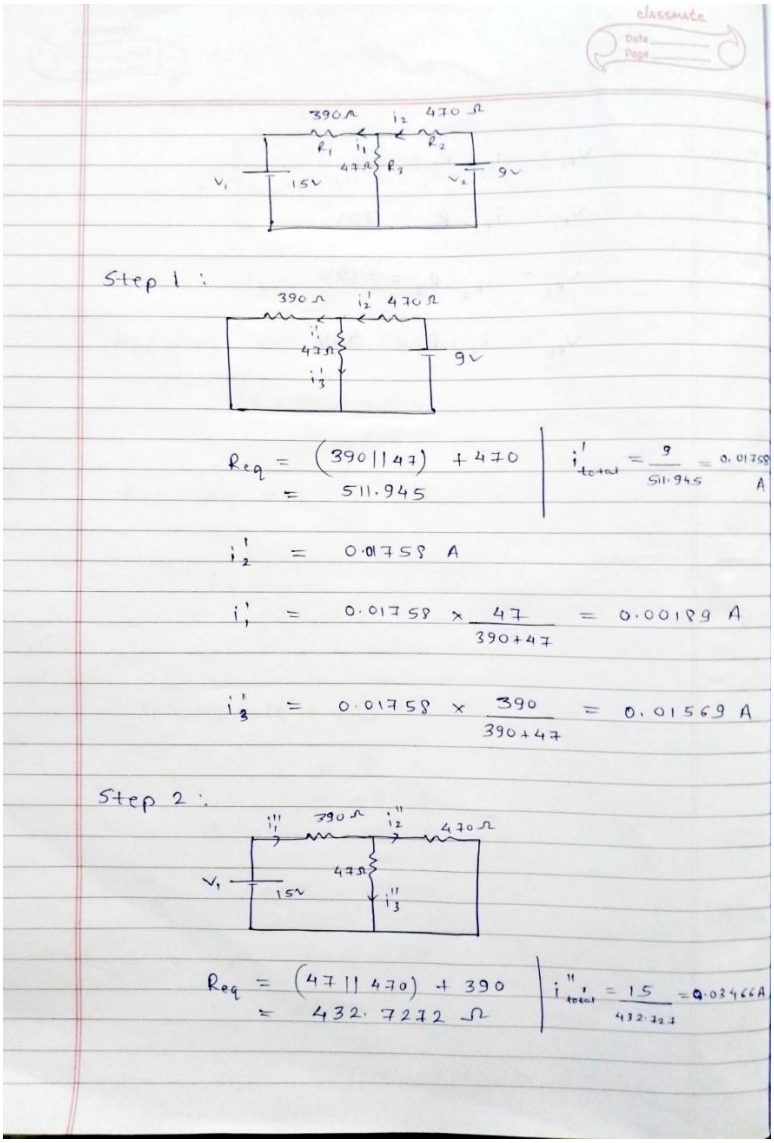
Active element: An active element is an element capable of generating electrical energy. The essential role of this active element is to magnify an input signal to yield a significantly larger output signal.

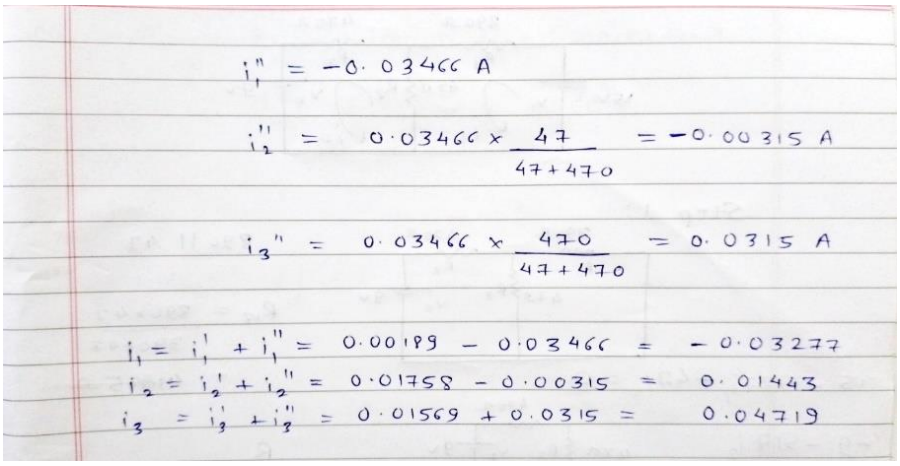
Superposition theorem : The superposition theorem is a derived result of the superposition principle suited to the network analysis of electrical circuits. The superposition theorem states that for a linear system (notably including the subcategory of time-invariant linear systems) the response (voltage or current) in any branch of a bilateral linear circuit having more than one independent source equals the algebraic sum of the responses caused by each independent source acting alone, where all the other independent sources are replaced by their internal impedances.

To ascertain the contribution of each individual source, all of the other sources first must be "turned off" (set to zero) by:

- Replacing all other independent voltage sources with a short circuit (thereby eliminating difference of potential i.e. V=0; internal impedance of ideal voltage source is zero (short circuit)).
- Replacing all other independent current sources with an open circuit (thereby eliminating current i.e. I=0; internal impedance of ideal current source is infinite (open circuit)).

CALCULATION:





RESULT TABLE:

V_1 (V)	V_2 (V)	Current through R_1 (A)			Current through R_2 (A)			Current through R_3 (A)		
		Theoretical	Observed	By Simulation	Theoretical	Observed	By Simulation	Theoretical	Observed	By Simulation
15	**-**	-0.03466	-0.032	-0.0346	-0.00315	-0.0032	-0.00315	0.0315	0.031	0.03151
-	**9**	0.00189	0.002	0.00189	0.01758	0.017	0.01758	0.01569	0.016	0.01569
15	**9**	-0.03277	-0.03	0.03277	0.01443	0.014	0.01443	0.04719	0.047	0.0472

CONCLUSION: