Verification of Superposition Theorem

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CIRCUIT DIAGRAM:

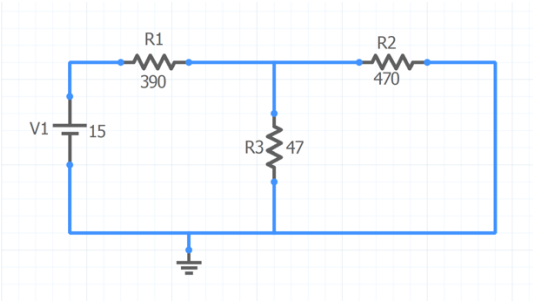


Figure 1

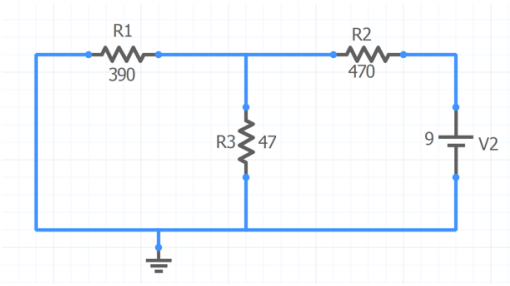


Figure 2

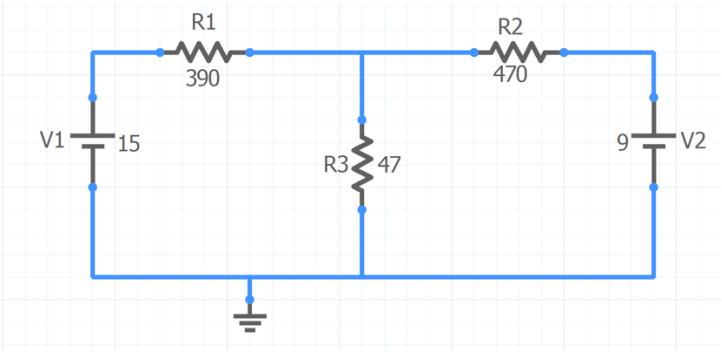


Figure 3

OBSERVATION TABLE:

R_1 = 390Ω , R_2 = 470Ω , R_3 = 47Ω

V_1 (V)	V_2 (V)	Current through R_1 (A)	Current through R_2 (A)	Current through R_3 (A)
15	-	$I_1' = 0.035$	$I_2' = 0.0032$	$I_3' = 0.032$
-	9	$I_1'' = 0.00189$	$I_2'' = 0.018$	$I_3'' = -0.0157$
15	9	$I_1 = 0.033$	$I_2 = 0.145$	$I_3 = 0.0477$

EXPERIMENT No: 2 **DATE: / / 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 a theory related to the following questions.

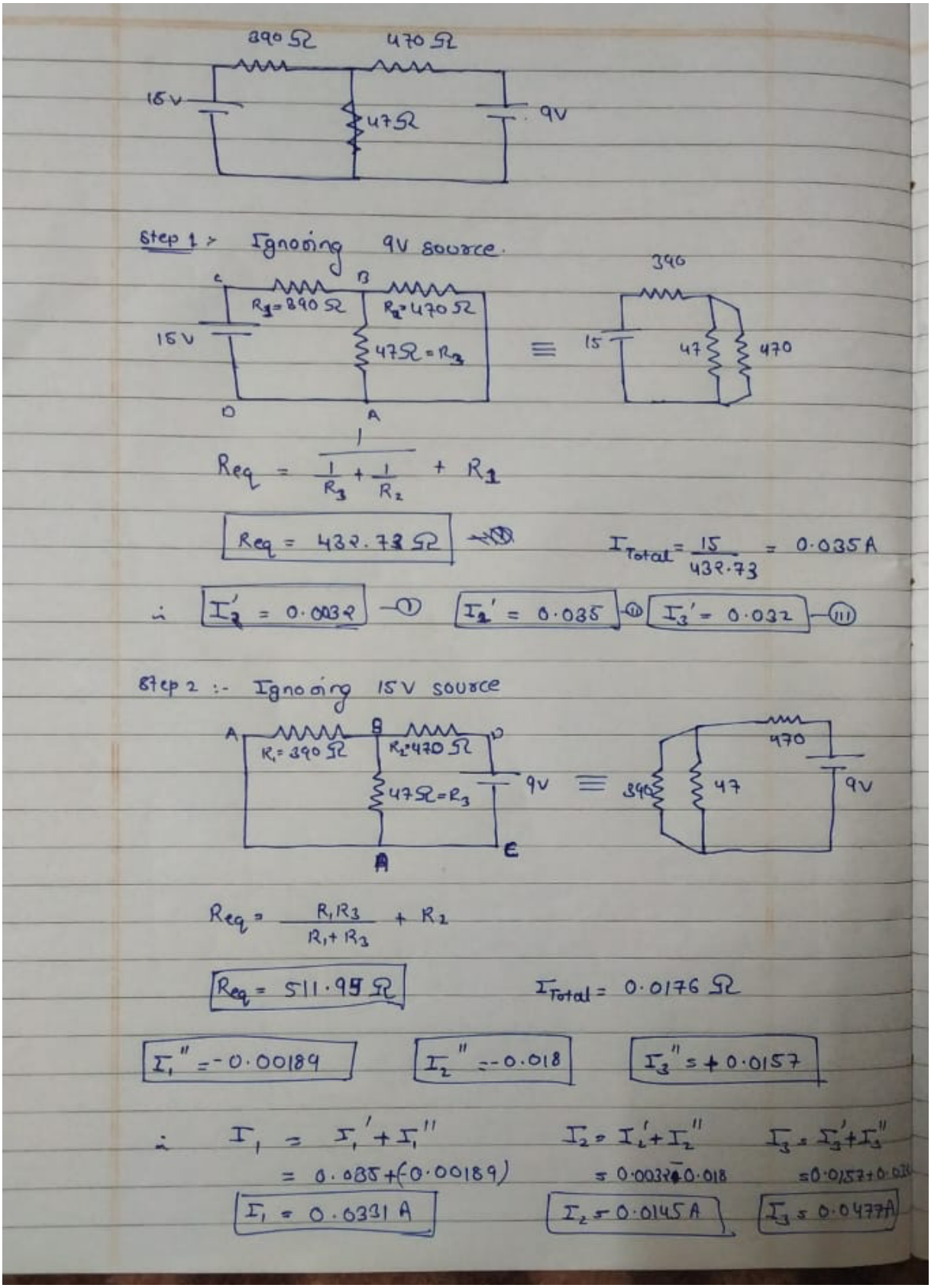
1) Define linear, bilateral, and active elements.
   Linear elements: Elements in which the constituent relation, the relation between voltage and current, is a linear function.
   Bilateral elements: The elements through which the magnitude of the current is independent of the polarity of the supply voltage.
   Active elements: An active element is an element capable of generating electrical energy

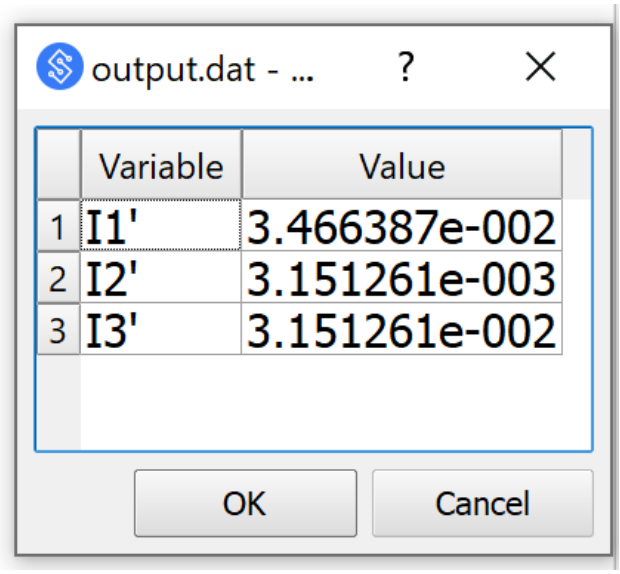
2) Write a statement of the Superposition theorem.
   If more than one source acts simultaneously in an electric circuit, then the current through any one of the branches of the circuit is the summation of currents that would flow through that branch for each source acting alone, keeping all the other sources dead

PROCEDUCE:

1) Connect the circuit as shown in the circuit diagram.
2) Apply voltage V_1=15V and remove voltage V_2 and short the path.
3) Note down the current reading through R_1, R_2 and R_3 due to voltage source V_1=15V.
4) Now remove V_1 and replace it by short path. Connect V_2=9V and measure the current through R_1, R_2 and R_3 due to V_2=9V.
5) Again, connect both the supply V_1=15V and V_2=9V and measure the current through R_1, R_2 and R_3.
6) Find the theoretical reading of current through R_1, R_2 and R_3 using superposition theorem and verify it with the practical reading.
7) Repeat steps 2 to 6 by changing the voltage V_1 and V_2.
8) Implement the given circuit using Sequel simulator.
9) Simulate the circuit, find currents, and verify them with theoretical values.

CALCULATION:

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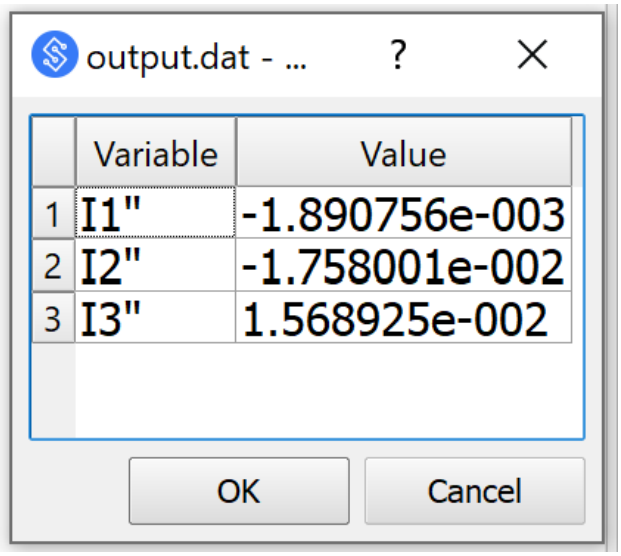
Value
1 I1' 3.466387e-002
2 I2' 3.151261e-003
3 I3' 3.151261e-002
OK
Cancel


output.dat - ...
Variable
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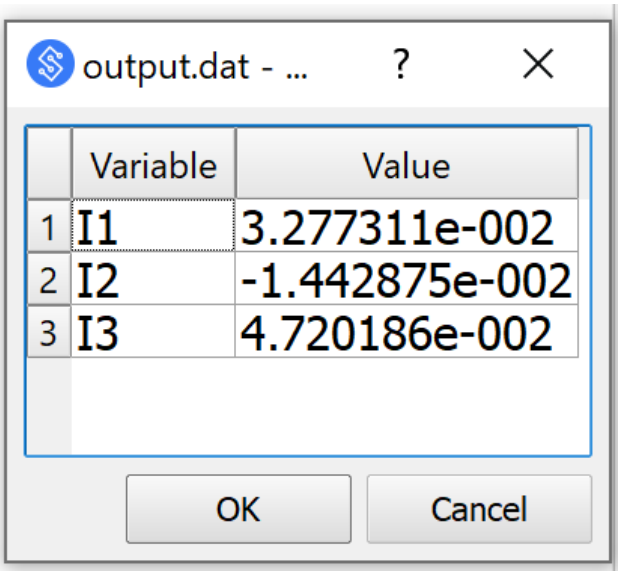
1 I1" -1.890756e-003
2 I2" -1.758001e-002
3 I3" 1.568925e-002
OK
Cancel


output.dat - ...
Variable
Value
1 I1 3.277311e-002
2 I2 -1.442875e-002
3 I3 4.720186e-002
OK
Cancel

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	**-**	0.035	0.035	0.0346	0.0032	0.0032	0.003151	0.032	0.032	0.03151
-	**9**	-0.00189	-0.00189	-0.00189	-0.018	-0.018	-0.0175	0.0157	0.0157	0.015689
15	**9**	0.0331	0.033	0.0327	-0.145	0.145	-0.1442	0.0477	0.0477	0.0472

CONCLUSION:

In this experiment, we learned about superposition theorem. We learned that we can calculate current across each resistor for each individual sources and then add them up toget net current across each resistor.