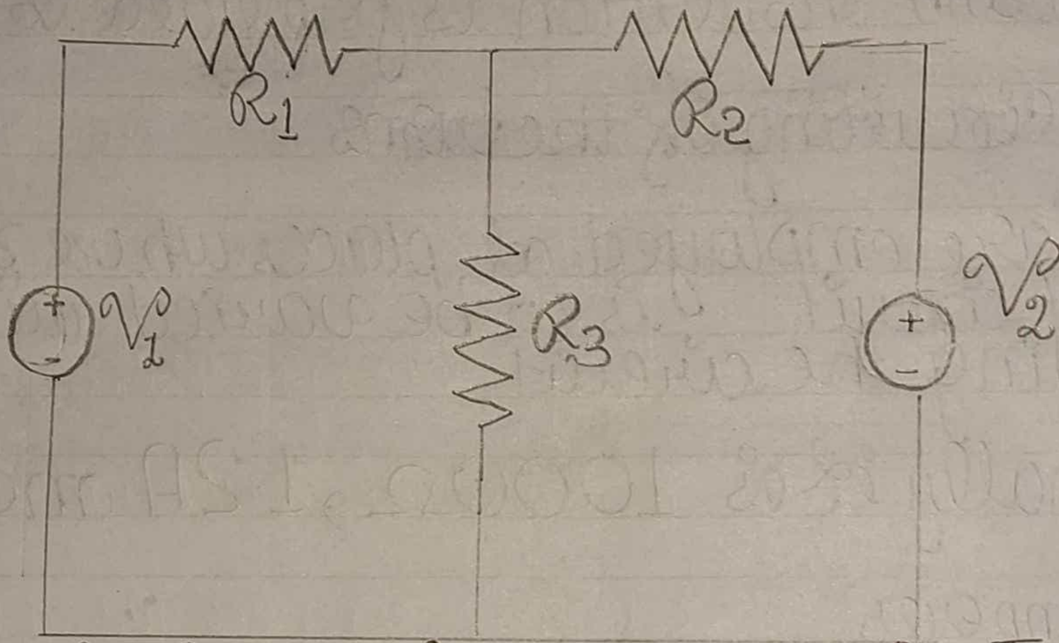
Experiment No :-> 1

Aim :-> To verify Superposition Theorem.

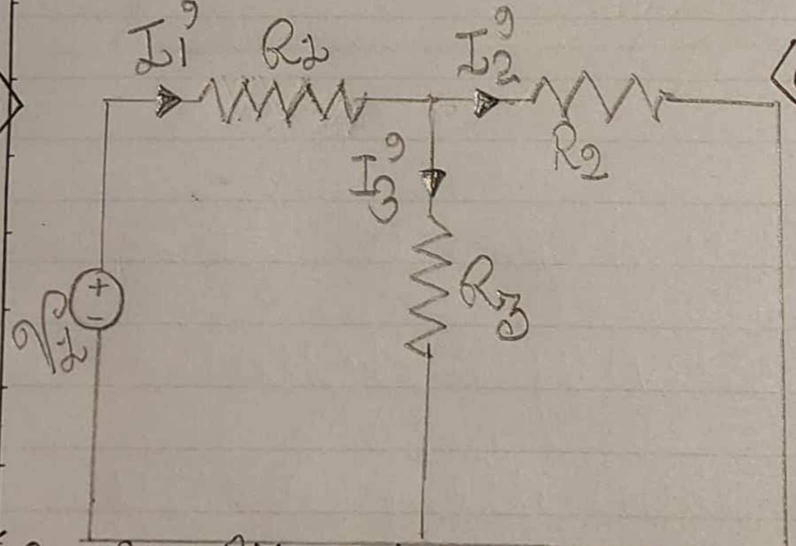
Circuit diagram :->

(i)



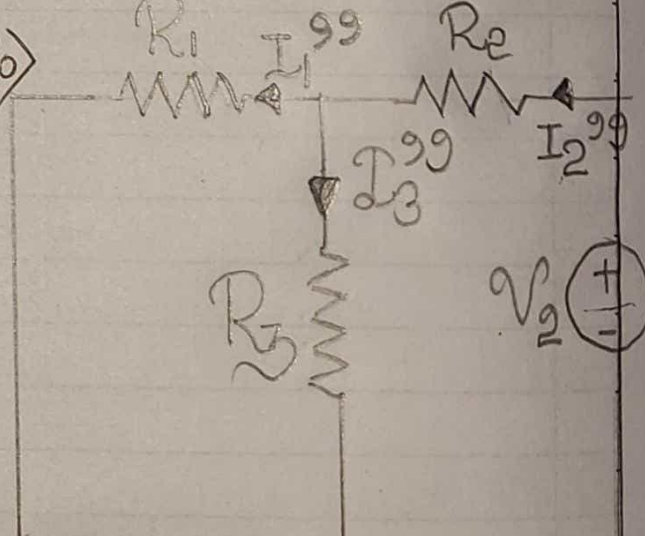
(Circuit analysis of Superposition Theorem)

(ii)



(Circuit with only V_2 short circuited)

(iii)



(Circuit with only V_1 short circuited)

Experiment Name / No.: 01

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Experiment No :-> 1

1.> **Aim :->** To verify Superposition Theorem

2.> **Apparatus :->** 2 Dc voltage sources, wires, variables resistors {Rheostats}, Ammeters(3)

3.> **Theory :->** If a number of voltage or current source are acting simultaneously in a linear network, the resultant current in any branch is the algebraic sum of the currents that would be produced in it, when each source acts alone replacing all other independent sources of their internal resistances

In the given figure (i) (<—), we apply superposition theorem, let us first take the sources :->

Case ii)

(ii) V_1 alone at first replacing V_2 by short circuit

$$I_1' = \left(\frac{V_1}{\frac{R_2 * R_3 + R_1}{R_2 + R_3}} \right)$$

Teacher's Signature:

$$I_2' = I_1' * \left(\frac{R_3}{R_2+R_3}\right)$$

$$I_3' = I_1' - I_2'$$

Case (iii) Now, removing V_1 by short circuit, let the circuit be energized by V_2 only as shown on the diagram drawn on the last page.

$$I_2'' = \frac{V_2}{\frac{R_1 * R_3}{R_1+R_3} + R_2}$$

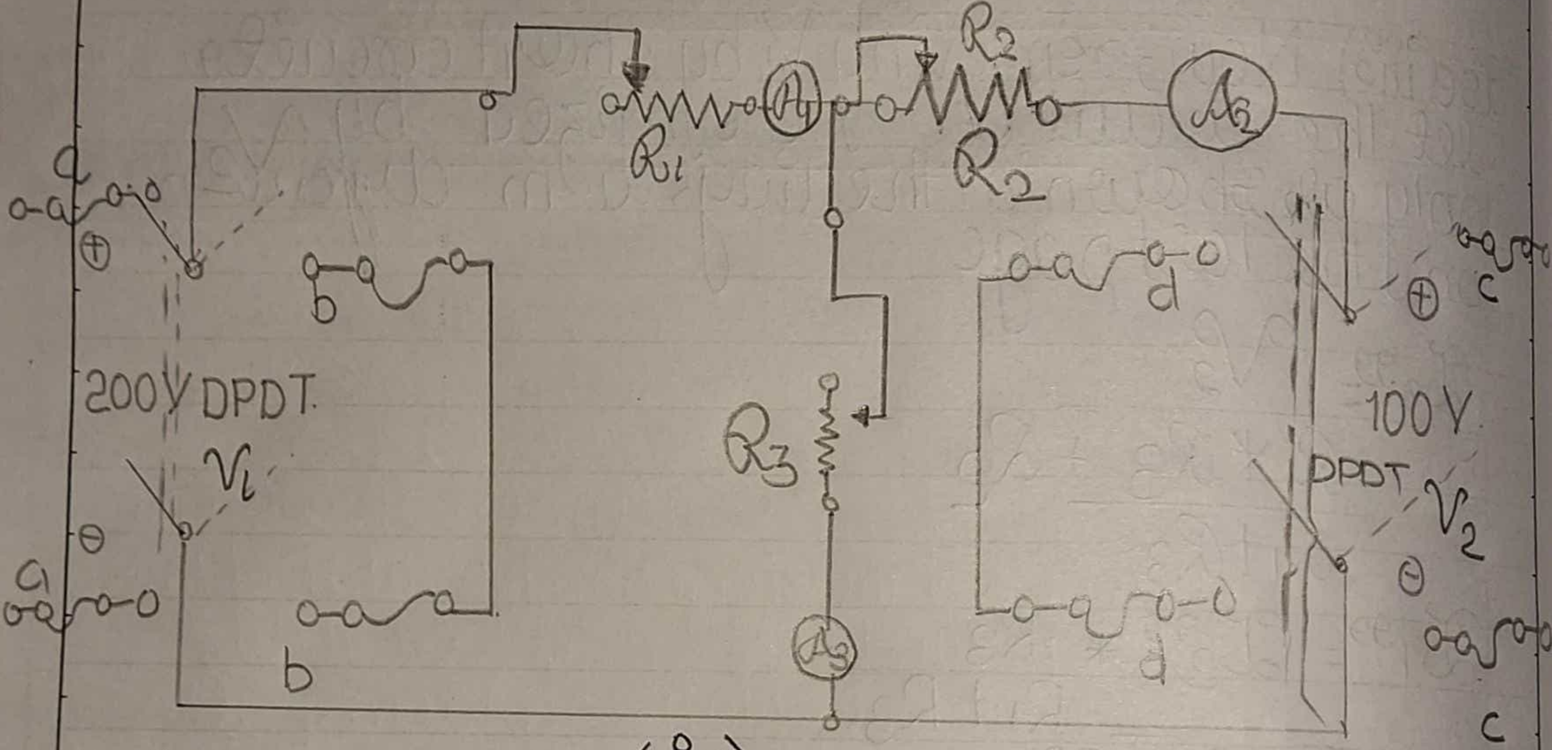
$$I_1'' = I_2'' * \frac{R_3}{R_1+R_3}$$

$$I_3'' = I_2'' \; I_1''$$

As per superposition Theorem,

We get :->

$$\left\{\begin{array}{l} I_3 = I_3' + I_3'' \\ I_2 = I_2' - I_2'' \\ I_1 = I_1' - I_1'' \end{array}\right\}$$



<oiV>

Experiment Name / No.: 01

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4) PROCEDURE :->

1.) Connect the circuit as shown in the diagram, keeping the switches open and resistance at their maximum positions

2.) Set S_1 to position "aa" and S_2 to position "cc" respectively which means both the sources are energized. Note down the current I_1, I_2 and I_3 from ammeter

3.) Set S1 to positions "aa" and S2 to position "dd" respectively which means the, only 220 V source is energized and the terminal of S_2 are shorted. Note down current I_1', I_2' I_3' from the ammeter A_1, A_2, A_3

4.) Set S_1 to positions "bb" and S_2 to position "c" respectively which means the only 110 V source is energized and the terminals of S_1 are shorted. Note down the current of I_1'', I_2'', I_3'' from the ammeters A_1, A_2, A_3

5.) Compare I_1, I_2, I_3 with $I_1' + I_1''$, $I_2' + I_2''$, $I_3' + I_3''$ taking care of signs properly to verify the theorem

Teacher's Signature:

6.) Repeat the step (2) to (6) for five different values of resistance for each three rheostats

5.) Observation Table:->

Sr. No.	I_1 (in amps)	I_2 (in amps)	I_3 (in amps)	I_1' (in amps)	I_2' (in amps)	I_3' (in amps)	I_1'' (in amps)	I_2'' (in amps)	I_3'' (in amps)
	⊕	⊖	⊕						
1	0.35484	0.09677	0.25806	.51613	-.32258	.19355	-.16129	.22581	.064516
2	.34836	-.093728	.25463	.50613	-.31555	.19058	-.15778	.22182	.064047
3	.34211	-.090827	.25129	0.49652	-.30881	.18771	-.15441	.21798	.063579
4	.33610	-.088060	0.24804	0.48727	-.30234	.18493	-.15117	.21428	0.063110
5	.33030	-.085421	.24487	0.47836	-.29613	0.18223	-.14806	.21071	0.062642

Set of values of Resistances used:->

R_1:-> {200, 205, 210, 215, 220} in ohms (Ω)

R_2:-> {300, 305, 310, 315, 320} in Ohms (Ω)

R_3:-> {500, 505, 510, 515, 520} in Ohms (Ω)

Teacher's Signature:

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Result:-> Hence the Superposition Theorem has been proved using Experiment No. 1.

Teacher's Signature: