Basic electrical engineering lap

Exp.2

Series and parallel Resistor’s Connection

د.جابر غايب
نور الهدى حسين

Objective *:*

To study the properties of series and parallel connection.

Tools needed:-

1. DC voltage supply.

1. Set of wires.

2. Resistances.

3. Multi-meter.

Theory :

1. The Series Circuit

A SERIES CIRCUIT or ‘‘series-connected circuit’’ is a circuit having JUST ONE CURRENT PATH. Thus, Fig.(1) is an example of a ‘‘series circuit’’ in which a battery of constant potential difference V volts, and three resistances, are all connected ‘‘in series’’.

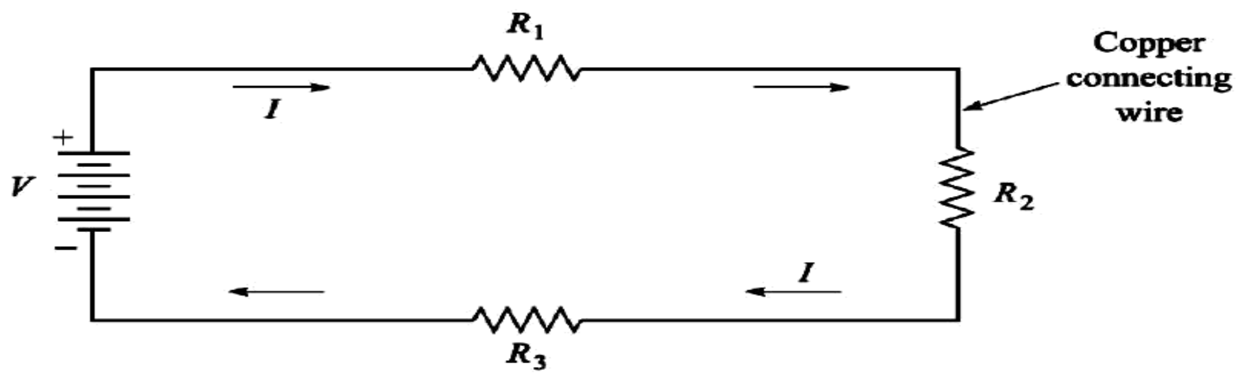


Fig.(1)

Since a series circuit has just one current path, it follows that all the components in a series circuit CARRY THE SAME CURRENT I, a fact evident from inspection of Fig.(1).

The current I is assumed to be a flow of positive charge, and thus flows out of the positive terminal of the battery and around through the external circuit, re-entering the battery at the negative terminal. This is indicated by the arrows in Fig.(1).

In a series circuit, the TOTAL resistance, RT, that the battery sees is equal to the SUM of the individual resistances. Thus, in the particular case of Fig.(1) the battery sees a total resistance, RT = R1 + R2 + R3, while in the general case of ‘‘n’’ resistances connected in series the battery sees a total resistance of :

RT = R1 + R2 + R3 +….. Rn

By Ohm’s law, it follows that the current I in a series circuit is equal to

$$I = \frac{V}{R_T} = \frac{V}{R_1 + R_2 + \cdots + R_n}$$

Resistance, on the other hand, consumes electrical energy, removing it from the circuit in the form of heat. Since resistance does not produce or generate electrical energy, it is a non-active or PASSIVE type of circuit element.

The potential difference between the terminals of a resistor is called the VOLTAGE DROP across the resistor, and, is equal to the current I times the resistance R; that is, the ‘‘voltage drop’’ across a resistance of R ohms carrying a current of I amperes is I*R volts.

$$V = IR_T$$
$$V = I(R_1 + R_2 + \cdots + R_n)$$
$$V = IR_1 + IR_2 + \cdots + IR_n$$

We have the important fact that:

In a series circuit, the applied voltage is equal to the sum of the

It should be pointed out that the voltage drop across a resistor is always from plus to minus in the direction of the current flow, a fact illustrated in Fig.(2).

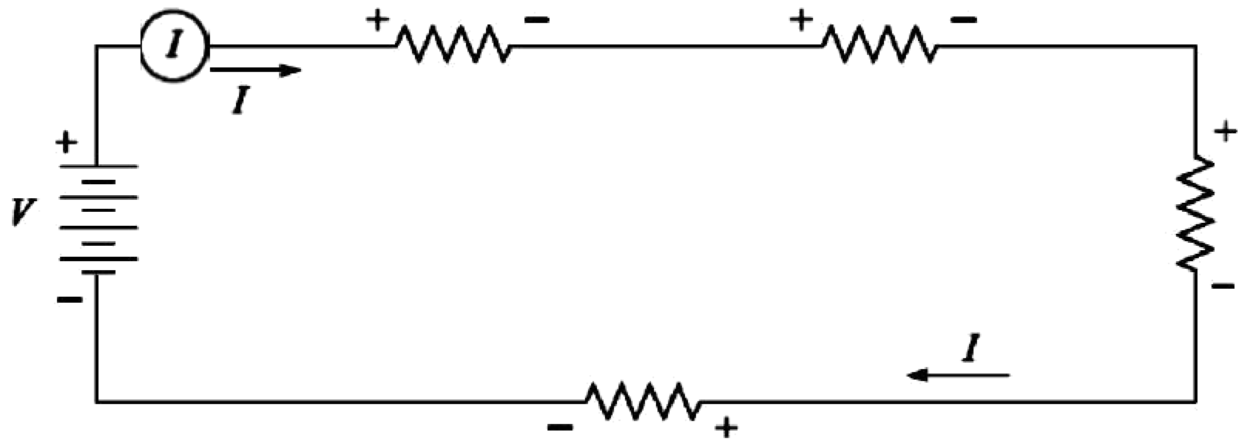


Fig.(2)

2. The Parallel Circuit

A PARALLEL circuit is one in which the battery current divides into a number of ''parallel paths.'' This is shown in Fig.(3), in which a battery, of constant V volts, delivers a current of I amperes to a load consisting of any number of n resistances connected ''in parallel.''

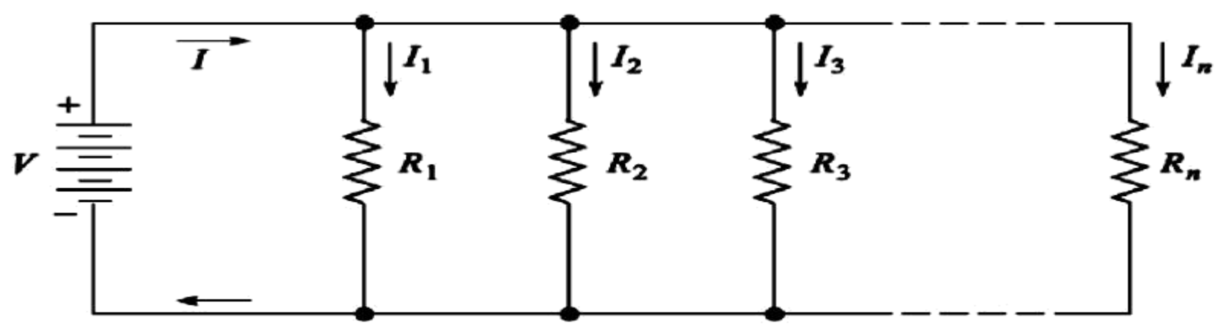


Fig.(3)

The currents in the individual resistances are called the ''branch currents,'' and the battery current I is often called the ''line current.'' From inspection of Fig.(3) we see that, in a parallel circuit, the battery current I is equal to the sum of the branch currents.

$$I = I_1 + I_2 + I_3 + \cdots + I_n$$

If the battery voltage V is applied equally to all n resistances; that is, the same voltage V is applied to all the parallel branches. Hence, by Ohm's law, the individual branch currents in Fig.(3) have the values:

$$I_1 = V/R_1, \qquad I_2 = V/R_2, \ldots, I_n = V/R_n$$

Then, we have:

$$I = V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots + \frac{1}{R_n}\right)$$

Now let RT be the total resistance as seen by the battery in Fig.(3).

Then, by Ohm's law, it has to be true that:

$$I = \frac{V}{R_T}$$

Since the left-hand sides of the last two equations are equal, the two right-hand sides are also equal. Setting the two right-hand sides equal, then canceling the Vs, gives :

$$\boxed{\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots + \frac{1}{R_n}}$$

Procedure

1. Using the DC circuit trainer, connect the circuit Shown in Fig. (4), take VT =10V, and R1=1kΩ, R2 = 100Ω and R3 =2kΩ.

2. Measured the voltage and current of "R1 , R2 & R3", then record it in table below :

	1kΩ	100Ω	2kΩ	
V(volt)				$V_T =$
I(mA)				$I_T =$

3. By using ohm's law, Calculate the RT .

4. Disconnect the DC power supply, and then measured the equivalent resistance by using the Multi-meter only.

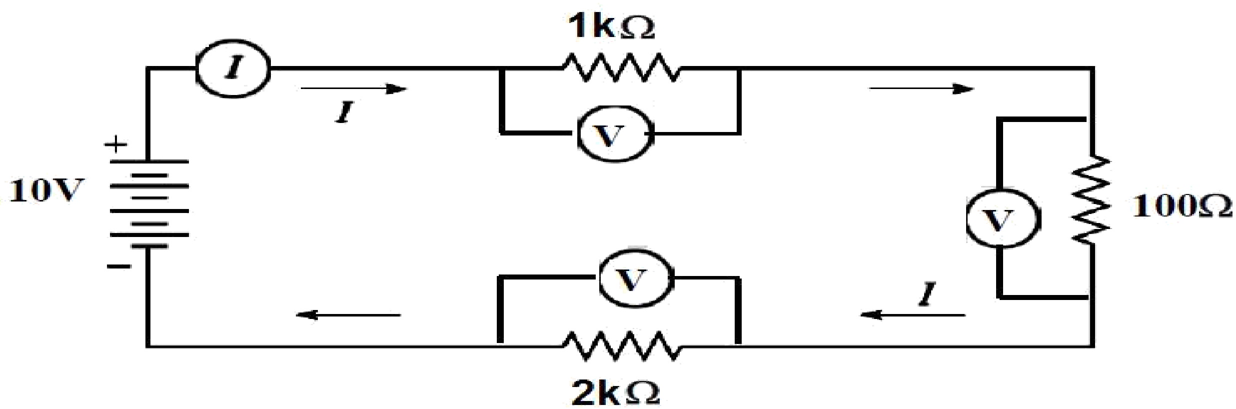


Fig.(4)

5. Repeat the procedure in steps (1,2,3&4) above , for the circuit shown in Fig.(5).

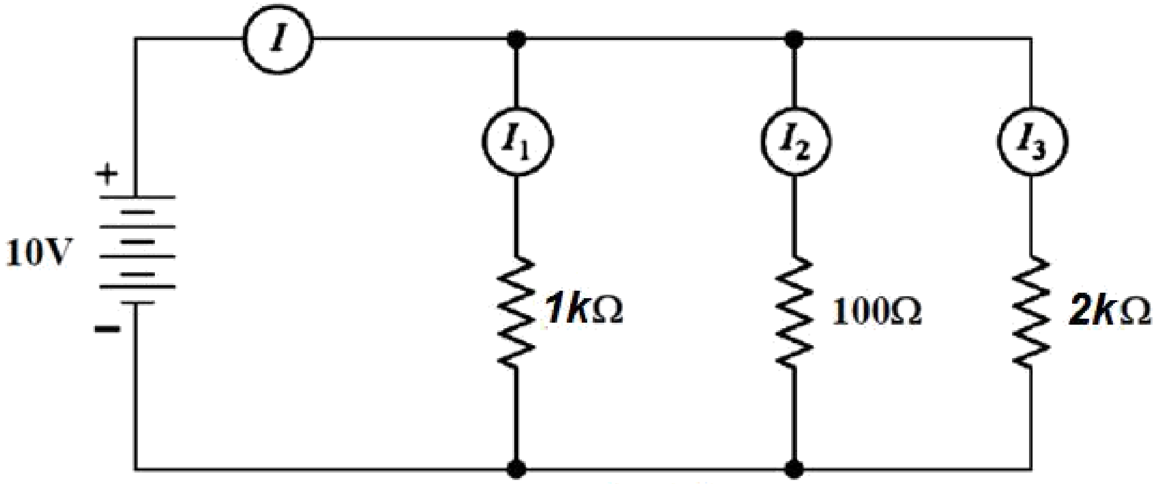
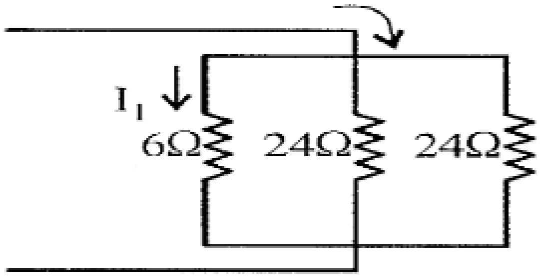


Fig.(5)

Discussion

1.Find the value of the current I_1 in the circuit bellow



2. from the circuit in the following figure find the value of the current and voltage in each resistance