Class: 1st
Subject: Electrical Technology
Lecturer: Omar A. Alkawak
E-mail: OmarAhmed@mustaqbal-college.edu.iq

Lecture No. 2,3

"Ohms law"

Lecture two, three

"Ohms law"

Ohms law :

This law applies to electric conduction through good conductors and may be stated as follows :

The ratio of potential difference (V) between any two points on a conductor to the current (I) flowing between them , is constant ,

in other words ,

$$\frac{V}{I} = \text{constant , or } \frac{V}{I} = R$$

Open and short circuit in series circuits :

1. Open circuit:

In this case there is no current flows through the circuit as shown in fig. 1 .

I = 0

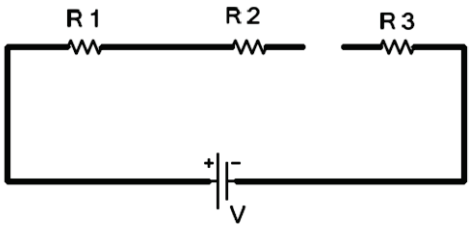


Fig. 1

2. Short circuit :

If the resistance is short circuited , the current will flow through the short circuit (no current flows through the shorted resistance)

as shown in fig. 2 .

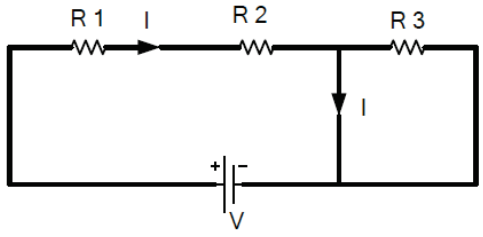


Fig.2

$$I = \frac{V}{R_1 + R_2}$$

Open and short circuit in parallel circuits :

1. Open circuit :

In this case , there is no current flow in the open branch as shown in fig. 3 .

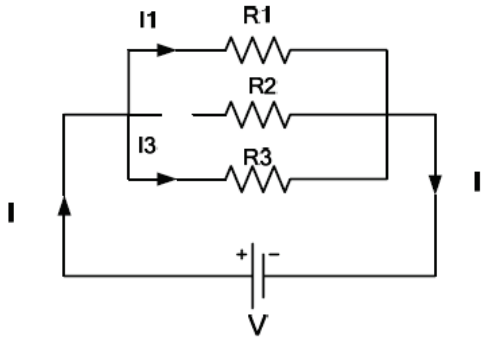


Fig. 3

I 2 = 0

I = I 1 + I 3

2. short circuit :

In this case , there is no current flow through R1 , R2 and R3 because the total current (I) pass through the short circuit as shown in fig. 4 .

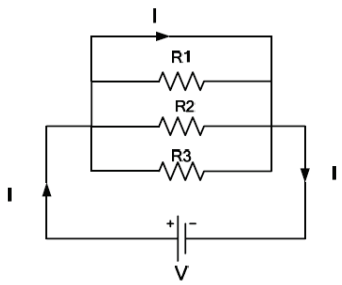


Fig. 4

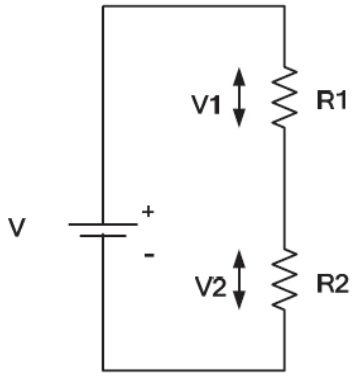
$$I = \frac{V}{r_i}$$

Where ri is the internal resistance of the battery .

Voltage divider rule (V.D.R : (

In series circuits , voltage across any resistance could be obtained in terms of total voltage as follows :

Voltage across resistance equal to the total voltage multiply by the value of this resistance divided by the sum of all resistances .



$$V_1 = V \times \frac{R_1}{R_1 + R_2}$$

$$V_2 = V \times \frac{R_2}{R_1 + R_2}$$

Example : Using voltage divider rule (V.D.R.) ,find V1 , V2 , V3 And V ' from fig. 5 .

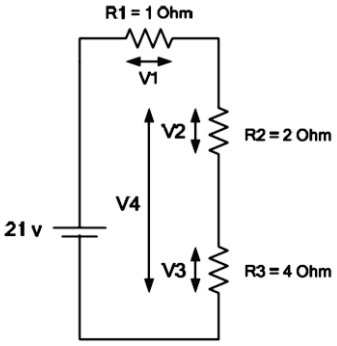


Fig. 5

$$V_1 = V \times \frac{R_1}{R_1 + R_2 + R_3} = 21 \times \frac{1}{1 + 2 + 4} = 3\ v$$

$$V_2 = V \times \frac{R_2}{R_1 + R_2 + R_3} = 21 \times \frac{2}{1 + 2 + 4} = 6\ v$$

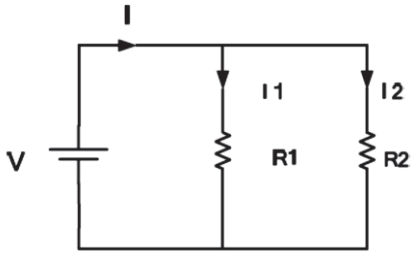
$$V_3 = V \times \frac{R_3}{R_1 + R_2 + R_3} = 21 \times \frac{4}{1 + 2 + 4} = 12\ v$$

$$V_4 = V \times \frac{R_2 + R_3}{R_1 + R_2 + R_3} = 21 \times \frac{2 + 4}{1 + 2 + 4} = 18\ v$$

Current divider rule (C.D.R : (

In parallel circuits , branch current could be obtained in terms of the total current as follows :

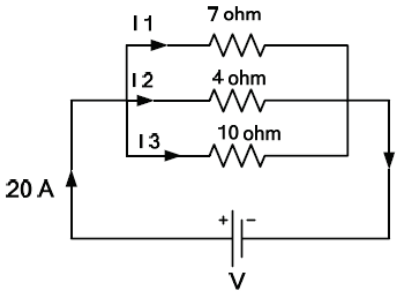
Branch current equal to the total current multiply by the resistance of other branch divided by the sum of all resistances .



$$I_1 = I \times \frac{R_2}{R_1 + R_2}$$

$$I_2 = I \times \frac{R_1}{R_1 + R_2}$$

Example : Using current divider rule (C.D.R.) , calculate I 1 , I 2 and I 3 from fig. 6 .



V Fig. 6

To find I 1 , the other resistances are (4 // 10)

$$\frac{4 \times 10}{4 + 10} = 2.857\ \Omega$$

$$I_1 = 20 \times \frac{2.857}{7 + 2.857} = 5.796\ A$$

To find I 2 , the other resistances are (7 // 10) .

$$\frac{7 \times 10}{7 + 10} = 4\ \Omega$$

$$I_2 = 20 \times \frac{4}{4 + 4} = 10\ A$$

To find I 3 , the other resistances are (7 // 4) .

$$\frac{7 \times 4}{7 + 4} = 2.545\ \Omega$$

$$I_3 = 20 \times \frac{2.545}{2.545 + 10} = 4.057\ A$$