SNS COLLEGE OF TECHNOLOGY
Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++'(III Cycle) Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

23ECB101 – CIRCUIT ANALYSIS AND DEVICES

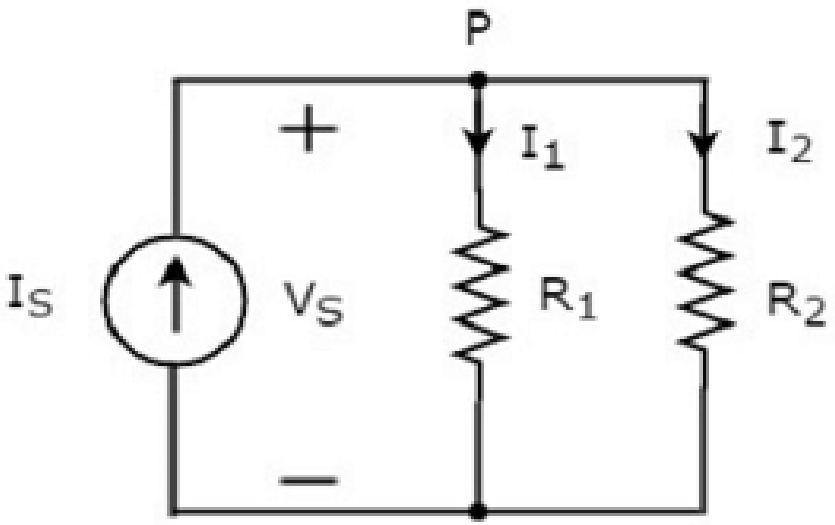
I YEAR/ II SEMESTER

UNIT 1 – MESH AND NODE ANALYSIS OF ELECTRIC CIRCUITS

TOPIC - Voltage and Current Division Rules

Current Division

- In a parallel circuit, current divides in all branches. Thus, a parallel circuit acts as a current divider.

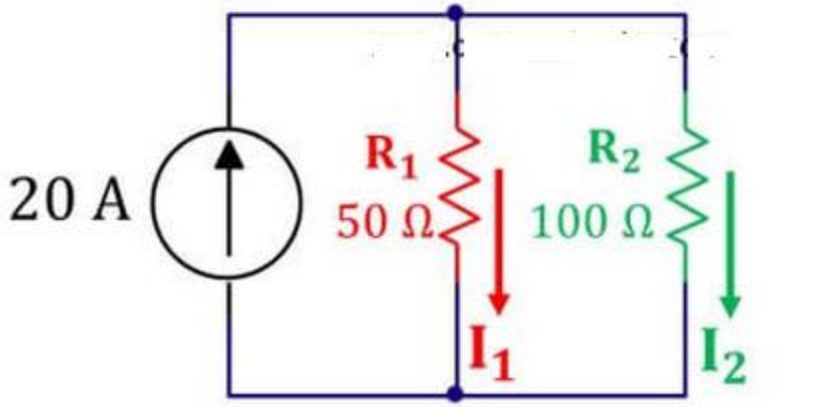


- $I1 = IS(R2/R1+R2)$
- $I2 = IS(R1/R1+R2)$

- Thus current division rule states that current through any branch is given by the ratio of opposite branch resistance divided by total resistance multiplied by the total current.

Example

- *Two parallel resistors having their values 50 ohms and 100 ohms are connected in parallel. Find the current flowing through each when the connected source is of 20 A.*



Where $R_t = R_1 || R_2 = 33.33\ \Omega$

$$I_1 = \frac{R_t}{R_1} * I_t$$

$$I_1 = \frac{33.33\ \Omega}{50\ \Omega} * 20\ A$$

$$I_1 = 13.33\ A$$

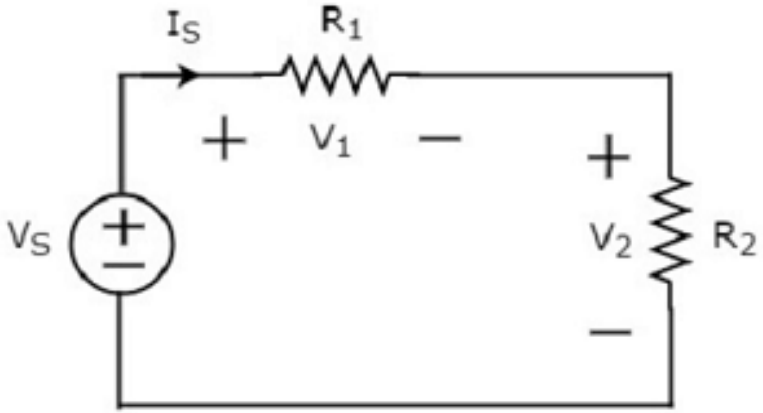
$$I_2 = \frac{R_t}{R_2} * I_t$$

$$I_2 = \frac{33.33\ \Omega}{100\ \Omega} * 20\ A$$

$$I_2 = 6.66\ A$$

Voltage Division

- The series circuit acts as a voltage divider. Since the same current flows through each resistor, the voltage drops are proportional to the values of resistor.



- $V1=VS(R1/R1+R2)$
- $V2=VS(R2/R1+R2)$

- Voltage division rule states that the Voltage drop across any resistor in a series circuit is equal to the ratio of that resistance value to the total resistance, multiplied by the source voltage.

Example

- Three resistive elements of 6kΩ, 12kΩ and 18kΩ are connected together in series across a 36 volt supply. Calculate, the total resistance, the value of the current flowing around the circuit, and the voltage drops across each resistor.

- Data given: V_S = 36 volts, R_1 = 6kΩ, R_2 = 12kΩ and R_3 = 18kΩ

$$R_T = R_1 + R_2 + R_3 = 6k\Omega + 12k\Omega + 18k\Omega = 36k\Omega$$

$$I = \frac{V_S}{R_T} = \frac{36}{36000} = 1mA$$

$$V_{R1} = V_S\left(\frac{R_1}{R_T}\right) = 36\left(\frac{6000}{36000}\right) = 6volts$$

$$V_{R2} = V_S\left(\frac{R_2}{R_T}\right) = 36\left(\frac{12000}{36000}\right) = 12volts$$

$$V_{R3} = V_S\left(\frac{R_3}{R_T}\right) = 36\left(\frac{18000}{36000}\right) = 18volts$$

Assessment

1. If there are 3 Resistors R_1, R_2 and R_3 in series and V is total voltage and I is total current then Voltage across R_2 is

a) $V R_3 / R_1 + R_2 + R_3$

b) $V R_2 / R_1 + R_2 + R_3$

c) $V R_1 / R_1 + R_2 + R_3$

d) V

2. For a parallel connected resistor R_1, R_2 and a voltage of V volts. Current across the first resistor is given by

a) $I R_1$

b) $I R_2$

c) $I R_1 / R_1 + R_2$

d) $I R_2 / R_1 + R_2$

3. Why is current division necessary?

a) In series current is the same

b) In parallel current differs

c) Because the voltage is also different

d) Because of Kirchhoff's laws.

THANK YOU