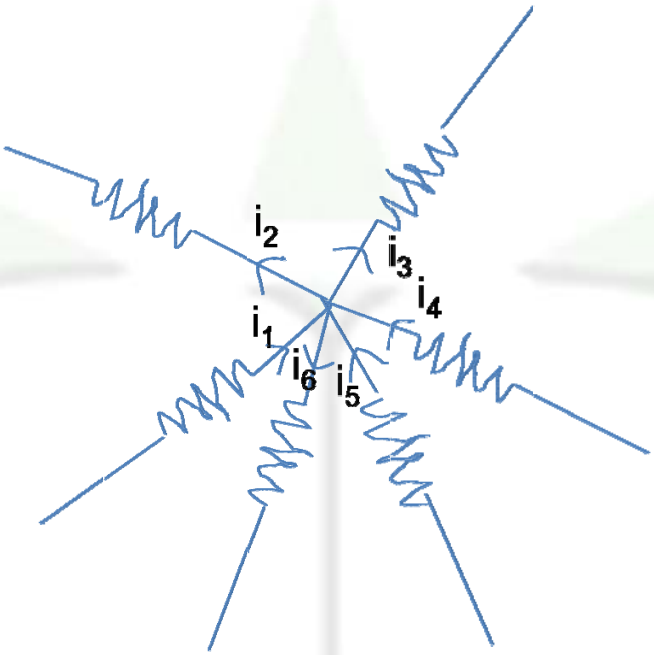
Kirchhoff's law: In complicated networks to find current flowing through different branches we apply Kirchhoff's law.

First law: The algebraic sum of currents meeting at a point is zero. i.e.Σi = 0

Explanation: Let us follow a convention current flowing towards the point is taken as positive and flowing away from the point is taken as negative.



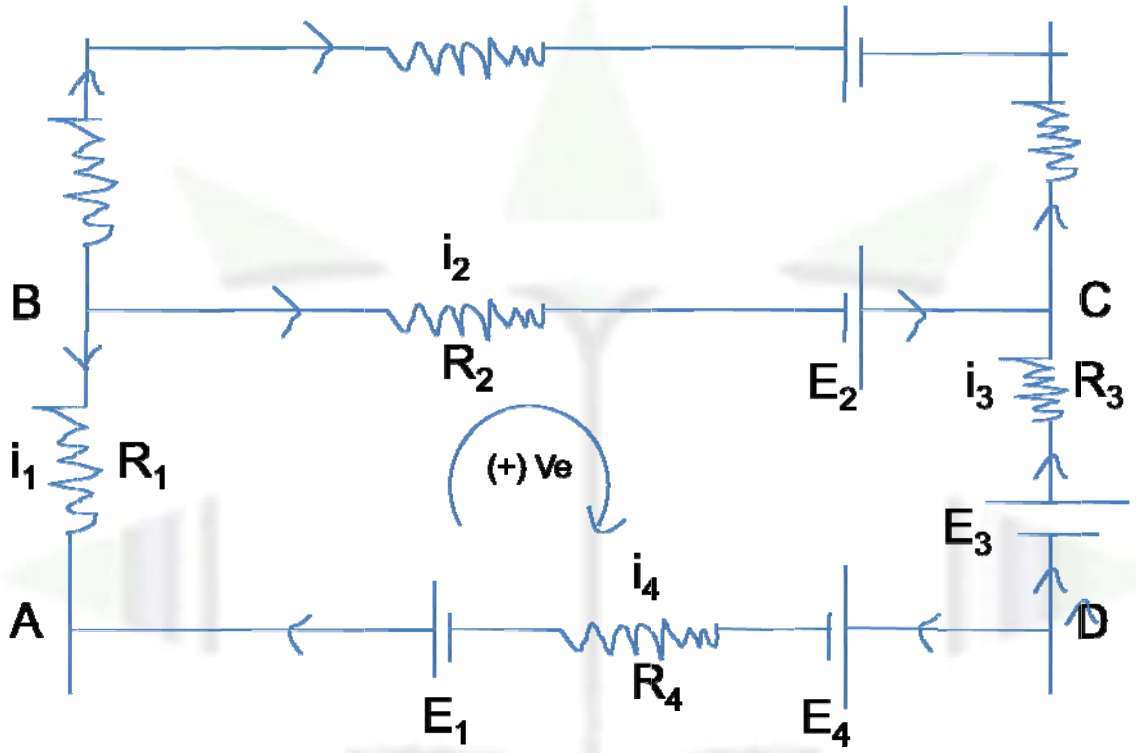
$$\sum i = i_1 - i_2 - i_3 + i_4 + i_5 - i_6 = 0$$

Kirchhoff's first law is also known as point theorem or junction theorem.

Second law: "In a closed mesh of electrical conductors the algebraic sum of product of resistance and the respective current in the different branches is equal to the total e.m.f applied in the closed mesh"

Kirchhoff's second law is also known as loop theorem.

$$\sum iR = \sum E$$



We follow a convention; assign any direction of current in a branch. A closed curve can be traversed either in clockwise or in anticlockwise. Assume any of this particular direction to be positive. If the current in the branch or the e.m.f of the cell is along the assumed direction it will be taken as positive and if they are opposite to that assumed direction they will be considered to be negative.

In our circuit ABCD clockwise direction is taken as positive.

$$\sum iR = -i_1R_1 + i_2R_2 - i_3R_3 + i_4R_4 = E_1 + E_2 - E_3 - E_4$$