UNIT I

KIRCHOFF'S LAW

INTRODUCTION KIRCHOFF'S LAW

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HISTORY OF KIRCHOFF'S LAW

INTRODUCTION

TYPES OF KIRCHOFF'S LAW

HISTORY OF KIRCHOFF'S LAW

Gustav Robert Kirchhoff
(German physicist)

- described two laws that became central to electrical engineering in 1845
- The laws were generalized from the work of Georg Ohm
- It's can also be derived from Maxwell's equations, but were developed prior to Maxwell's work

INTRODUCTION

What ?

- A pair of laws stating general restrictions on the current and voltage in an electric circuit.

How ?

- The first of these states that at any given instant the sum of the voltages around any closed path, or loop, in the network is zero.
- The second states that at any junction of paths, or node, in a network the sum of the currents arriving at any instant is equal to the sum of the currents flowing away.

TYPES OF KIRCHOFF'S LAW

KVL

- Kirchoff Voltage Law

KCL

- Kirchoff Current Law

KIRCHOFF'S CURRENT LAW

INTRODUCTION KCL

NODES ANALYSIS

EXERCISE

INTRODUCTION OF KCL

1

Kirchhoff's Current Law is sometimes called "Kirchhoff's First Law" or "Kirchhoff's Junction Rule"

along with Kirchhoff's Voltage Law makes up the two fundamental laws of Electrical Engineering

2

In this lesson it will be shown how Kirchhoff's Current Law describes the current flow through a junction of a circuit

3

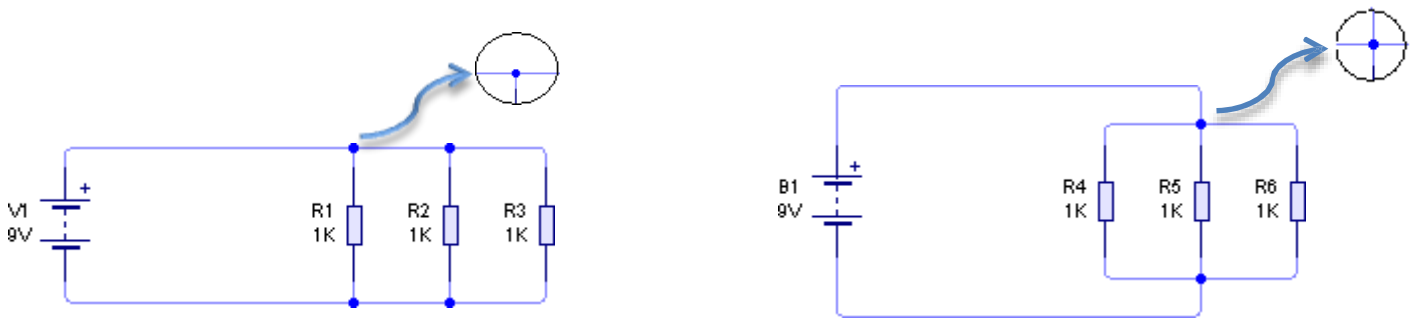
KCL helps to solve unknowns when working with electrical circuits

4

KCL with the addition of KVL and Ohm's Law will allow for the solution of complex circuits

- Definition that will help in understanding Kirchhoff's Current Law:

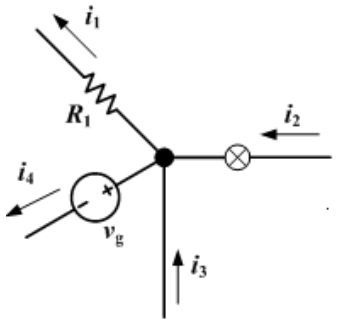
Junction - A junction is any point in a circuit where two or more circuit paths come together.



Examples of a Junction

- Kirchhoff's Current Law generally states:

The algebraic sum of all currents entering (+) and leaving (-) any point (junction) in a circuit must equal zero.

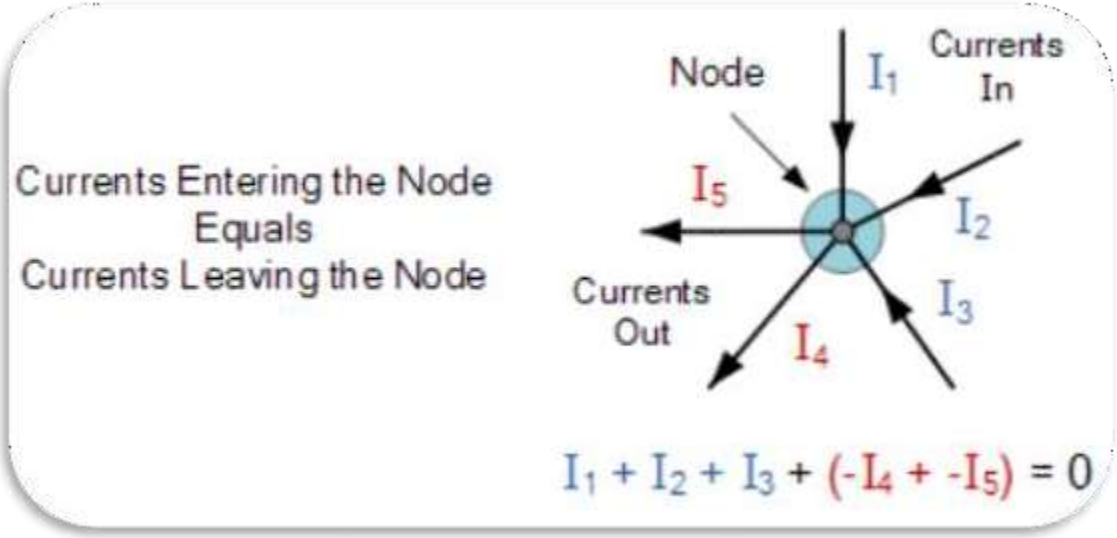


$$\sum_n i_n = i_1 + i_2 + i_3 + i_4 = 0$$

- Restated as:

The sum of the currents into a junction is equal to the sum of the currents out of that junction.

- The algebraic sum of all currents entering (+) and leaving (-) any point (junction) in a circuit must equal zero.



- Here, the 3 currents entering the node, I_1, I_2, I_3 are all positive in value and the 2 currents leaving the node, I_4 and I_5 are negative in value. Then this means we can also rewrite the equation as;

$$I_1 + I_2 + I_3 - I_4 - I_5 = 0$$