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

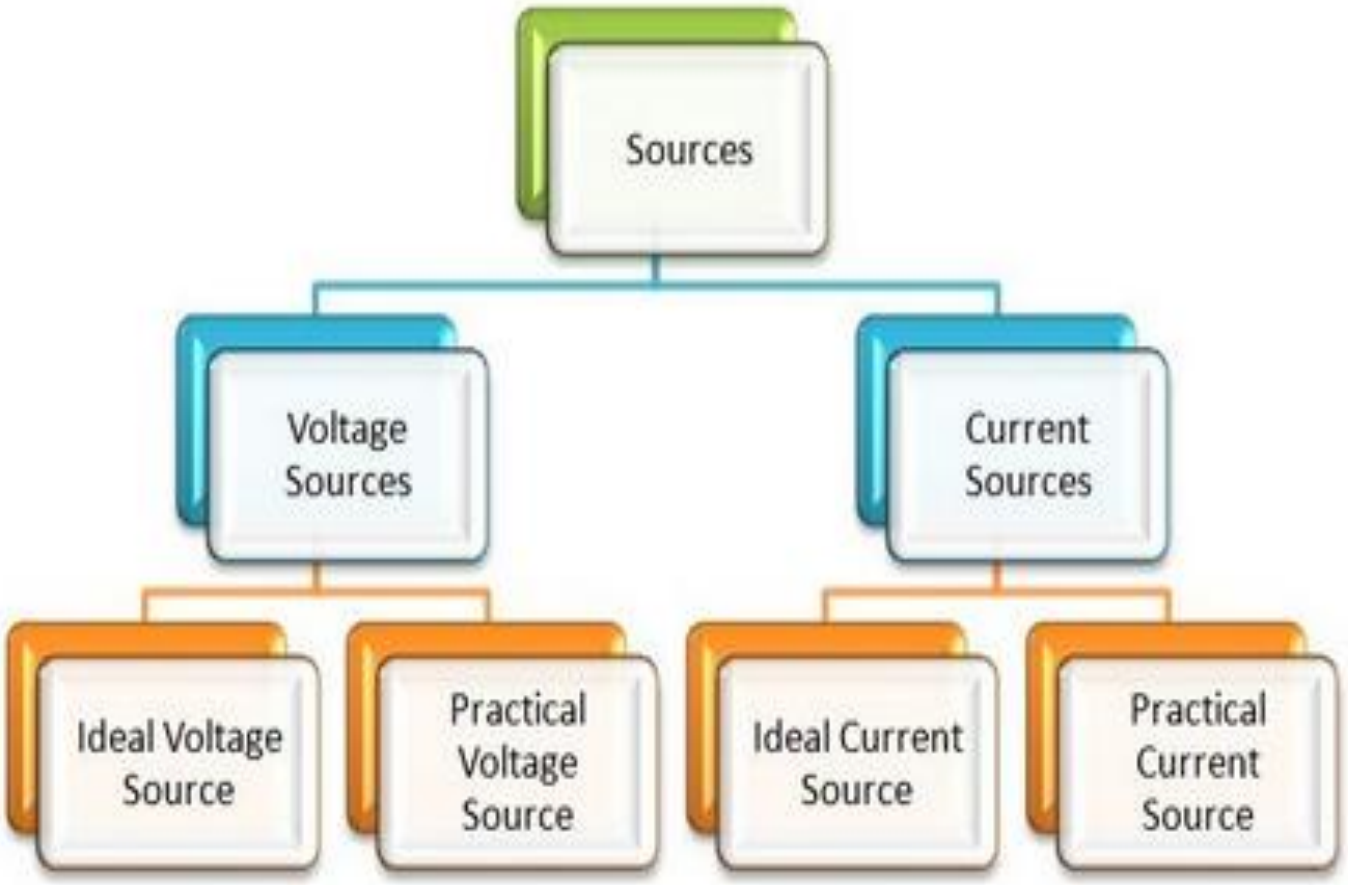
TOPIC - Series and Parallel Connected Sources

Introduction

- A **Source** is a device which converts mechanical, chemical, thermal or some other form of energy into electrical energy. In other words, the source is an active network element meant for generating electrical energy.

- The various types of sources available in the electrical network are voltage source and current sources.

Sources

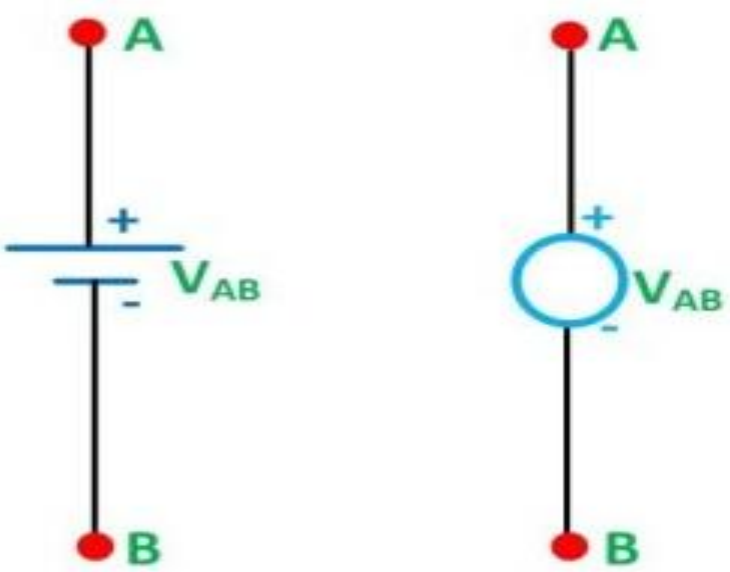

Sources
Voltage Sources
Current Sources
Ideal Voltage Source
Practical Voltage Source
Ideal Current Source
Practical Current Source

Voltage Source

- *A Voltage Source is a device that generates an exact output voltage which, in theory, does not change regardless of the load current.*

- **Ideal Voltage Source** have zero internal resistance. Practically an **ideal voltage source** cannot be obtained. **Sources** having some amount of internal resistances are known as **Practical Voltage Source**. due to this internal resistance; **voltage** drop takes place, and it causes the terminal **voltage** to reduce.

- The smaller is the internal resistance (r) of a voltage source, the more closer it is to an Ideal Source. The symbolic representation of the ideal and practical voltage source is shown below.

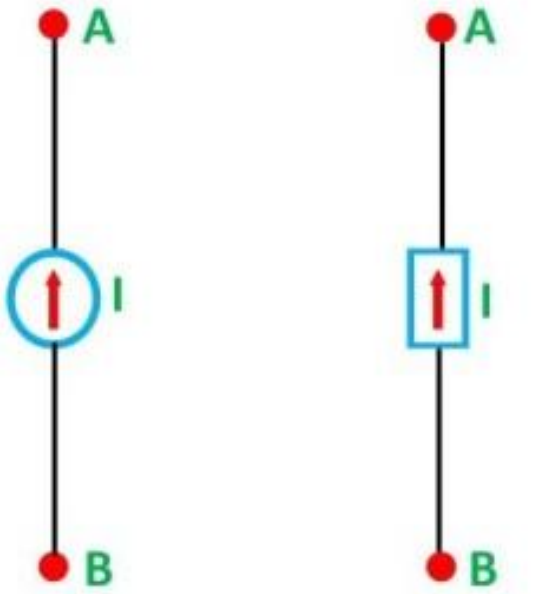


Current Source

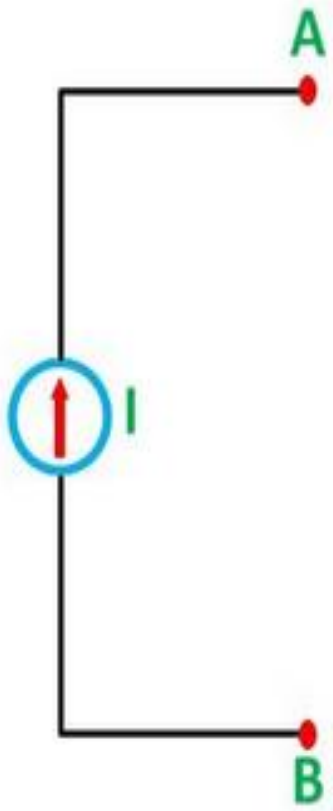
- A **current source** is an electronic circuit that delivers or absorbs an electric **current** which is independent of the voltage across it.

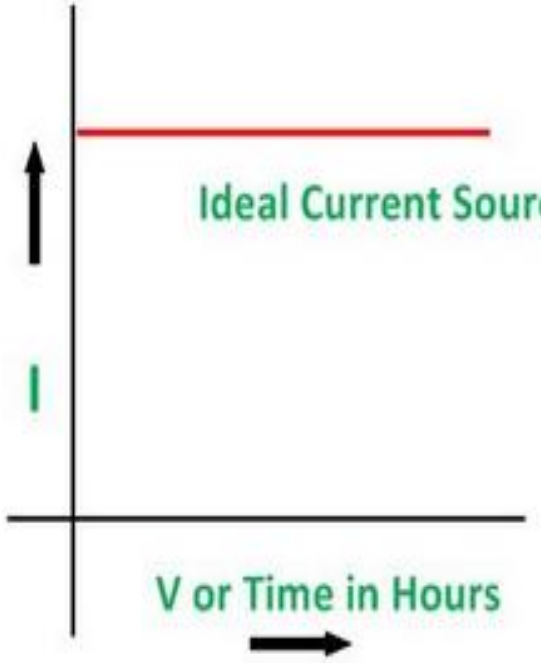
- An **ideal current source** is a **current source** that supplies constant **current** to a circuit despite any other conditions present in the circuit. An **ideal current source** provides this constant **current** with 100% efficiency.

- *The symbolic representation of the ideal and practical current source is shown below*

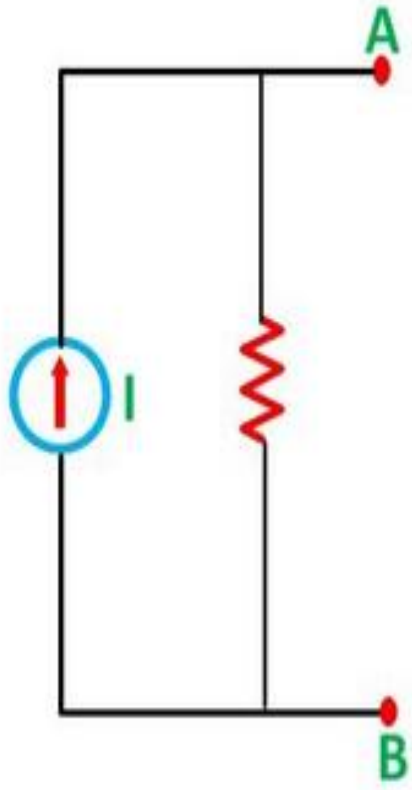


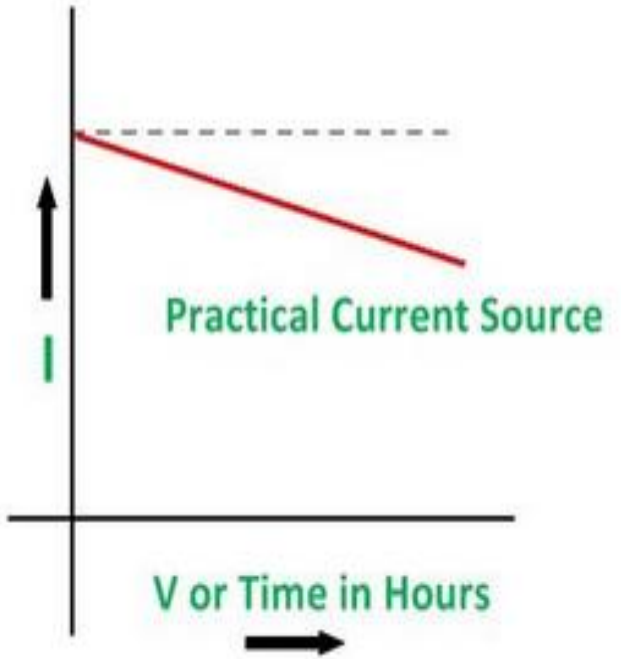
Ideal Current Source



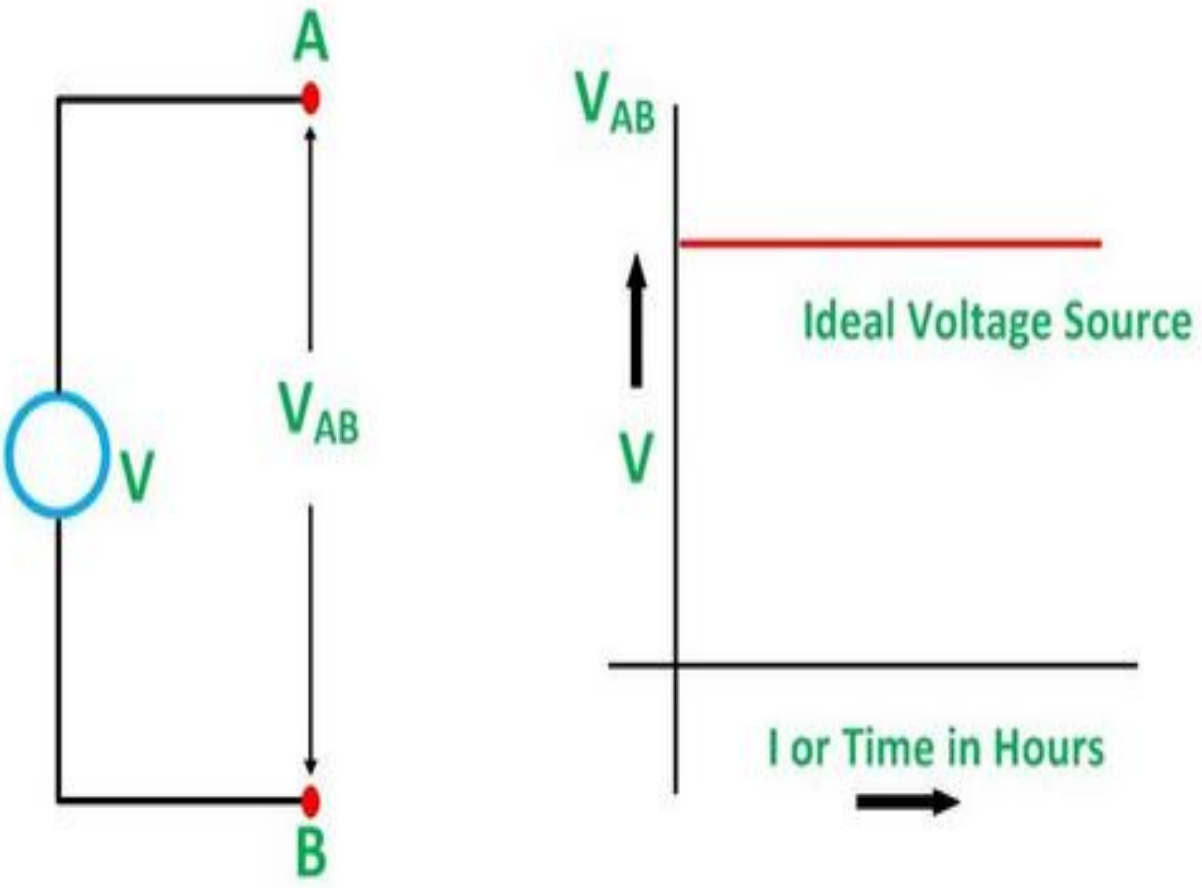


Practical Current Source

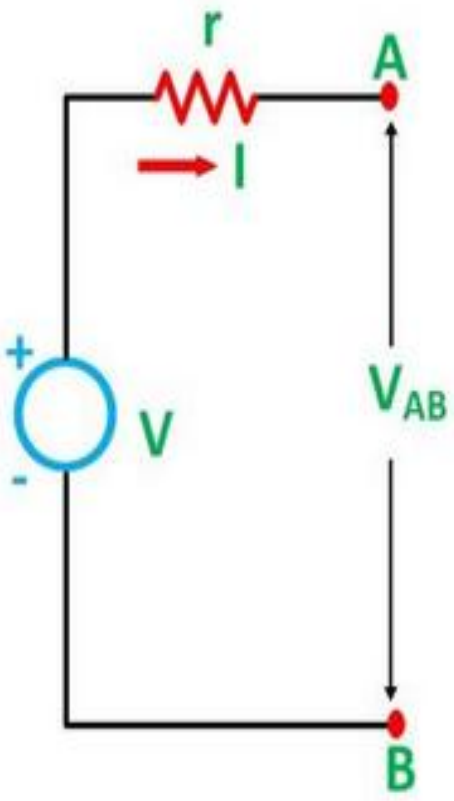


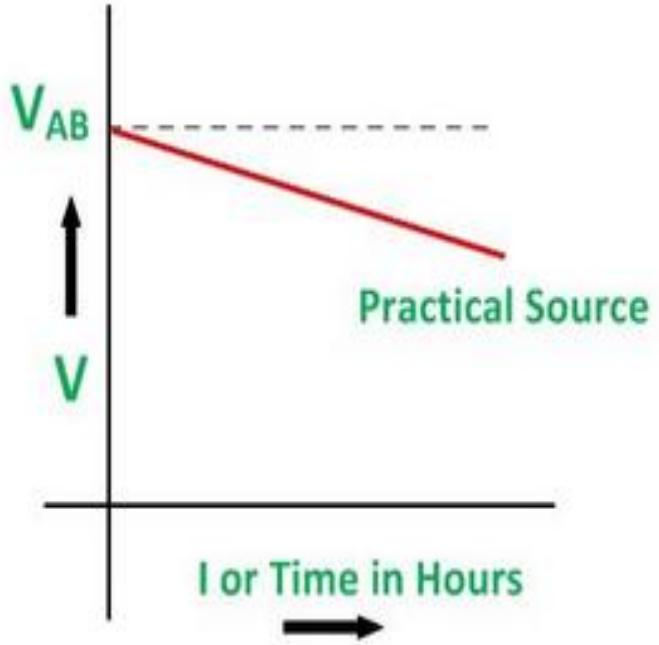


Ideal Voltage Source



Practical Voltage Source

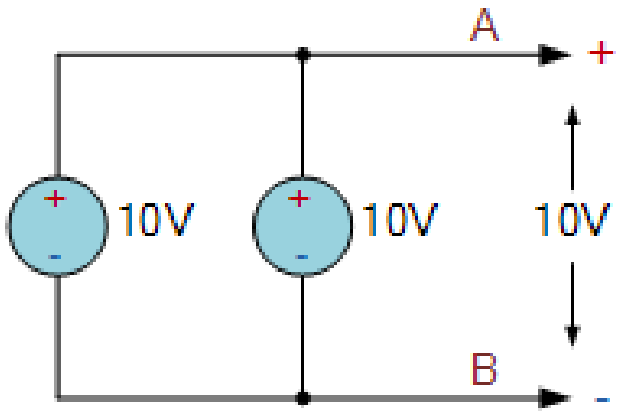




Connecting Voltage Sources Together

- Ideal voltage sources can be connected together in both parallel or series the same as for any circuit element. Series voltages add together while parallel voltages have the same value.

Voltage Source in Parallel



Ideal voltage sources can be connected in parallel provided they are of the same voltage value.

Connection of Voltage Source in Series

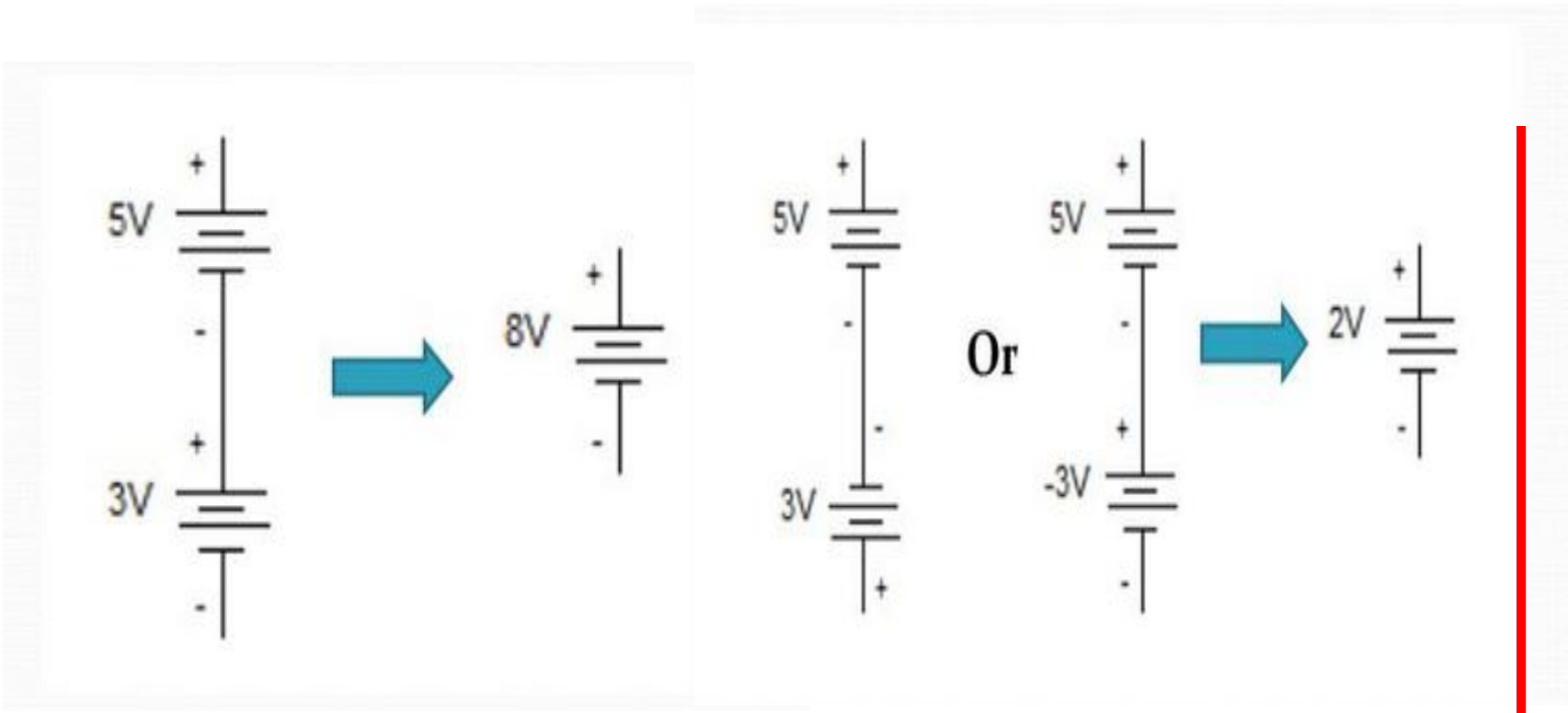
- Voltage source in Series Can be connected in two configurations
- Series Aiding Configuration:

  In this configuration the two voltages are added to get the resultant voltage

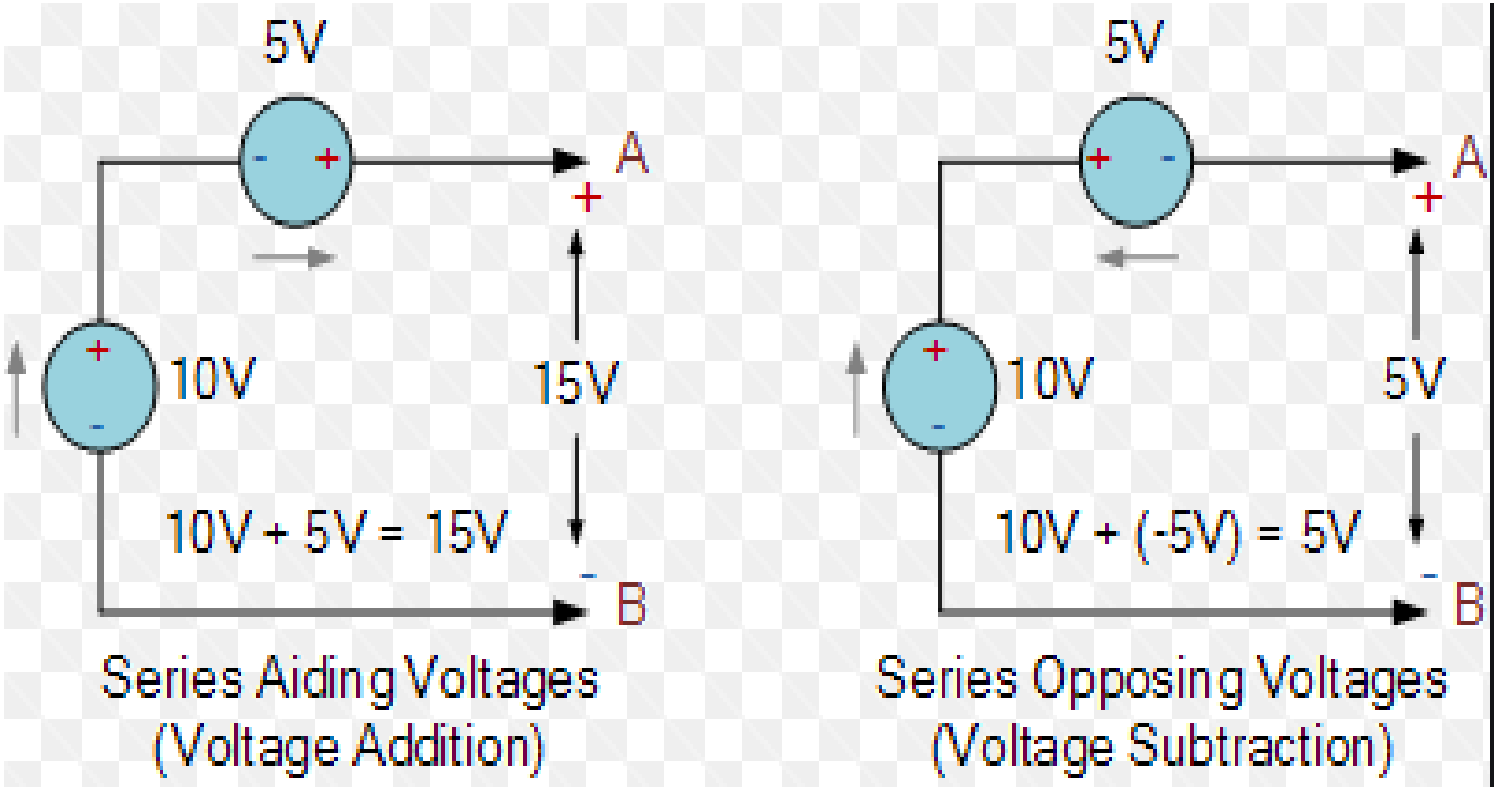
- Series Opposing Configuration:

  In this configuration the two voltages are subtracted to get the resultant voltage

Example



Example


5V
A
10V
15V
10V + 5V = 15V
B
Series Aiding Voltages
(Voltage Addition)
5V
A
10V
5V
10V + (-5V) = 5V
B
Series Opposing Voltages
(Voltage Subtraction)

Current Sources in Series

- **Current sources** are not allowed to be **connected** together in **series**, either of the same value or ones with different values.
- series connected current sources add an unknown factor into circuit analysis, which is not good.
- Another reason why series connected sources are not allowed for circuit analysis techniques is that they may not supply the same current in the same direction.

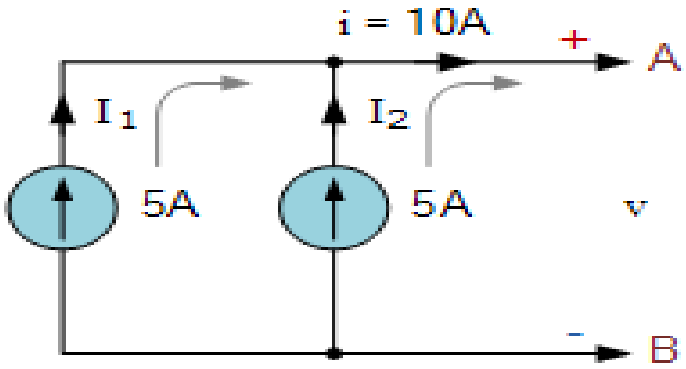
Current Source in Parallel

- Connecting two or more current sources in parallel is equivalent to one current source whose total current output is given as the algebraic addition of the individual source currents.
- Current source in Parallel can be connected in two configurations
- Parallel Aiding Configuration:

  In this configuration the two currents are added to get the resultant current
- Parallel Opposing Configuration:

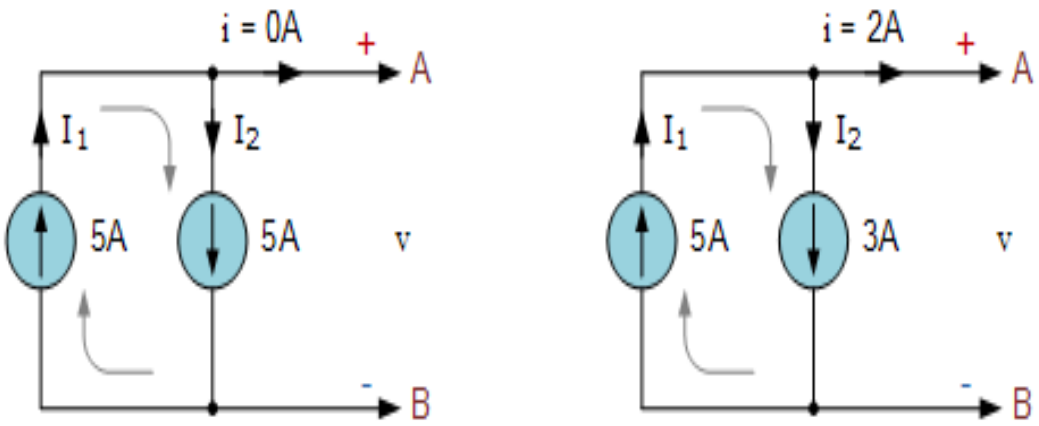
  In this configuration the two currents are subtracted to get the resultant voltage

Parallel Aiding Configuration



Here in this example, two 5 amp current sources are Combined to produce 10 amps as $I_T = I_1 + I_2$.

Parallel Opposing Configuration



for example, two current sources of 5 amps each would result in zero output as 5A -5A = 0A. Likewise, if the two currents are of different values, 5A and 3A, then the output will be the subtracted value with the smaller current subtracted from the larger current. Resulting in a I_T of 5 - 3 = 2A.

Assessment

1. In case of ideal current sources, they have

_____

a) zero internal resistance
b) low value of voltage
c) large value of currrent
d) infinite internal resistance

2. A practical current source can also be represented as

_____

a) a resistance in parallel with an ideal voltage source
b) a resistance in parallel with an ideal current source
c) a resistance in series with an ideal current source
d) none of the mentioned

3. A practical voltage source can also be represented as

_____

a) a resistance in series with an ideal current source
b) a resistance in series with an ideal voltage source
c) a resistance in parallel with an ideal voltage source
d) none of the mentioned

THANK YOU