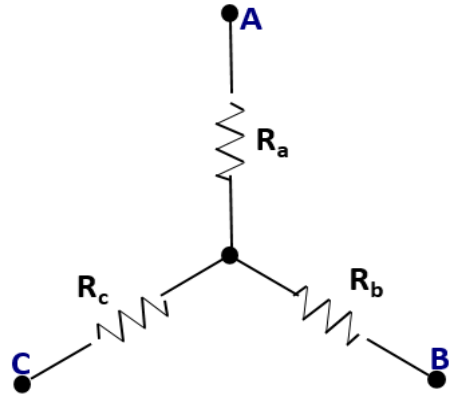
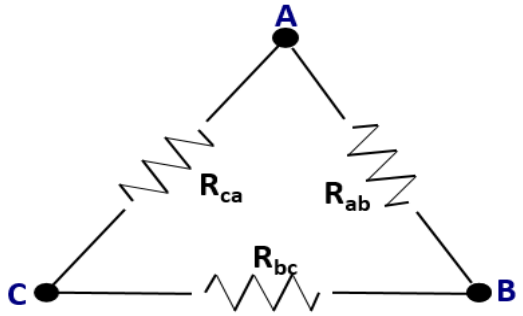
Basic Electrical Technology

Mesh Current Analysis

Recap: Star-Delta & Source Transformations

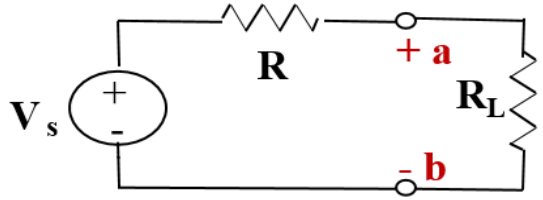


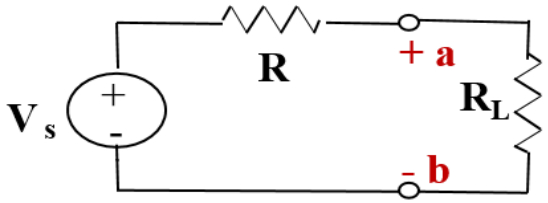
Star Connection



Delta Connection

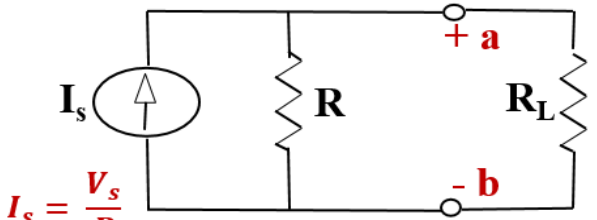
Practical Voltage source



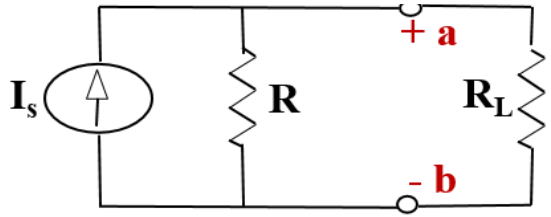


$V_s = R \times I_s$

Practical Current source



$I_s = \frac{V_s}{R}$



Objective

Application of KVL for the analysis of DC circuits

Introduction

Kirchhoff's Voltage Law (KVL)

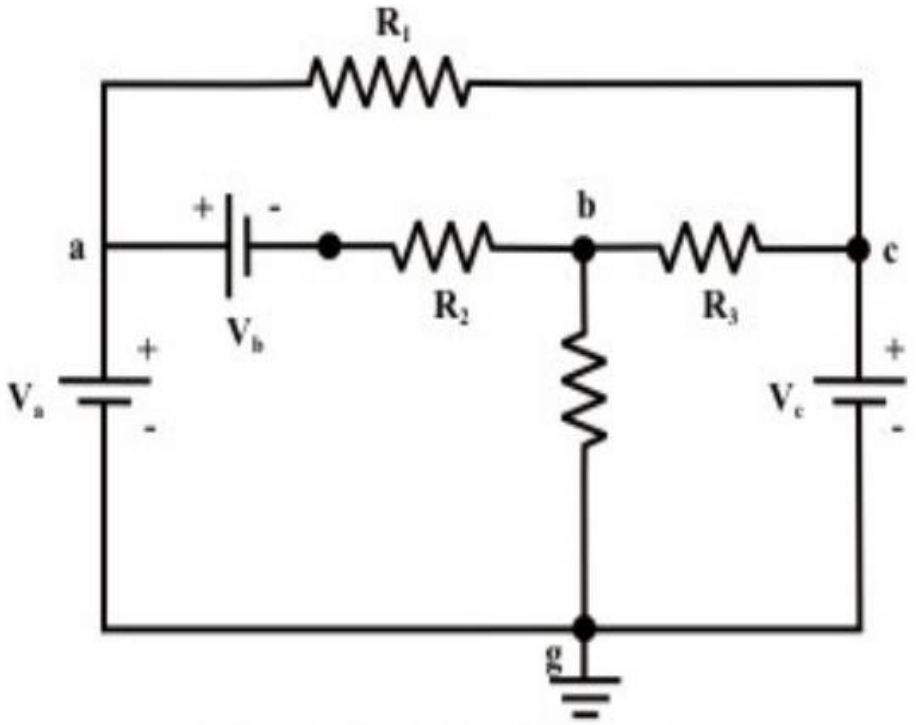
- States that in a closed circuit, the algebraic sum of all source voltages must be equal to the algebraic sum of all the voltage drops.

Loop

- Any closed path in an electric circuit
- Inside loops: a-b-g-a, b-c-g-b & a-c-b-a
- Outside loops: a-c-g-a & a-b-c-g-a

Mesh

- Special case of loop that does not have any other loops within it.
- a-b-g-a, b-c-g-b & a-c-b-a



Mesh Current Analysis Method

1. Transform all the practical current sources to voltage sources

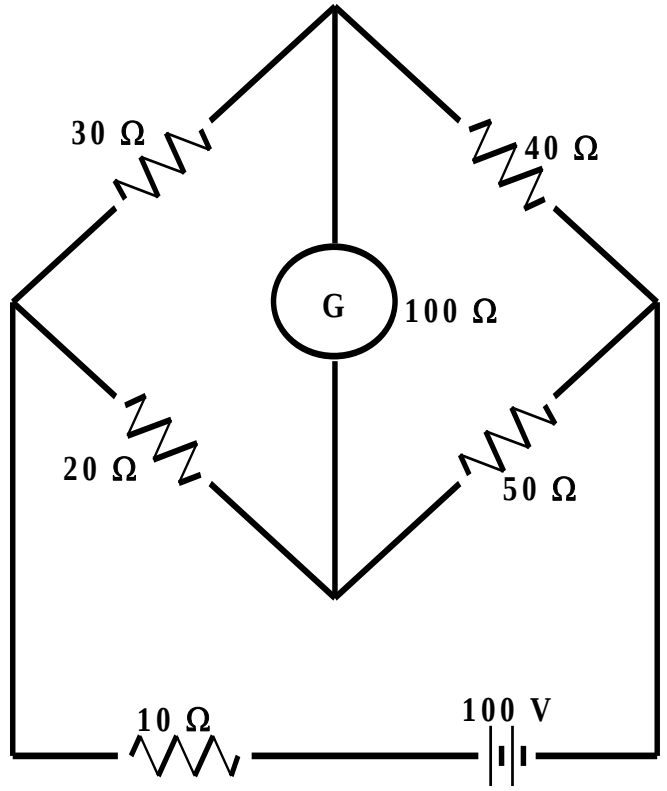
2. Mark currents in all the meshes (or independent loops) in clockwise direction

3. Write KVL equations for these independent meshes
   a) Sign convention: Voltage drop ---> as negative
   b) Voltage rise ---> as positive

4. Solve for the currents

Illustration 1

Determine the current through the galvanometer "**G**"



Answer : 84 mA

Illustration 1 contd…

How to write the network equations by inspection?

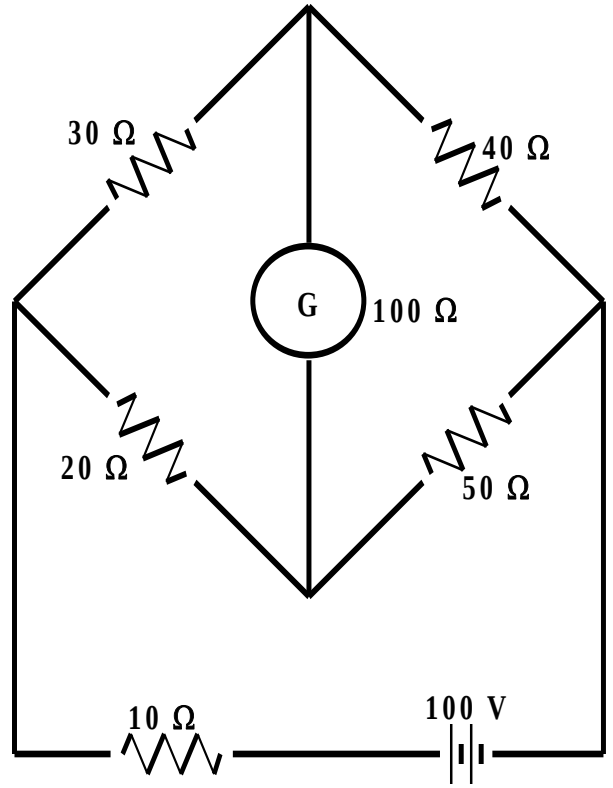
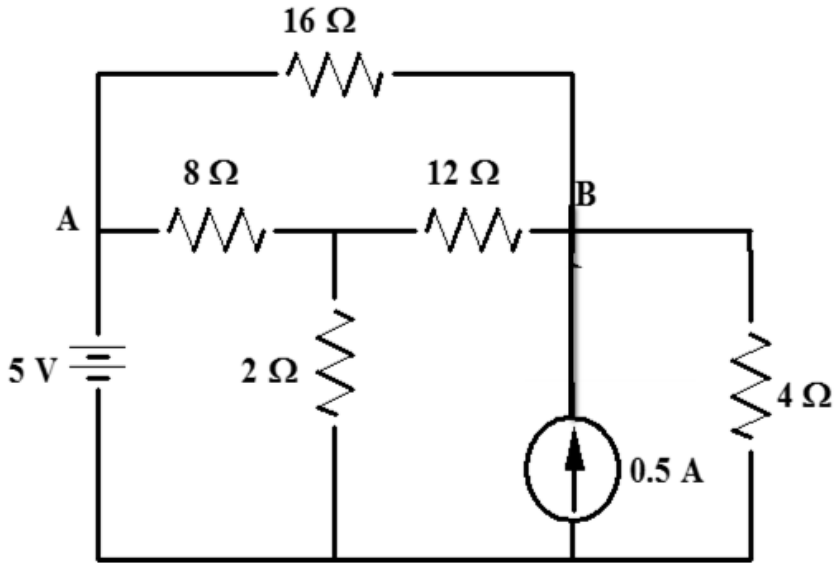


Illustration 2

Determine the current and its direction through the 2 Ω resistor. Also, determine the potential difference between A & B

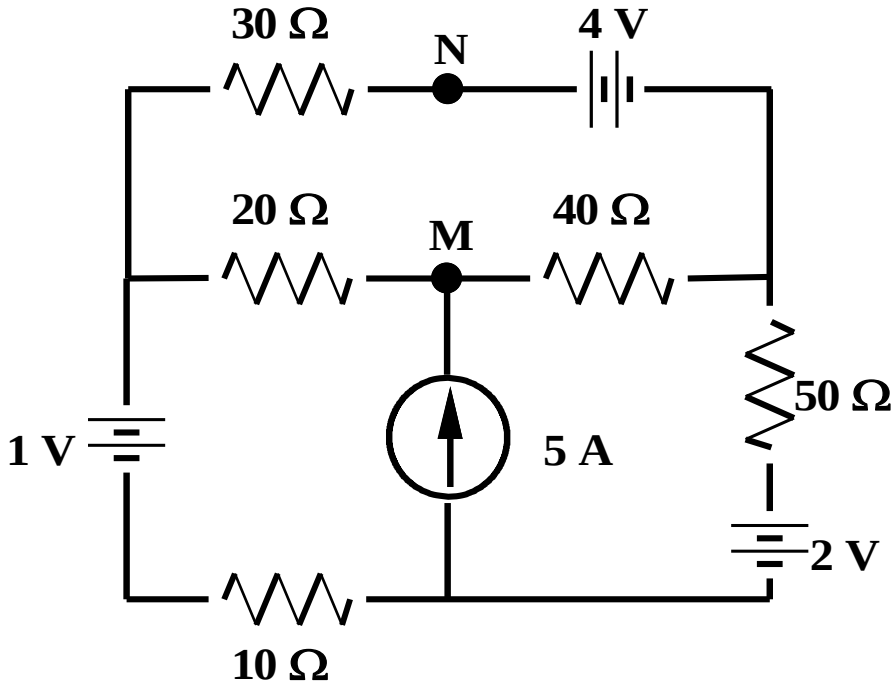


Answer : $I_{2\Omega}$=0.575 A (downwards)

V_A-V_B = +2.7 V

Illustration 3

Find the power supplied by the 5 A current source. Also, determine the voltage between the points M & N.



Answer : $P_{5A} = 556.5$ W

$V_M - V_N = 55.8$ V

Summary

- Mesh currents are determined
- Other operating conditions can be determined using the mesh currents
- Concept of super-mesh: If there is a current source between two meshes