Node Voltage Analysis

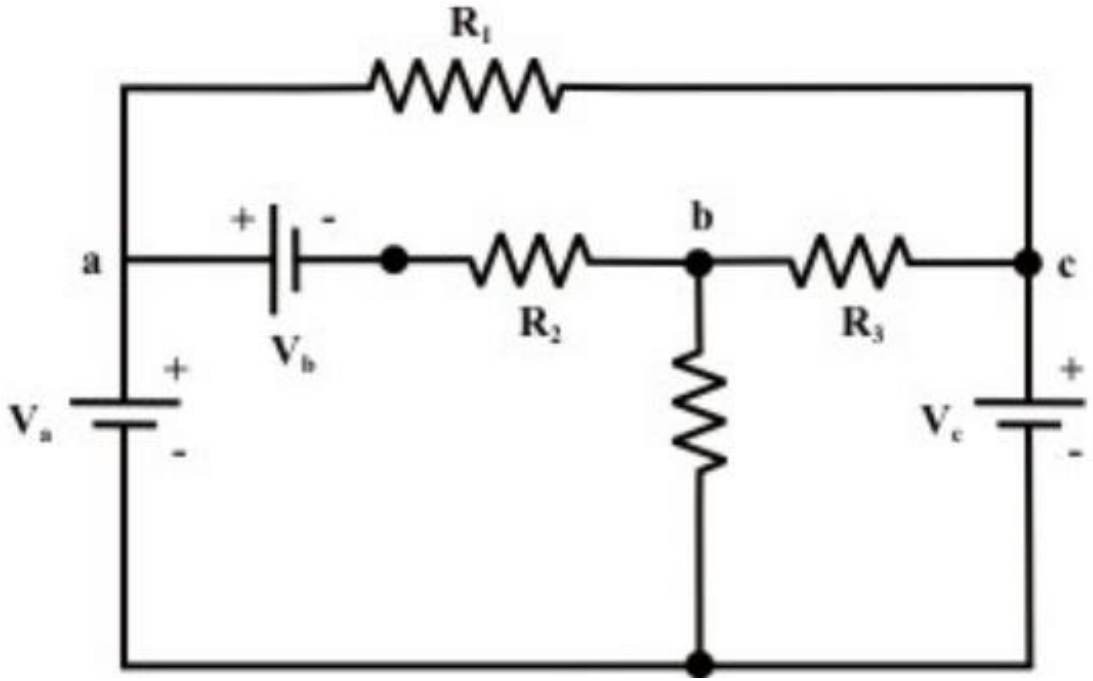
NETWORK REDUCTION TECHNIQUE

Class 6 - 10 November 2021

Introduction

Kirchhoff's Current Law (KCL)

- At any node (junction) in a circuit, the algebraic sum of currents entering and leaving the node at any instant of time must be equal to zero



Node

- A point in an electric circuit where 3 or more elements are connected

Branch

- A conducting path between two nodes in a circuit containing circuit elements

Node Voltage Analysis Method

- Convert all the practical voltage sources to current sources
- Identify nodes in the circuit
- One of the nodes is taken as reference node
- Assign a voltage to each of the remaining nodes
- Write KCL equations for all the nodes (excluding the reference node)
- Solve for voltages

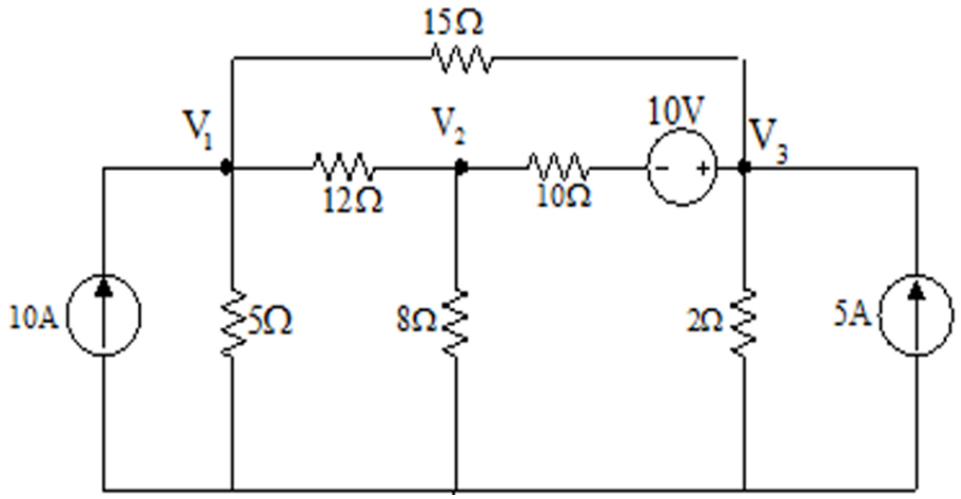


Illustration 1

Determine the current through the galvanometer "**G**". Also, write network equations using inspection method

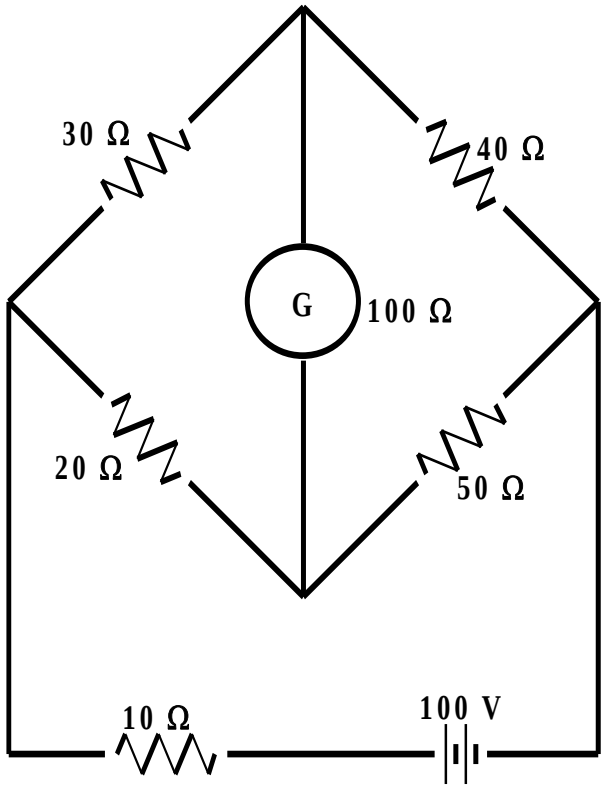


Illustration 2

Realize the network defined by node voltage equation

$$\begin{bmatrix} 1.55 & -0.5 & -0.05 \\ -0.5 & 0.875 & -0.25 \\ -0.05 & -0.25 & 0.4 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix} = \begin{bmatrix} 4 \\ -2 \\ 0 \end{bmatrix}$$

Quiz

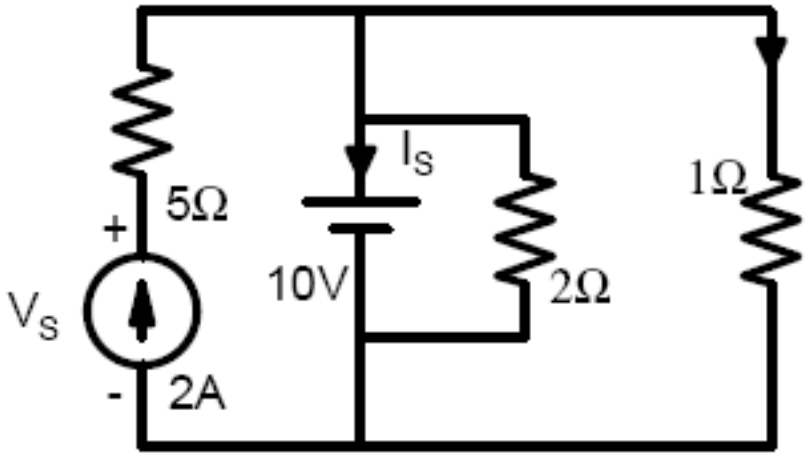
The current Is in amperes in voltage source and voltage Vs across the current source is

a) -13, 20

b) -13, 10

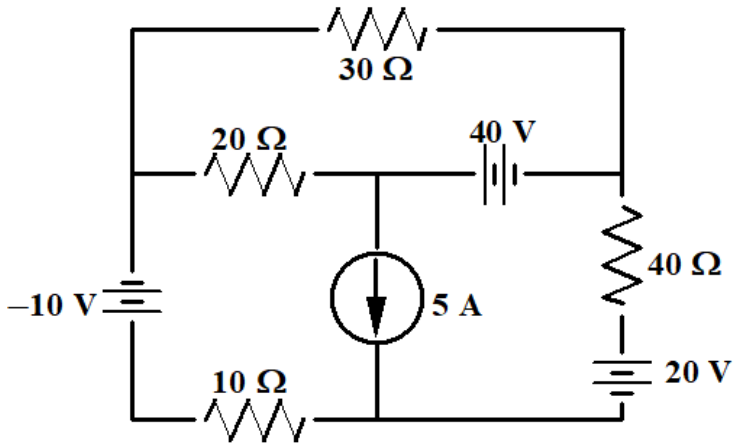
c) 13, -10

d) 13, -20



Supernode

Find the current through 40 V battery. Is the battery charging or discharging?



Ans: 4.19 A,
Discharging