



# **SNS COLLEGE OF TECHNOLOGY**

## **An Autonomous Institution**

### **Coimbatore-35**



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' 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 – KIRCHHOFF'S LAW-KVL

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# Kirchhoff's Voltage Law



## Kirchhoff's Second Law or Kirchhoff's Voltage Law

According to Kirchhoff's Voltage Law,

The voltage around a loop equals the sum of every voltage drop in the same loop for any closed network and equals zero.

Put differently, the algebraic sum of every voltage in the loop has to be equal to zero and this property of Kirchhoff's law is called conservation of energy.

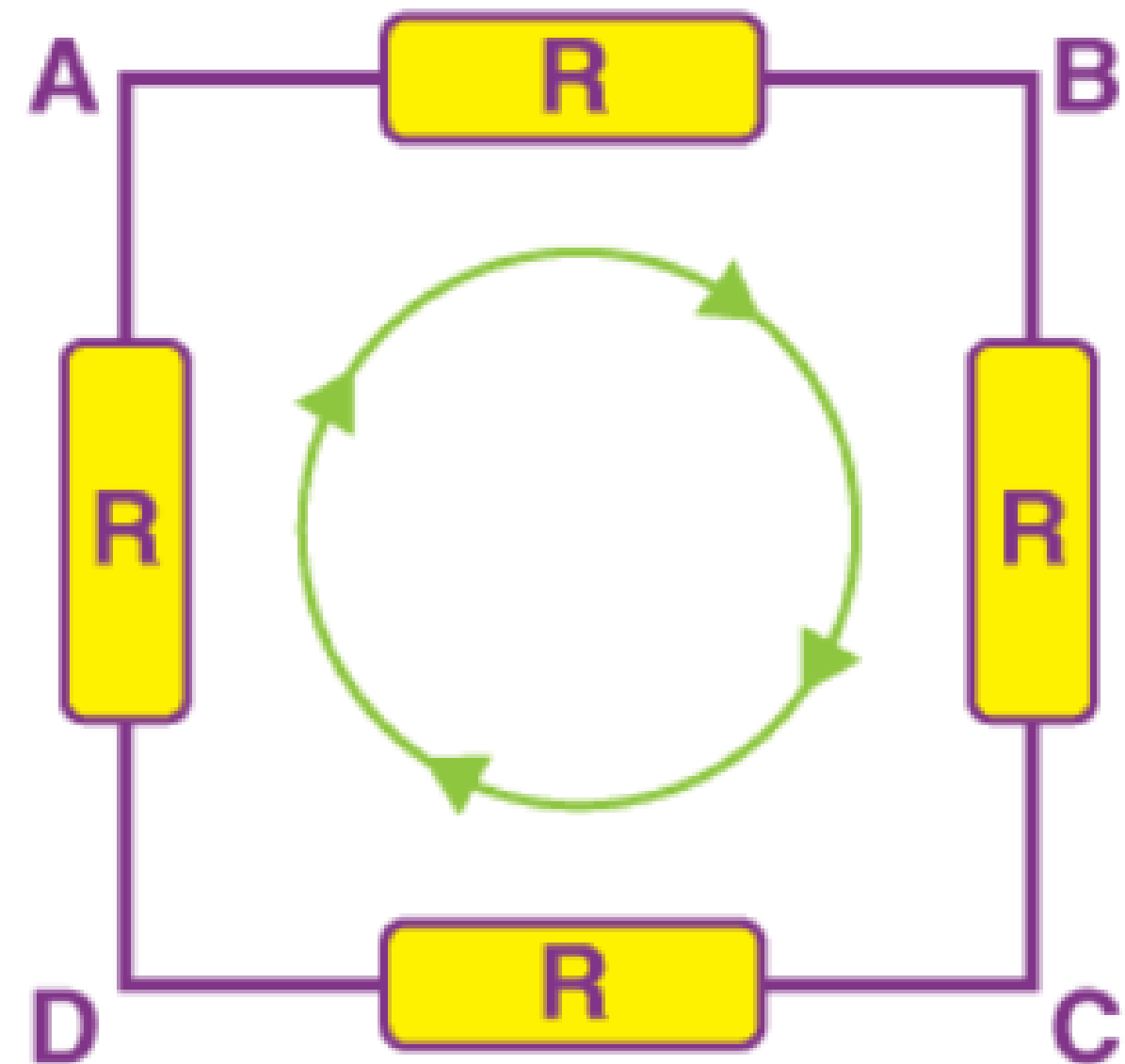


# Kirchhoff's Voltage Law



The sum of all the voltage drops around the loop is equal to zero

$$V_{AB} + V_{BC} + V_{CD} + V_{DA} = 0$$





# Kirchhoff's Voltage Law



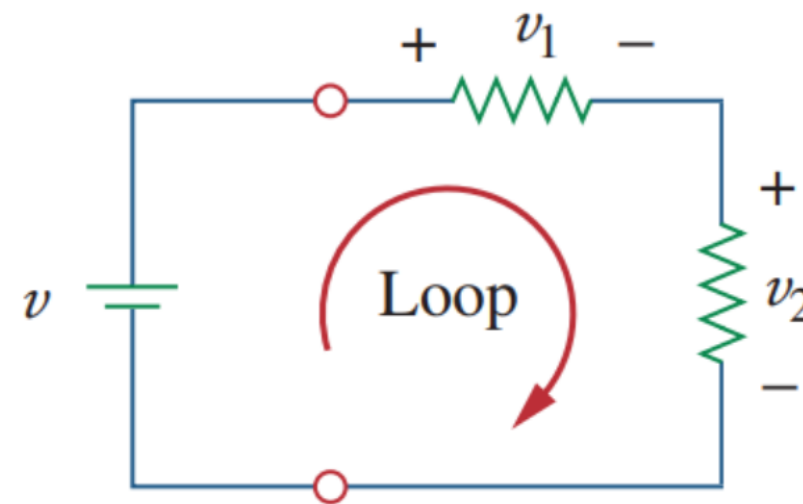
- When you begin at any point of the loop and continue in the same direction, note the voltage drops in all the negative or positive directions and returns to the same point.
- It is essential to maintain the direction either counterclockwise or clockwise; otherwise, the final voltage value will not be zero. The voltage law can also be applied in analyzing circuits in series.



# Kirchhoff's Voltage Law



When either AC circuits or DC circuits are analysed based on Kirchhoff's circuit laws, you need to be clear with all the terminologies and definitions that describe the circuit components like paths, nodes, meshes, and loops.



$$KVL: -v + v_1 + v_2 = 0$$

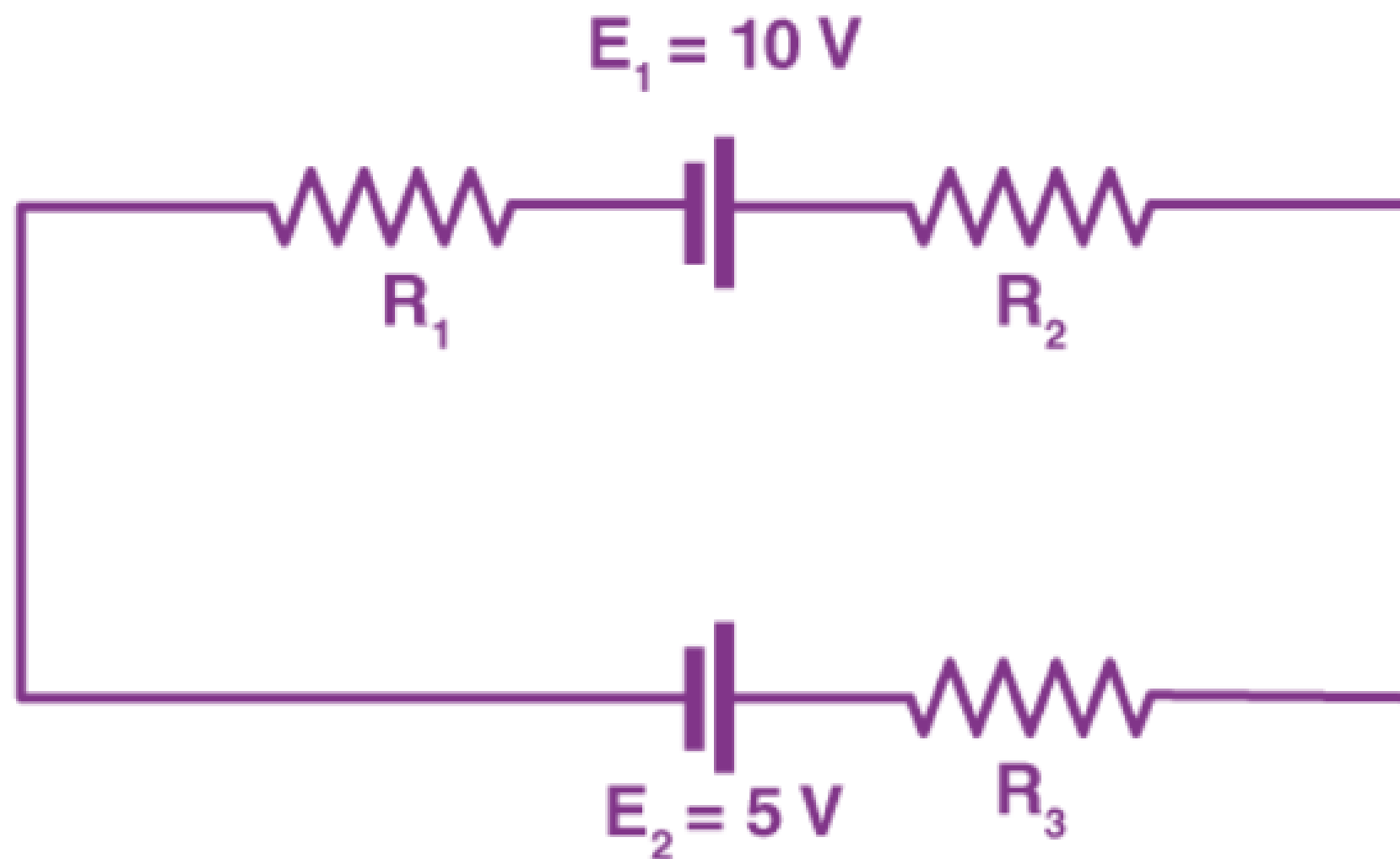


# Kirchhoff's Voltage Law



## Kirchhoff's Law Solved Example

If  $R_1 = 2\Omega$ ,  $R_2 = 4\Omega$ ,  $R_3 = 6\Omega$ , determine the electric current that flows in the circuit below.





# Kirchhoff's Voltage Law



## Solution:

Following are the things that you should keep in mind while approaching the problem:

1. You need to choose the direction of the current. In this problem, let us choose the clockwise direction.
2. When the current flows across the resistor, there is a potential decrease. Hence,  $V = IR$  is signed negative.



## Kirchhoff's Voltage Law



If the current moves from low to high, then the emf (E) source is signed positive because of the energy charging at the emf source. Likewise, if the current moves from high to low voltage (+ to -), then the source of emf (E) is signed negative because of the emptying of energy at the emf source.

In this solution, the direction of the current is the same as the direction of clockwise rotation.

$$- IR_1 + E_1 - IR_2 - IR_3 - E_2 = 0$$





## Kirchhoff's Voltage Law



Substituting the values in the equation, we get

$$-2I + 10 - 4I - 6I - 5 = 0$$

$$-12I + 5 = 0$$

$$I = -5/-12$$

$I = 0.416$  A. The electric current that flows in the circuit is  $0.416$  A.



**THANK YOU**