



SNS COLLEGE OF TECHNOLOGY
An Autonomous Institution
Coimbatore-35



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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-KCL



Kirchhoff's Law



Kirchhoff's circuit laws lie at the heart of circuit analysis.



Gustav Robert Kirchhoff

Gustav Robert Kirchhoff (1824-1887)



Kirchhoff's Law



History about Gustav Robert Kirchhoff

- Gustav Robert Kirchhoff, a German physicist, was born on March 12, 1824, in Königsberg, Prussia. His first research topic was the conduction of electricity.
- This research led to Kirchhoff formulating the Laws of Closed Electric Circuits in 1845.
- These laws were eventually named after Kirchhoff and are now known as Kirchhoff's Voltage and Current Laws.
- Since these laws apply to all electric circuits, understanding their fundamentals is paramount in understanding how an electronic circuit functions.



Kirchhoff's Law



History about Gustav Robert Kirchhoff

- Although these laws have immortalised Kirchhoff in Electrical Engineering, he has additional discoveries.
- He was the first person to verify that an electrical impulse travelled at the speed of light. Furthermore, Kirchhoff made a major contribution to the study of spectroscopy, and he advanced the research into blackbody radiation.



Kirchhoff's Law

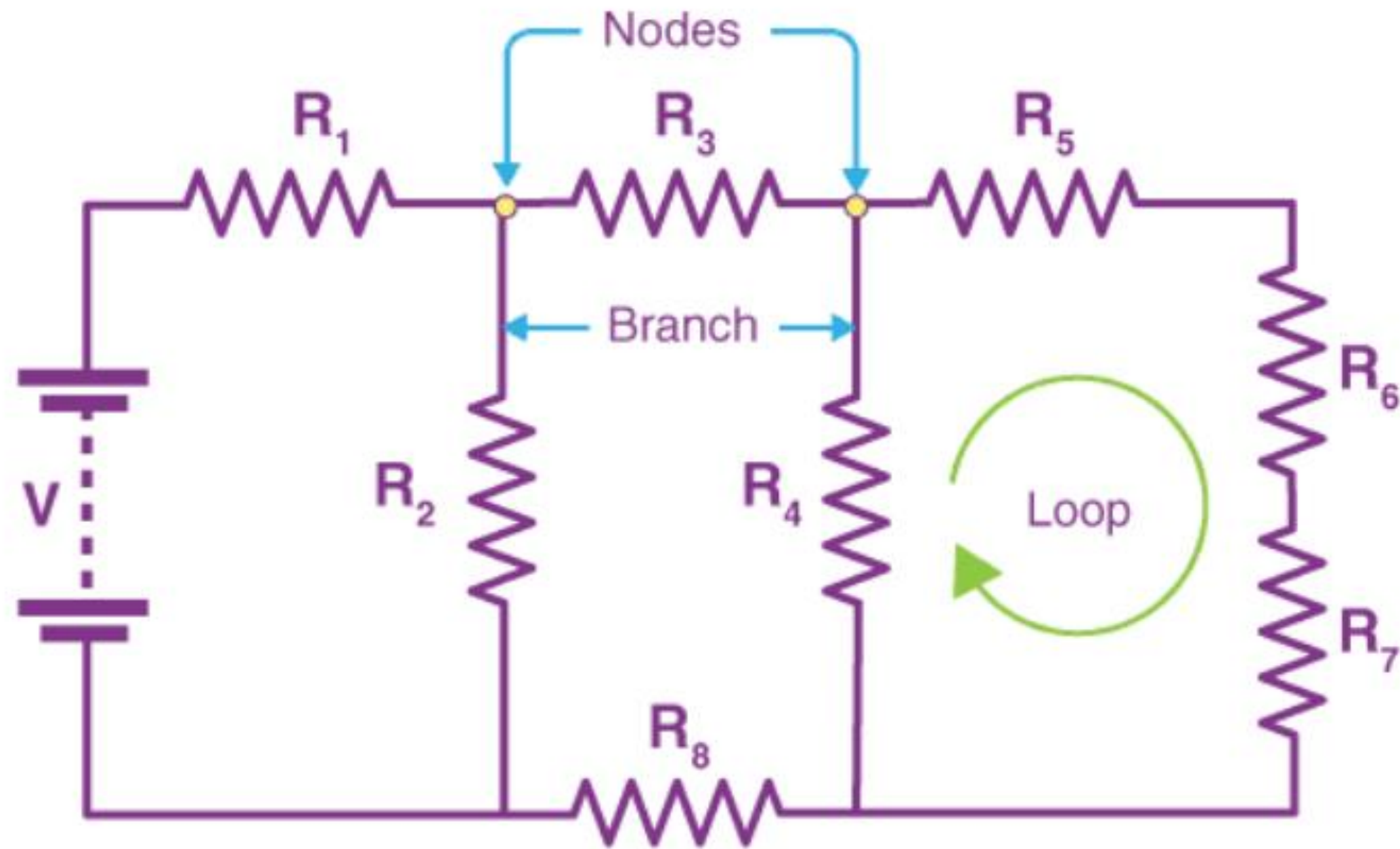


What Are Kirchhoff's Laws?

In 1845, a German physicist, Gustav Kirchhoff, developed a pair of laws that deal with the conservation of current and energy within electrical circuits. These two laws are commonly known as Kirchhoff's Voltage and Current Law. These laws help calculate the electrical resistance of a complex network or impedance in the case of AC and the current flow in different network streams. In the next section, let us look at what these laws state.



Kirchhoff's Law





Kirchhoff's Law



- Kirchhoff's Current Law goes by several names: Kirchhoff's First Law and Kirchhoff's Junction Rule. According to the Junction rule, the total of the currents in a junction is equal to the sum of currents outside the junction in a circuit.
- Kirchhoff's Voltage Law goes by several names: Kirchhoff's Second Law and Kirchhoff's Loop Rule. According to the loop rule, the sum of the voltages around the closed loop is equal to null.



Kirchhoff's Law

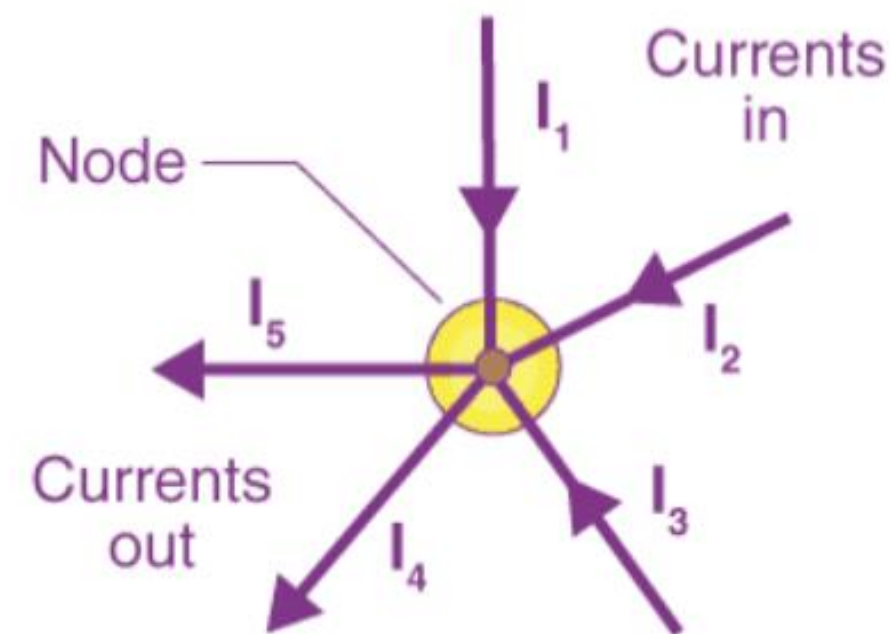


Kirchhoff's First Law or Kirchhoff's Current Law

According to Kirchhoff's Current Law,

The total current entering a junction or a node is equal to the charge leaving the node as no charge is lost.

Currents entering the node equals current leaving the node



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



Kirchhoff's Law



- In the above figure, the currents I_1 , I_2 and I_3 entering the node is considered positive, likewise, the currents I_4 and I_5 exiting the nodes is considered negative in values. This can be expressed in the form of an equation:
- $I_1 + I_2 + I_3 - I_4 - I_5 = 0$
- A node refers to a junction connecting two or more current-carrying routes like cables and other components. Kirchhoff's current law can also be applied to analyse parallel circuits.



THANK YOU