Experiment No : 04

Name of the Experiment : Verification of Kirchhoff's Current Law.

Objective:

- To verify Kirchhoff's Current Law (KCL) experimentally by analyzing the current distribution at a node in an electrical circuit.
- To measure and compare the sum of currents entering and leaving a junction, validating that they are equal as per KCL.
- To gain practical experience in constructing electrical circuits and using measuring instruments such as ammeters to record current values.
- To understand the concept of current conservation at circuit junctions through practical experimentation.

Theory:

Kirchhoff's Current Law (KCL) is a fundamental principle in electrical circuit analysis that describes the conservation of electric charge at a junction (or node) in an electrical circuit. It states that the total current entering a junction is equal to the total current leaving the junction, assuming there is no accumulation of charge at the node. This law is based on the principle of charge conservation.

The mathematical expression for Kirchhoff's Current Law is:

$$\sum I_{in} = \sum I_{out}$$

Where:

- I_{in} is the current entering the junction.
- I_{out} is the current leaving the junction.

Apparatus:

- Ammeter (3 pieces; 0-5A & 0-2A)
- Resistor (2 pieces; 108Ω, 37Ω)
- AC voltage source (220V, 50Hz)
- Connecting wires
- VARIAC

Circuit Diagram:

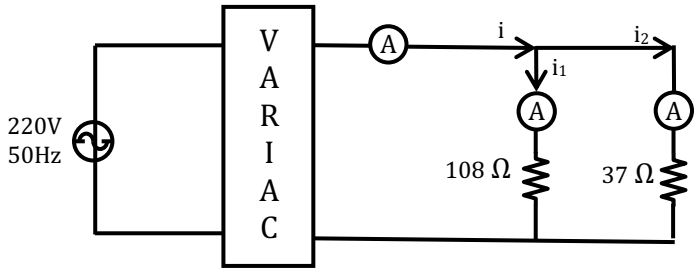

Figure-01: Electric Circuit

Data Table:

SL no.	Current, i (A)	Current, i_1 (A)	Current, i_2 (A)	Calculated Current (A)	Error
1	1.18	0.9	0.25	1.15	2.54%
2	1.31	0.9	0.45	1.35	3.05%
3	1.62	0.9	0.80	1.70	4.94%

Result:

The experimental verification of Kirchhoff's Current Law (KCL) demonstrated that the total current entering a node is equal to the total current leaving the node. For the given circuit, the measured total current (i_1) closely matched the sum of the branch currents (i_1 and i_2) across different voltage and resistance values. The observed errors in calculated current ranged between 2.54% and 4.94%, which were within acceptable limits. These minor errors can be attributed to instrumental inaccuracies, connection issues, or slight fluctuations in resistance values. The results confirm the validity of KCL, as the current distribution at the junction adhered to the principle of conservation of charge.

Conclusion:

The experimental results successfully verify Kirchhoff's Current Law (KCL), demonstrating that the total current entering a node equals the total current leaving the node. The minor errors observed in the measurements were likely caused by limitations of the measuring instruments, connection imperfections, or environmental factors such as temperature variations. Despite these small discrepancies, the results strongly support the principle of KCL, reaffirming its fundamental role in electrical circuit analysis and its reliability in predicting current distribution in circuits.