CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION ENGINEERING
CHITTAGONG-4349, BANGLADESH.

Course No. EEE-182

Course Title: Basic Electrical Engineering Sessional

Experiment No. 3

VERIFICATION OF KCL AND CURRENT DIVIDER RULE

PRELAB WORK:

- **Read this laboratory manual carefully before coming to the laboratory class, so that you know what is required.**
- Try to **follow** the lecture notes of **EEE 111.**
- **DONOT** copy others blindly!!!
- **Submit your lab report before the roll call.**

OBJECTIVE:

This experiment is intended to verify Kirchhoff's current law (KCL) and current divider law with the help of parallel circuits and derive the equivalent resistance of the series circuit both experimentally and analytically.

THEORY:

KCL states that, sum of the currents entering any node equals the sum of the currents leaving the node –

$$\sum I_{entering} = \sum I_{leaving}$$

The voltage divider law is given by –

$$I_x = \frac{R_p}{R_x} \times I_s$$

The equivalent (total) resistance of a parallel circuit is given by –

$$\frac{1}{R_p} = \sum \frac{1}{R_y} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots \quad ; where, \;\; y = 1, 2, 3 \; etc$$

APPARATUS:

1. One DC voltmeter (0~300V).
2. Three DC Ammeter (0~5A).
3. Three Rheostats.
4. Four SPST switches.
5. One multimeter.
6. One DC power supply.

CIRCUIT DIAGRAM:

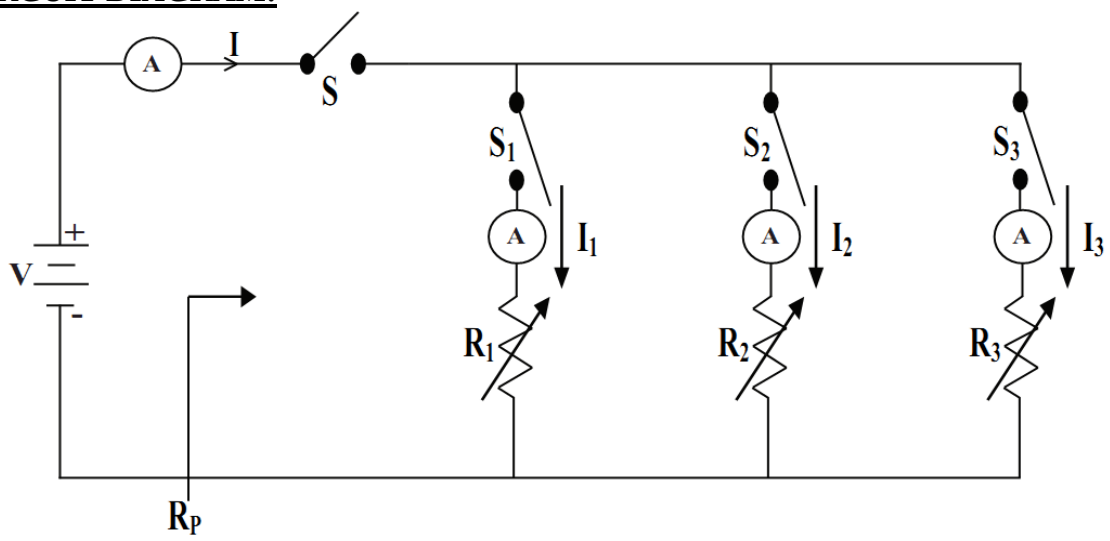

Figure: Verification of KCL and Current divider rule.

PROCEDURE:

1. Connect three rheostats R_1, R_2, R_3 in series through a SPST switch to a DC power supply as shown in Fig. 1.
2. Apply 20V DC from the DC power supply.
3. Set the rheostats R_1, R_2, R_3 above 20Ω and measure V_s, I, I_1, I_2, I_3 their maximum value and take readings of V_1, V_2, V_3, V_s using a voltmeter, I using an ammeter and R_1, R_2, R_3 using a multimeter. Vary the rheostats in such a way that ammeter reading does not exceed the current rating of any of the rheostats. Take at least 5 sets of reading and enter it in the table.
4. Verify KCL (i.e. $I = I_1 + I_2 + I_3$) for each set of data, find total resistance of the parallel circuit using the formula $R_p = (1/R_1 + 1/R_2 + 1/R_3)^{-1}$. Compare this with experimentally obtained value $R_p = V_s/I$. Verify current divider rule for each set of data.

EXPERIMENTAL DATA:

No. of obs.	V_s volts	I amps	I_1 amps	I_2 amps	I_3 amps	$I = I_1 + I_2 + I_3$ amps	$Rp = (1/R1 + 1/R2 + 1/R3)^{-1}$ ohms	$R_p = V_s/I$ ohms

REPORT:

1. Show the results in tabular form.
2. Comment on the results obtained and discrepancies (if any).

CAUTION:

1. Do not switch on the supply until the circuit has been checked by your teacher.
2. Take care of the apparatus.
3. Do not touch any open ended wire or cable with applying voltage supply at the other end.

HOME TASK:

Answer the following questions –

1. Show analytically that, for a parallel circuit –

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

2. If a voltmeter is connected in series with an element, what could possibly happen?
3. "KCL is the restatement of the Law of the conservation of charge" – justify the statement.
4. "KCL is applicable for close circuit too" – justify the statement.