Verification of Kirchhoff's Laws

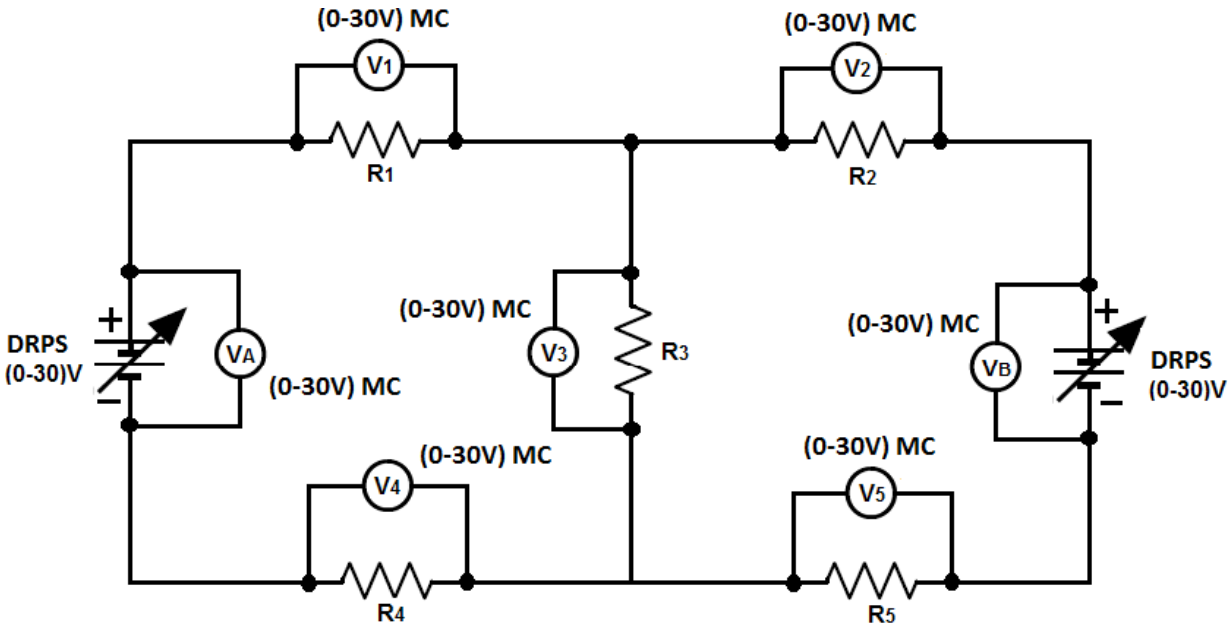
Exp. No: **Date:**

Aim: To verify Kirchhoff's voltage law for the electric circuit.

Apparatus required:

S.No	Name of the equipment	Range/ Specification	Type	Quantity
1	Resistors		Carbon composite	5
2	Bread board	30V, 1A	-	1
3	Regulated power supply	(0-30)V, 2A	-	1
4	Voltmeter	(0-30)V, MC	Digital	5
5	Connecting wires	1/22 guage	Copper	Adequate

Circuit diagram for KVL:



Circuit diagram for Kirchhoffs Voltage law

Procedure for KVL:

1. Connect the circuit as per circuit diagram
2. Switch on the power supply.
3. Apply the input voltages and note down the readings of the voltmeters. i.e. Voltage drop across all the resistances.
4. Repeat step-3 for different input voltages.

Tabular column for KVL:

S.No	Applied voltages		Mesh-1			Mesh-2		
	VA(V)	VB(V)	V1(V)	V3(V)	V4(V)	V2(V)	V3(V)	V5(V)

Theoretical calculations for KVL:

Applying KVL to loop1 we get (in C.W direction)

$$-I_1 R_1 - (I_1 - I_2) R_3 -- I_1 R_4 + V_1 = 0 \text{ ------- Eq. (1)}$$

Applying KVL to loop2 we get (in C.W direction)

$$-I_2 R_5 - (I_2 - I_1) R_3 - I_2 R_4 + V_2 = 0 \text{ ---------- Eq.(2)}$$

By solving equation (1) and (2) we get I_1 and I_2

Using ohms law, we have

$V_1 = -I_1 R_1$

$V_2 = -I_2 R_2$

$V_3 = -(I_1 - I_2) R_3$

$V_4 = -I_1 R_4$

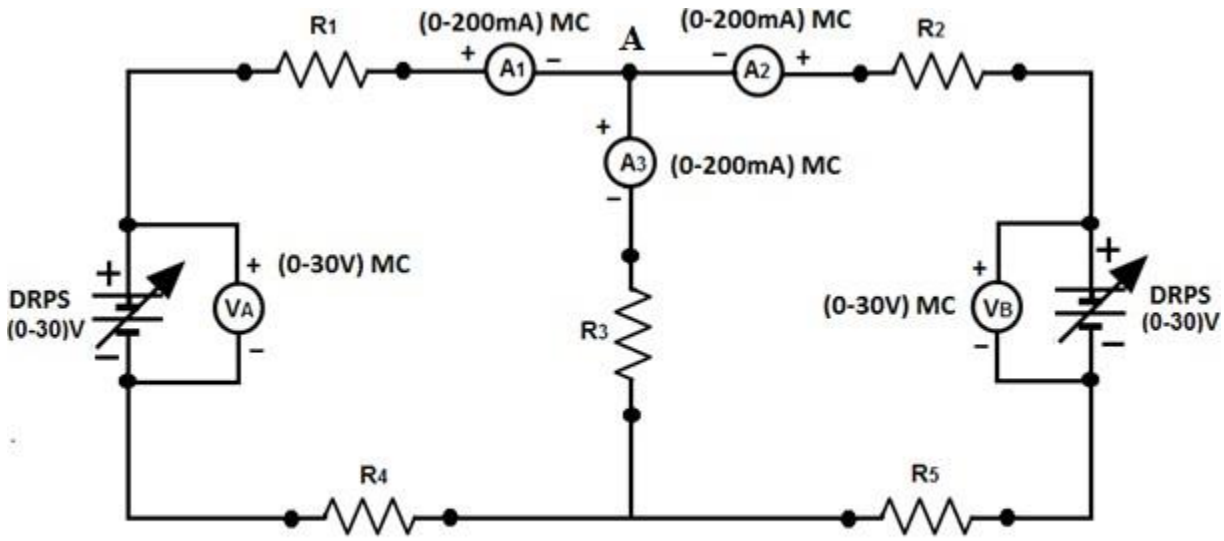
$V_5 = -I_2 R_5$

b) To verify Kirchhoff's current law for the electric circuit.

Apparatus required:

S.No	Name of the equipment	Range/ Specification	Type	Quantity
1	Resistors		Carbon composite	5
2	Bread board	30V, 1A	-	1
3	Regulated power supply	(0-30)V, 2A	-	1
4	Ammeter	(0-500)mA, MC	Digital	3
5	Connecting wires		Copper	Required

Circuit diagram for KCL:



Circuit diagram for Kirchhoffs Current law

Procedure for KCL:

1. Connect the circuit as per circuit diagram
2. Switch on the power supply.
3. Apply the input voltages and note down the readings of the ammeters.
4. Repeat step-3 for different input voltages.

Tabular column for KCL:

S.No	Applied voltages		I1	I2	I3
	VA(V)	VB(V)	(mA)	(mA)	(mA)

Theoretical calculations for KCL:

Applying KCL to Node A, we have

$$I_1 + I_2 - I_3 = 0 \text{ -------- Eq (1)}$$

Applying ohms to three resistive branches, we have

$$I_1 = V_1 / R_1$$

$$I_2 = V_2 / R_2$$

$$I_3 = - (V_3 / R_3)$$

$$V_1 / R_1 + V_2 / R_2 - V_3 / R_3 = 0 \text{---------From eq (1)}$$

$$V_3 = \frac{(V1 / R1) + (V2 / R2)}{R_3}$$

Precautions:

1. Set the current adjustment knob of the RPS in maximum position and voltage coarse and voltage fine adjustment knobs in minimum position.
2. While using multimeter as a voltmeter or ammeter insert the connecting probes in proper sockets.

Result: