Green University of Bangladesh

Department of Electrical & Electronic Engineering

Student Work Sheet

Course Code : EEE – 1204
Course Title : Electrical Circuit Theory Lab

Experiment No.: 01

Name of Experiment: ***Verification of Ohm's.***

Objectives:

1. Verify Ohm's Law.
2. Plot Current (I) vs Voltage (V) Curve.

Theory:

Ohm's Law: ***At Constant temperature current through a conductor is directly proportional to voltage applied across it.***

$I \propto V$ Where, V = Voltage across the conductor
I = Current through the conductor

$I = GV$ Where, $G = \frac{1}{R}$ Conductance of the Conductor

$I = \frac{V}{R}$ And R = Resistance of the Conductor

or $R = \frac{V}{I}$

According to the Law $R = \frac{V1}{I1} = \frac{V2}{I2} = \frac{V3}{I3} = \frac{V4}{I4} = \frac{V5}{I5}$

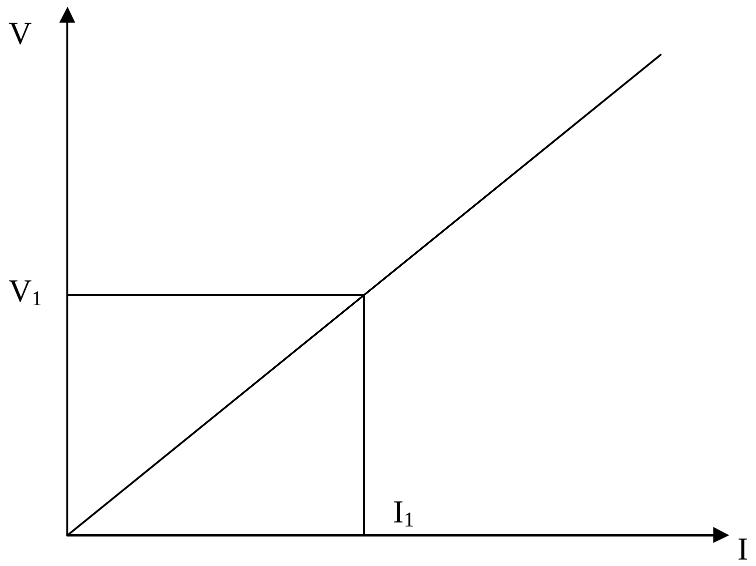

Figure 1.2

Required Equipment:

1. DC Power Supply   Loadstar
2. Resistor   R
3. DC Voltmeter
4. DC Ammeter
5. Connecting wires

Circuit Diagram:

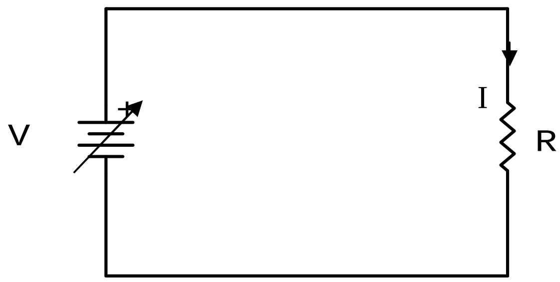

Fig. 1.1

Procedures:

- Connect three resistor R in series to a DC power supply as shown in Figure 1.1. Set V = 5 V.
- Take readings I_1 Corresponding to V_1 using Ammeter.
- Set V = 10V, Take readings I_2 Corresponding to V_2 using Ammeter
- Repeat for V = 15V, 20V and 25V.
- Put them in Table.
- Plot your observation in a graph page.

Table:

Voltage (V)	V_1 (V)	V_2 (V)	V_3 (V)	V_4 (V)	V_5 (V)
Current (I)					

Calculation:

Calculate $\frac{V1}{I1}, \frac{V2}{I2}, \frac{V3}{I3}, \frac{V4}{I4}, \frac{V5}{I5}$. Then show that the ratios equals to the Resistance.

Report:

1. Show the results in tabular form.
2. Show the verification.
3. Explain the curve.
4. Comment on the results obtained and discrepancies (if any).

Experiment No. : 02

Name of Experiment: ***Verification of KVL & Voltage Divider Rule.***

Objectives:

1. Verify Kirchoff's Voltage Law (KVL)
2. Verify Voltage Divider Rule

Theory:

KVL: Around any complete circuit the algebraic sum of the voltage rise equals the sum of voltage drops.

Voltage Divider Rule: The Voltage Divider Rule can be given by

$$V_x = (R_x/R_{eq})\ V$$

Where, V = voltage across / supplied to any series circuit
R_{eq} = equivalent resistance of the series circuit = $\sum R_i$
R_x = any particular resistor in the series circuit
V_x = voltage across R_x.

If, i = 3 then $\sum R_i = R_1+R_2+R_3$

Required Equipment:

1. Resistors R_1 = 1kΩ, ½ W; R_2 = 1kΩ, ½ W; R_3 = 6kΩ, ½ W
2. Voltmeter
3. Trainer Board
4. Connecting wires

Circuit Diagram:

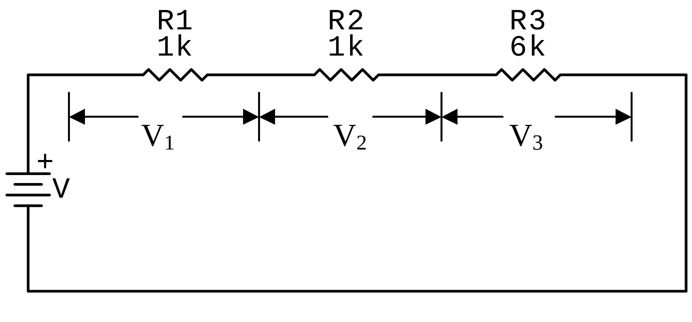

Figure 2.1

Procedures:

- Connect three resistors R_1 & R_2 & R_3 in series to a DC power supply as shown in Figure 2.1. Set V = 10 V.
- Take readings of V_1, V_2 & V_3 using voltmeter.
- Verify KVL ($V = V_1 + V_2 + V_3$).
- Verify Voltage Divider Rule using the equation $V_x = (R_x/R_s)\ V$

Table:

No. of Obs.	V (V)	V_1 (V)	V_2 (V)	V_3 (V)

Report:

1. Show the results in tabular form.
2. Show the verification.
3. Comment on the results obtained and discrepancies (if any).
4. State the rules of connection voltmeter in the circuit.
5. If a voltmeter would be connected in parallel across an element what would happen.

Experiment No.: 03

Name of Experiment: *Verification of KCL & Current Divider Rule.*

Objectives:

1. Verify Kirchhoff's Current Law (KCL).
2. Verify Current Divider Rule.

Theory:

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

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

The Current Divider Rule is given by

$$I_x = (R_p/R_x)\ I$$

Where, R_p is the equivalent resistance of a parallel circuit which is given by the following formula

$R_p = (1/R_1 + 1/R_2 + \text{--------})^{-1}$

Required Equipment:

1. Resistors $R_1 = R_2 = R_3 = 1K\Omega$
2. Ammeter
3. Trainer Board
4. Connecting Wires

Circuit Diagram:

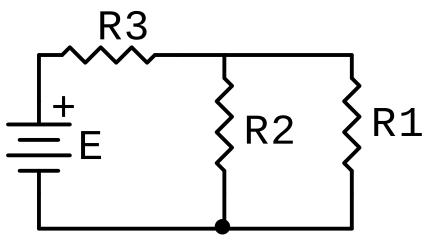

Figure 3.1

Procedure:

- Connect two resistors R_1 and R_2 in parallel to a DC power supply as shown in Figure 3.1. Set E = 10V from the trainer board.
- Take readings of I_1, I_2 and I using three ammeters,
- Verify KCL (i.e. $I = I_1 + I_2$).
- Find R_p using the equation $R_p = (1/R_1 + 1/R_2)^{-1}$
- Verify Current Divider Rule (i.e. $I_1 = (R_p/R_1)\ I$ & $I_2 = (R_p/R_2)\ I$)

Table:

No. of Obs.	I, A (measured)	I_1, A (measured)	I_2, A (measured)	$I = E/R_p$ A (theoretical)	$I_1=(R_p/R_1)$ A (theoretical)	$I_1=(R_p/R_1)$ A (theoretical)	$I=I_1+I_2$ A (theoretical)

Report:

1. Show the result in tabular form.
2. Comment of the results obtained and discrepancies (if any).
3. State the rules of connection voltmeter in the circuit.
4. If an ammeter is connected in parallel across an element what could be the possible danger.

Experiment No.: 04

Name of Experiment: ***Verification of Thevenin's Theorem.***

Objectives:

1. Verify Thevenin's Theorem.

Theory:

Thevenin's Theorem states that, "any two terminal network made up of linear resistances and voltage & current sources can be replaced by a single voltage source (V_{th}) and a series connected resistance (R_{th}) so chosen, a) the voltage should be measured at the network terminal at open circuit and b) the resistance should be measured at network terminal at open circuit, all the voltage and current source in the network being inactive.

V_{th} = the open circuit voltage (V_{OC}) at the two terminals A & B.
R_{th} = the resistance liking into the terminals A & B of the network with all sources removed.

Required Equipments:

1. Resistors $R_1 = R_L = 6K\Omega$, $R_4 = 1K\Omega$, $R_3 = 2K\Omega$
2. Voltmeter
3. Ammeter
4. Connecting wires

Circuit Diagram:

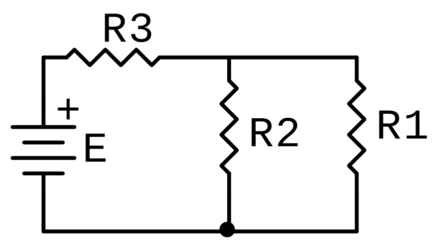

Figure 4.1

Procedure:

- Connect the circuit as shown in Figure 4.2. Take the reading of the ammeter and the voltmeter.
- Connect the circuit as shown in Figure 4.3. Measure the voltage at the terminal AB.
- Connect the circuit as shown in Figure 4.4. Measure the resistance of the terminal AB
- Finally construct the Thevenin's equivalent circuit as shown in Figure 4.4 using V_{th} & R_{th}.
- Measure the current through the $6K\Omega$ resistor, also measure the voltage across the same resistor.

Table:

No. of Obs.	I_{RL} (A)	V_{RL} (V)	V_{th} (V)	R_{th} (KΩ)	I_{RL} (A) (new)	V_{RL} (V) (new)

Report:

1. Show the result in tabular form.
2. Comment on the result obtained and discrepancies (if any).
3. Theatrically find out the Thevenin's equivalent circuit.

Experiment No.: 05

Name of Experiment: ***Verification of Superposition Theorem.***

Objective:

1. Verify Superposition Theorem

Theory:

Superposition Theorem states that, “current.”

Required Equipments:

1. Resistor R_1, R_2, R_3 = 1KΩ; 0.5 W
2. Ammeter
3. Trainer Board
4. Connecting Wires

Circuit Diagram:

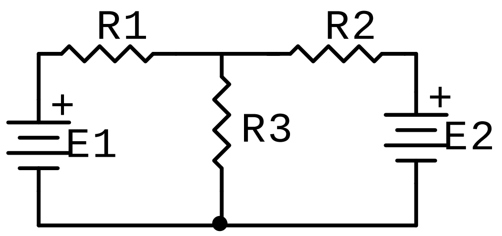

Figure 5.1

Procedure:

- Connect the circuit as shown in Figure 5.1. Take the reading of I_3.
- Then connect the circuit as shown in Figure 5.2. Take the reading I_3'.
- Then connect the circuit as shown in Figure 5.3. Take the reading I_3''.

Table:

No. of Obs.	I_3 (A) (measured)	I_3' (A) (measured)	I_3'' (A) (measured)	$I_3=I_3'+I_3''$ (calculated)

Report:

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

Experiment No.: 06

Name of Experiment: ***Verification of KVL & KCL using reactive elements.***

Objectives:

1. Study RLC series and series-parallel circuits when energized by an AC source.
2. Construct phasor diagram.
3. Verify KVL & KCL.

Required Equipment:

1. Function Generator
2. AC Voltmeter
3. AC Ammeter
4. Resistor Load Bank
5. Capacitor Load Bank
6. Inductor Load Bank
7. AC Power Supply

Circuit Diagram:

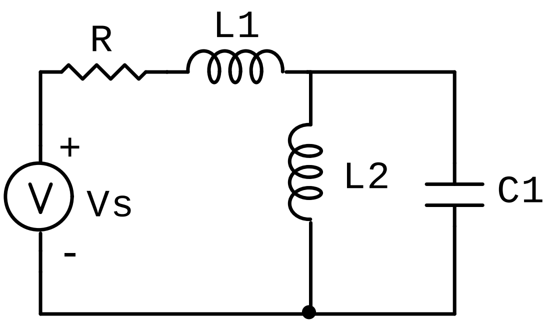

Fig. 6.1

Procedures:

- Connect the circuit as shown in Figure 6.1. Switch power 'ON'.
- Measure the voltages V_R, V_L, & V_C and the current I. Then switch power 'OFF'
- Connect the circuit as shown in Figure 6.1. Switch power 'ON'
- Measure the voltages V_R, V_L & V_P and the currents I, I_1, I_2. Switch power 'OFF'.

Table:

Type of Data	I (A)	V_S (V)	V_R (V)	V_L (V)	V_C (V)	V_S (V) (by vector diagram)
Practical						
Calculated						

Table :

Type of Data	V_S (V)	V_R (V)	V_L (V)	V_P (V)	I (A)	I_1 (A)	I_2 (A)	I (A) (by vector diagram)
Practical								
Calculated								

REPORT:

1. Theoretically calculate all the voltages and the currents in the circuits of Figure 7.1 & Figure 7.2. Compare these values to that measured.
2. Assuming the circuit elements to be ideal, draw the phasor diagrams for both the circuits using the experimental data.
3. Show that the data obtained satisfies KVL & KCL.

Experiment No.: 07

Name of Experiment: *AC power measurement by Digital Wattmeter*.

Objectives:

1. Measure AC power by digital wattmeter.
2. Measure AC power by calculating current & Voltage.

Required Equipment:

1. Lamp Board
2. Digital Wattmeter
3. Power Supply

Circuit Diagram:

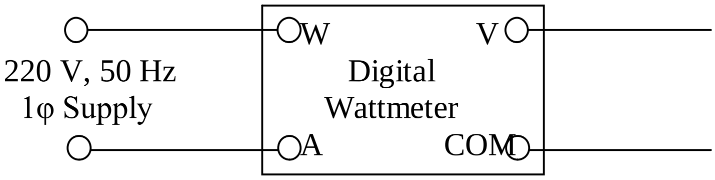

Figure 7.1

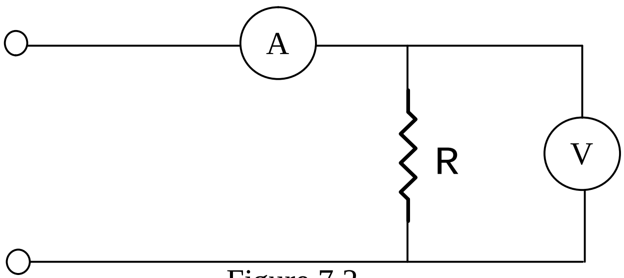

Figure 7.2

Procedure:

- Connect the circuit as shown in Figure 7.1. Take reading of the wattmeter.
- Connect the circuit as shown in Figure 7.2. Take reading of Ammeter & Voltmeter. Calculate power using the equation P = VI.

Table:

No. of Obs.	P (W)	I (A)	V (V)	P' = VI (W)

Report:

1. Calculate power from the equation for Arrangement – II.
2. Comment on the result obtained and discrepancies (if any).

Experiment No.: 08

Name of Experiment: *Measure power of a balanced three phase wye* (Y) *connected load using two wattmeter method.*

Objective:

1. Measure power of three phase balanced load.

Required Equipments:

1. AC voltmeter
2. AC Ammeter
3. Lamp Board
4. 2 Analog Wattmeter

Circuit Diagram:

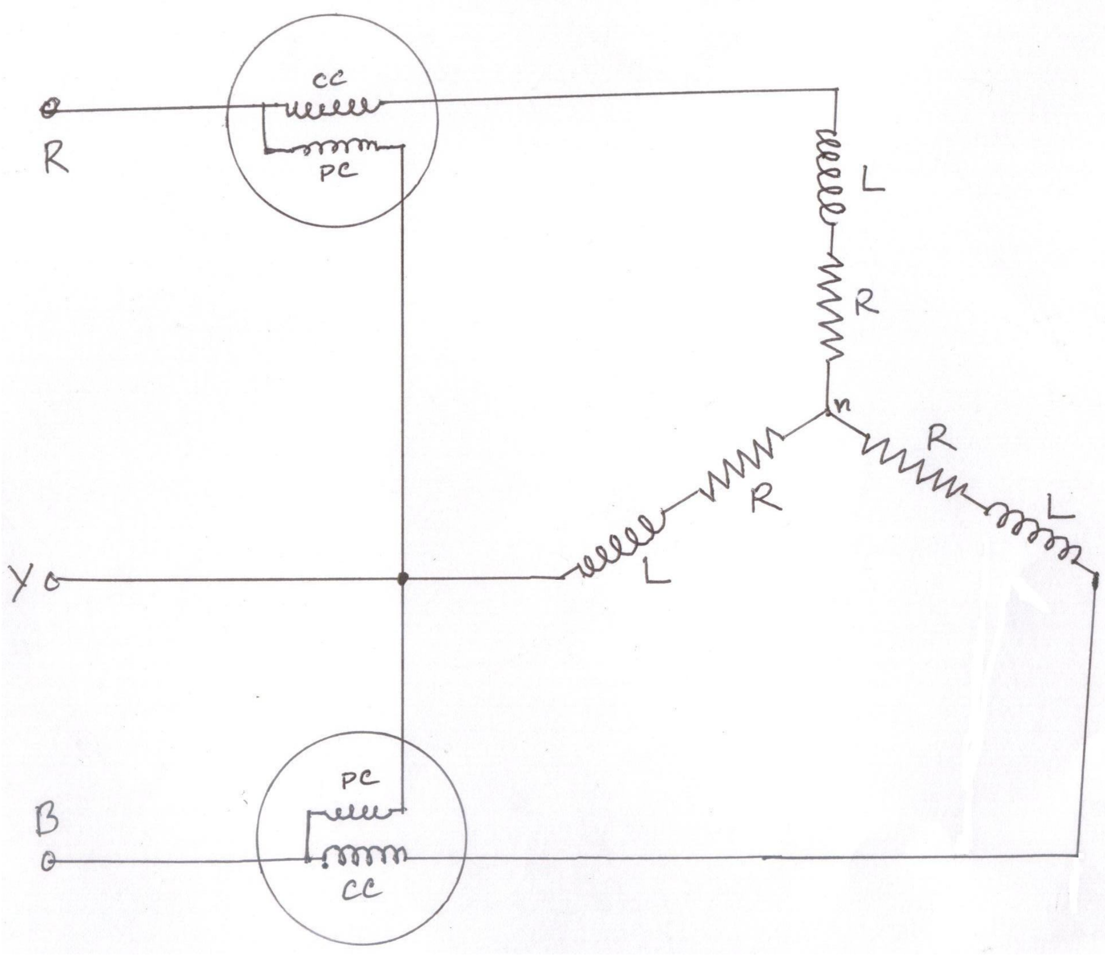

Figure 8.1

Procedure:

- Connect the circuit as shown in Figure 8.1.
- Take reading of the watt meters.
- If the two watt meters give opposite deflection then interchange the connections of CC or PC of any one.
- Take reading of connected Ammeter & Voltmeter.

Table:

No. of Obs.	P_1 (W)	P_2 (W)	$P = P_1 + P_2$ (W)	$P = \sqrt{3}VI \cos\theta$ (W)

Report:

1. Calculate power from the equation $P = \sqrt{3}VI \cos\theta$.
2. Comment on the result obtained and discrepancies (if any).