IMPERIAL COLLEGE OF ENGINEERING, KHULNA

Department of Computer science & Engineering

B.Sc. Engineering odd Semester Sessional Examination-2019

Course Title: Electrical circuit & Electronics lab Course Code: EEE 1132

Time: 2:00 Hours

Perform ***any one*** experiment from the following:

1. To verify of Ohm's law
2. To design and simulate a Half-wave rectifier Circuit
3. To design and simulate a Full- wave rectifier Circuit
4. To verify V-I characteristics of p-n junction diode.
5. Verification of Kirchhoff's voltage law
6. Verification of Kirchhoff's current law
7. To verify Thevenin's law
8. Verification of Series circuit configuration
9. Verification of Parallel circuit configuration

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IMPERIAL COLLEGE OF ENGINEERING

Boikali, Khulna

AFFILIATED BY RAJSHAHI UNIVERSITY

(CODE: 385)

Submitted by,

STUDENT'S NAME : TERESA JENCY BALA

DEPARTMENT : COMPUTER SCIENCE & ENGINEERING

ID NUMBER : 19 385 20 113

SUBJECT CODE : APEE1132

SUBJECT NAME : ELECTRICAL CIRCUIT AND ELECTRONICS LAB

Assignment no- 01

Submitted to,

MD. ABU BAKER SIDDIK ABIR,

LECTURER, ICE

08.4.19

Date: 5th April, 2019

Day: Friday

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INDEX

S.L	Name of Experiment	Page No	Date of Performance	Date of Submission	Remarks
01	Introduction to lab equipments		27.01.19	04.02.19	A+
02	Verification of Ohm's law		10-02-19	17-02-19	A+
03	Verification of Series & parallel circuit configuration		17-02-19	24-02-19	A+
04	Experiment on a) Connection of wattmeter b) Identify CC & PC c) Energy meter & bill calculation		10-03-19	24-03-19	A+
05	Experiment on RLC Series circuit configuration		03-03-19	10-03-19	A+
06	Introduction with breadboard & Color Code		05-05-19	11-05-19	A+
07	Verify V-I Characteris-tics of P-n junction		11-05-19	12-05-19	A+
08					
09					
10					

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Assignment - 01 (Questions)

Q1: What is meter?

Q2: Write down the functions of ammeter, voltmeter, galvanometer, ohmmeter, potentiometer, Wattmeter, multimeter.

Q3: Why in CSE?

Q4: Write down the advantages and disadvantages of AC & EDC.

Q5: What are called Electrical & Electronics devices.

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IMPERIAL COLLEGE of ENGINEERING

(Affiliated by Rajshahi University Code: 385)

Department of CSE

Experiment no- 01

Date of Performance: 27-01-19

Date of Submission: 04-02-19

Experiment Name: Introduction to Lab equipments

Course Code:	APEE 1132
Semester:	Odd
Part:	I

Remarks:

Abir ✓

Submitted by,

Teresa Jency Bala

Roll: 113

ID: 19 385 20 113

Part-01, Odd Semester

Dept. of CSE

Submitted to,

Md. Abu Baker Siddiq Abir,

Lecturer ICE

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CSE
1/1, Odd
Semester

1st Year
Odd Semester

Assignment - 01

Imperial College of Engineering (ICE)

Submitted by:
Name: Teresa Jency Bala
Department: CSE
Roll : 1938520113

Thanks!!
Very Good

Subject: APEE1132, EE Circuit Lab.

Topics: Electrical meters, AC & DC advantages and disadvantages, Electrical and electronic devices.

Submit to:
Md. Abubakar Siddiq
(Abir Sir), Instraction.

Date: 03 February, 2019

Day: Sunday

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Figure: Ammeter

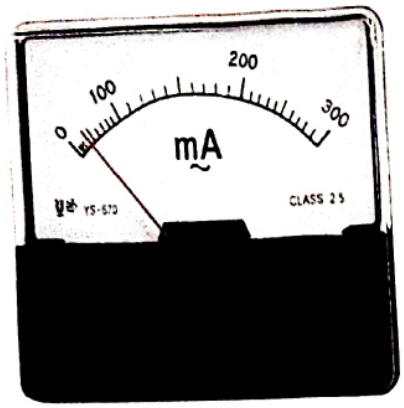
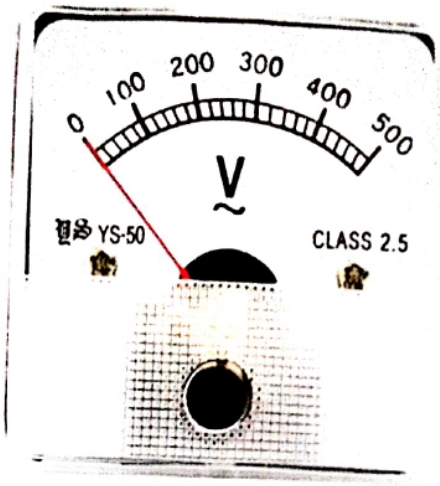


Figure: Voltmeter



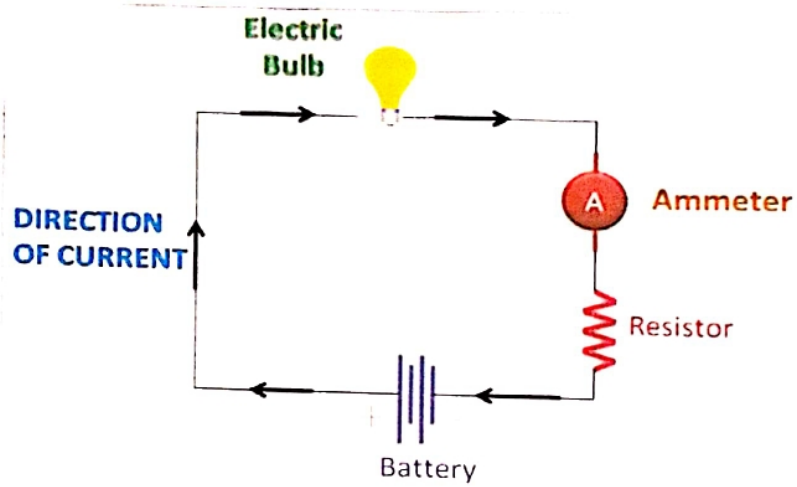


Figure: Ammeter in circuit

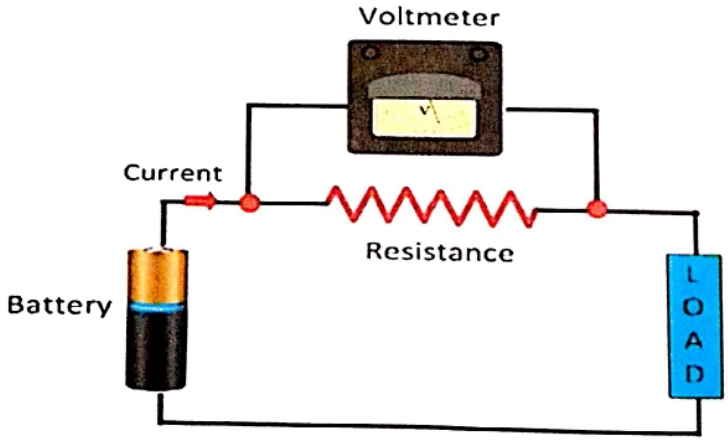


Figure: Voltmeter in circuit

Thanks

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APEE1132

*Meters: The instruments used for measuring physical and electrical quantities is known as measuring instruments or meters.

In laboratories almost all meters are electrical instruments The functions of some meters are given below;-

Ammeter (From Ampere Meter):

1 It's used to measure the current in a circuit.
2. Electric currents are measured in ampere (A).
3. Very Low resistance
4. Connected in series in circuit

Ammeter can be classified into two types. ⓐ DC Ammeter
ⓑ AC Ammeter

Voltmeter:

1. Device for measuring potential difference (the voltage) between two wires, usually across a circuit element or a group of element.
2. The unit of measuring is Voltage (V)
3. Very high resistance to avoid loading effect.
4. Connected in parallel along circuit.

For measuring both AC & DC circuit the voltage voltmeter can be used.

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Figure: Multimeter

Figure: Galvanometer

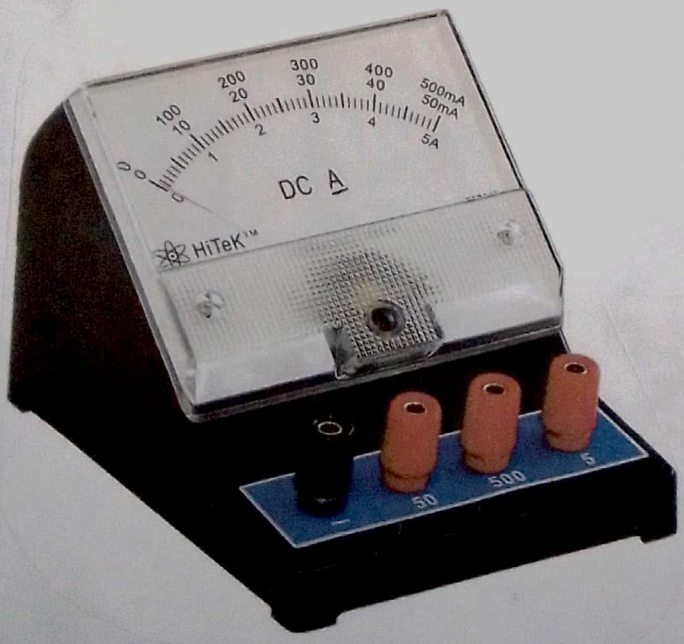

Figure: Ammeter

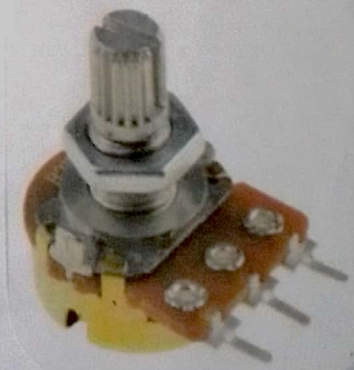

Figure: Potentiom

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Galvanometer: An instrument for detecting and measuring small electric current and it's direction.

Ohmmeter: An electrical instrument that measures electrical resistance. Function:-

1. To measure the resistance, the component must be removed from circuit altogether.
2. Ohmmeter work by current the component being tested.

Potentiometer: A three-terminal resistor with a ~~sliding~~ sliding or rotating contact /rheostat. Used to determine potential.

Wattmeter: For measuring the electric power in watts of any given circuit.

Multimeter: To measure Electric current, voltage, and resistance also known as VOM (volt-ohm-milli ampere), It's just one meter with all functions of those three meters.

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3. AC & DC advantages & disadvantages.

Alternate Current:

Advantages:

1. The power can be generated at high voltage.
2. It is easy and cheaper.
3. AC voltage can easily be increased or decreased using step-up and step-down transformers.
4. More efficient.
5. AC can be easily converted to DC.
6. Transmission rate high.

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Disadvantage:

1. Requires more copper than DC
2. AC line has capacitance for this continuous loss of power occures due to changing current even when the line is open.

Direct Current

Advantages:

1. No inductive and capacitive loss
2. Semiconductors work on DC
3. Computers and mobiles work on DC.
4. Solar energy sources produce electricity in DC.

Disadvantages:

1. DC circuit breakers and switches comes with limitations (costly too).
2. DC voltage level can not be changed easily.

4 Electrical and Electronics Devices

High voltage required

⊙ Electrical devices/instruments: Those which uses electric energy are known as electrical devices. Also helps to determine flow of current, voltage, power etc. meters which are used in

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electrical and electronics laboratories. Some examples are: DC batteries, generator, wattmeter; DC motor, transformers. etc.

Use of low voltage, active components

⊙ Electronics / Electronic devices: The name as it says ELECTRON(ics); and is the study of Electron flow in circuit. So, the devices which has transistors, diodes, micropro-cessor are so called electronics devices. Some examples are: Television, ~~DVD~~ DVD players, laptop, desktop, smart phones, oven, washing machines, game console, radio, printers etc.

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CSE

1st Year, Odd Semester

Imperial College of Engineering

Code: 385

Assignment-02 [Circuit Lab]

Submitted by,

Name: Teresa Jency Bala

Roll: 19 38 52 01 13

Subject: APEE1132

Topic: Ohm's law, graph, meters of laboratory and there uses, AC & DC discussion.

Submitted to,

Md. Abubakkar Siddiq Abir,
Lecturer,
ICE

Date: 17/02/19

Day: Sunday

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1. Define Ohm's law. And draw it's graph with equation.

Soln:
Ohm's law states that at a constant temperature the flow of current I (Ampere) through a conductor is directly proportional to the potential difference V (volt) across the two ends of the conductor. The equation form, $I \propto V$. $\frac{V}{I} = R$ where, R is the resistance which is constant.

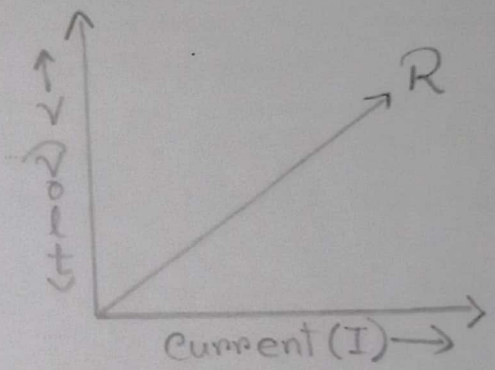

Fig: V vs I graph

2. Draw circuit diagram of Ohm's law with necessary equipments.

Soln:

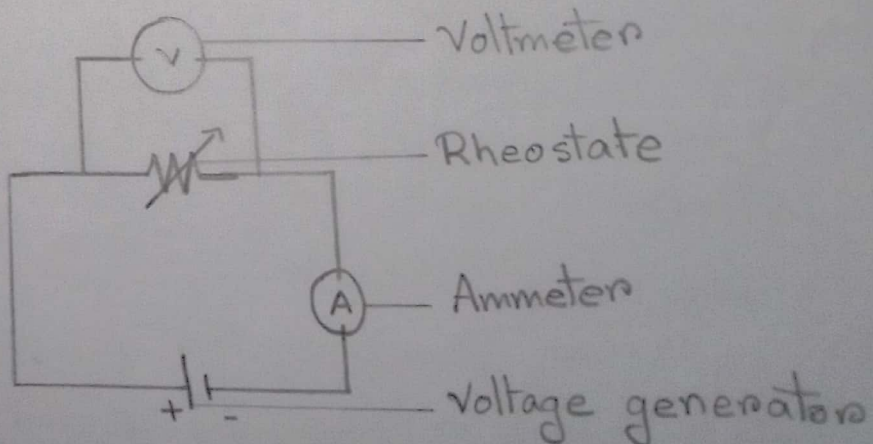

Figure: Voltmeter is in parallel, Ammeter is in series with rheostate in circuit.

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3. How to connect Ammeter and voltmeter?

Soln:

Ammeter is connected in series with the resistance.

Voltmeter is connected in parallel with the resistance.

4. Write the properties of Ammeter & Voltmeter.

Soln:

Ammeter	Voltmeter
1. Used to measure Current flow.	1. Used to measure the potential difference.
2. Measured in Ampere (A)	2. Measured in Volt (V)
3. Very Low resistance	3. Very High resistance
4. Connected in series, in circuit.	4. Connected in parallel in circuit
5. Two types: (a) DC ammeter. (b) AC ammeter.	5. voltmeter can be used to measure both AC & DC circuit's potential difference.

5. Write the uses of different meters.

(a) Ammeter - Determines amount of current flow.

(b) Voltmeter - Measures potential difference in voltage.

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ⓒ Galvanometer: Deflects to detect the electric current flow with direction.

ⓓ Ohmmeter: Measures electric resistance.

ⓔ Potentiometer: Determine potential.

ⓕ Wattmeter: Measures electric power

ⓖ Multimeter: Measures voltage, current & resistance.

6. Symbols of various meters.

Soln:

Voltmeter — (V) / mV

Galvanometer — (G) / (↑)

Ammeter — (A) / (A) / (A) / (mA) — 0-100 A

Ohmmeter — (Ω)

Potentiometer — ⏚ / ⏚

Wattmeter — (W)

7. Write about DC & AC.

Soln: Direct Current:

1. No inductive and capacitive loss.
2. Semi-conductors work on DC.
3. Computers and mobiles works on DC.
4. Solar energy source producue DC electricity

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5. DC voltage level can not be changed easily
6. Too costly equipments.

Alternate Current :

1. The power can be generated at high voltage
2. It is easy and cheapper
3. Using step-up and step-down transformers AC voltage can easily be changed.
4. More efficient than DC.
5. AC easily converted to DC.
6. Transmission rate is high
7. Requires more copper than DC.

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IMPERIAL COLLEGE of ENGINEERING

(Affiliated by Rajshahi University Code: 385)

Department of CSE

Performance Date: 3rd Feb, 2019
Submission Date: 17, Feb, 2019

Experiment no- 02

Electrical Circuit & Electronics.

Experiment Name: Lab Report,

Verification of Ohm's Law.

Course Code:	APEE1132
Semester:	Odd
Part:	01

Submitted by,

Teresa Jency Bala

Roll: 13

ID: 19 38 52 01 13

Part-01, Odd Semester

Dept. of CSE

Imperial College of Engineering

Submitted to,

Md. Abubakar Siddiq (Abir), Lecturer

Remark:

Abir 17.2.19.

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Experiment - 02: Varification of Ohm's law.

2.1 Objective:

1. To be introduced with ohm's law
2. To justify ohm's law.
3. To be familiar with different circuit configuration.

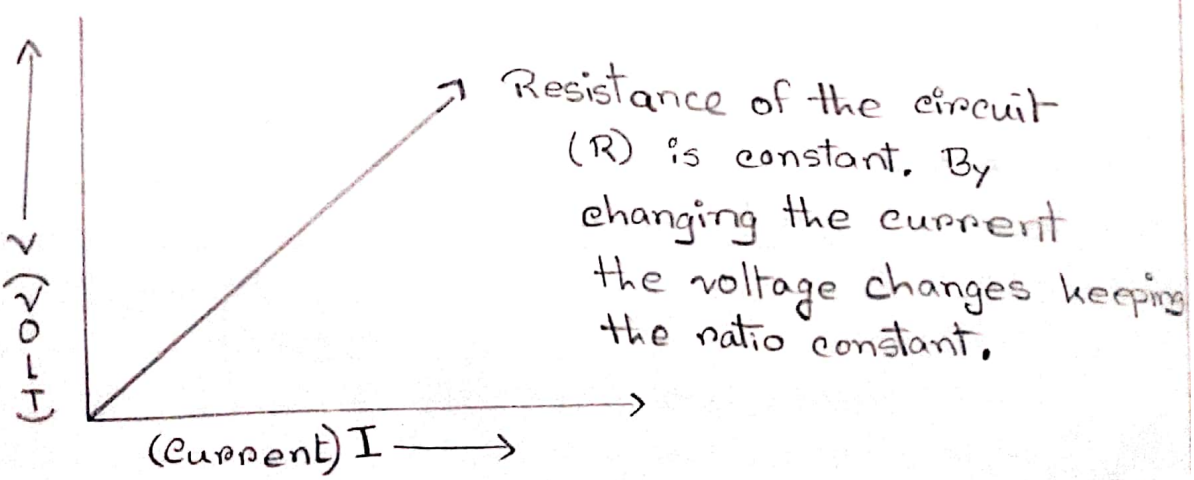
2.2 Theory:

Ohm's law states that at a constant temperature the flow of current I (Ampere) through a conductor is directly proportional to the potential difference V (volt) across the two ends of the conductor, In equation form, $I \propto V$.

The ratio of V : I is constant and is called the resistance, R of the conductor.

$\frac{V}{I}$ = constant = R or, $V = IR$ $\therefore R = \frac{V}{I}$, where R is constant for the given metallic wire at a given tempe-rature.

If the values of V are plotted against I on a graph paper, the graph is known as a V-I graph. As the temperature of the conductor rises, its resistance also increases.



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2.3
List of Equipments:

Table-01: Table of required equipments

Serial No.	Name of element	Range	Quantity
1.	Rheostate	(0-100) Ω	1
2.	DC Power supply	(0-30) V	1
3.	Flexible wire		2

2.4.
Experimental figure:

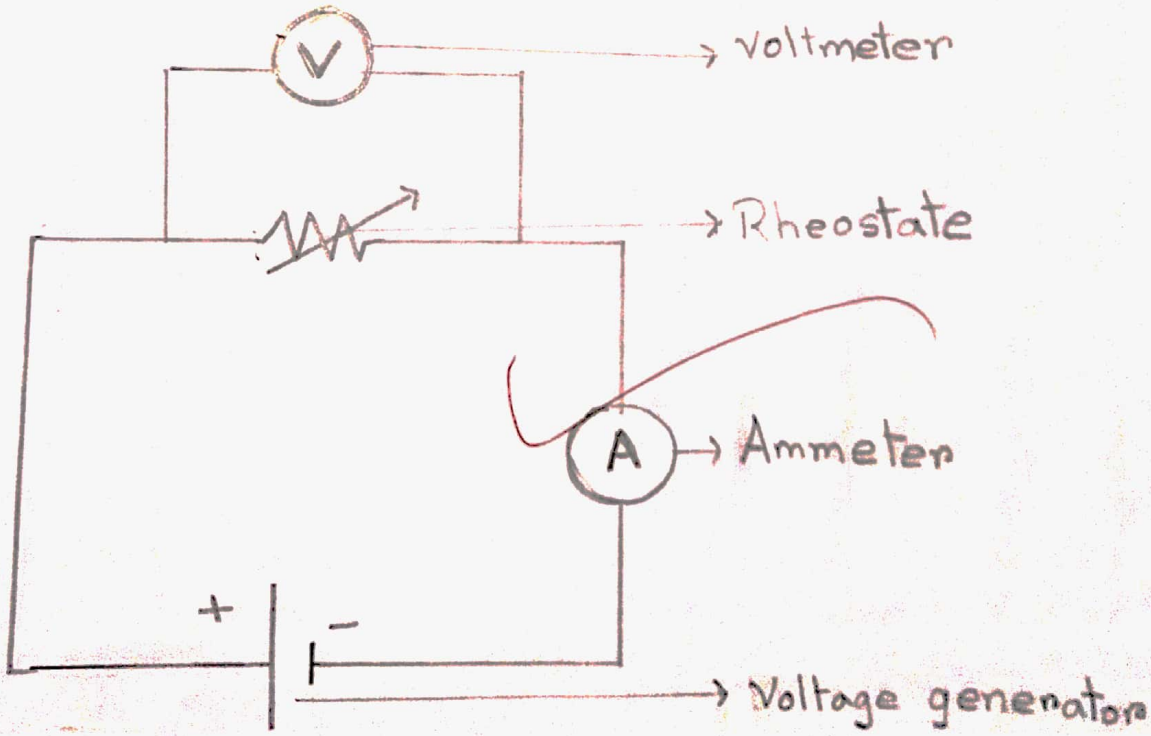

Figure-1: Voltmeter in parallel and Ammeter in series with the rheostate in the circuit

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Roll: 19 38 52 01 13

Here,
Along XOX' 1 box = 0·005 unit
Along YOY' 2 box = 1 unit

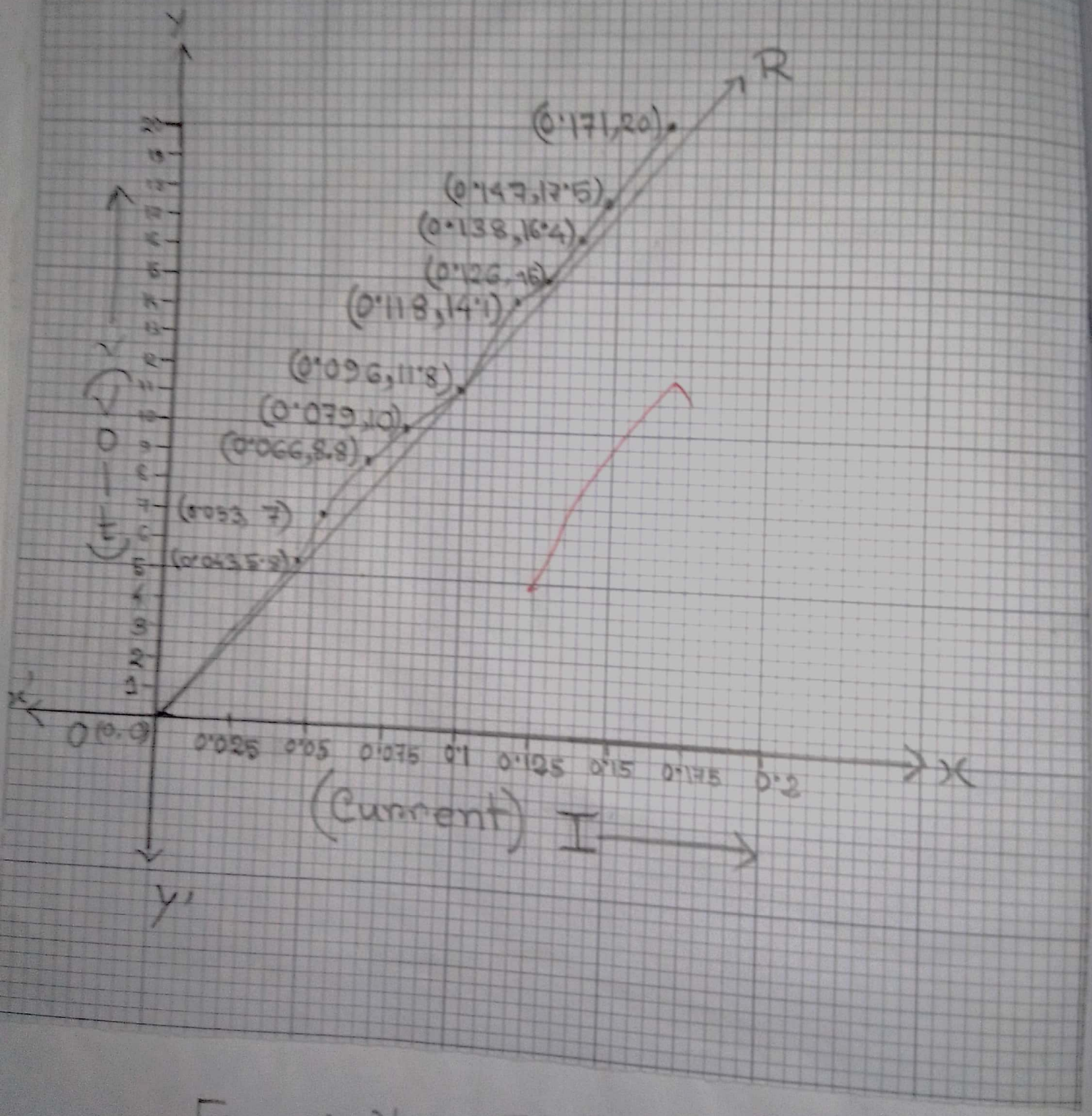

Figure: V vs I graph

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2.5
Experimental data:

Table 02: Experiment data.

Current, I (Ampere)	Voltage, V (volt)
$I_1 = 0.043$ A	$V_1 = 5.8$ V
$I_2 = 0.053$ A	$V_2 = 7$ V
$I_3 = 0.066$ A	$V_3 = 8.8$ V
$I_4 = 0.079$ A	$V_4 = 10$ V
$I_5 = 0.096$ A	$V_5 = 11.8$ V
$I_6 = 0.118$ A	$V_6 = 14.1$ V
$I_7 = 0.126$ A	$V_7 = 15$ V
$I_8 = 0.138$ A	$V_8 = 16.4$ V
$I_9 = 0.147$ A	$V_9 = 17.5$ V
$I_{10} = 0.171$ A	$V_{10} = 20$ V

2.6
Calculation:-

The general formula; $R = \frac{V}{I}$

$\therefore R_1 = \frac{V_1}{I_1} = 134.88\ \Omega$

$R_2 = \frac{V_2}{I_2} = 132.07\ \Omega$

$R_3 = \frac{V_3}{I_3} = 133.3\ \Omega$

$R_4 = \frac{V_4}{I_4} = 126.5\ \Omega$

$R_5 = \frac{V_5}{I_5} = 122.9\ \Omega$

$R_6 = \frac{V_6}{I_6} = 119.49\ \Omega$

$R_7 = \frac{V_7}{I_7} = 119.04\ \Omega$

$R_8 = \frac{V_8}{I_8} = 118.8\ \Omega$

$R_9 = \frac{V_9}{I_9} = 119.04\ \Omega$

$R_{10} = \frac{V_{10}}{I_{10}} = 116.95\ \Omega$.

R

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Discussion: We were supposed to get a straight line in the graph as the resistence should have been constant. But in calculation we did not get accurately constant value of R. The main reason for this inconvenience are –

1) The rheostate used for determining current and voltage on the DC supply got heated for continuous current flow. As a result resistance range varied and was not fixed.

2) The room temperature was not permanent.

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Conclusion: The experiment for getting the accurate graph of Ohm's law is not that easy. The room temperature and the internal temperature of the rheostate are two big factors for getting the straight line in the graph paper. The connection of the DC power supply and rheostate should be done perfectly to get proper flow of current.

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Assignment - 02 (Questions)

Q-1: Define Ohm's law. And draw it's graph with equation.

Q-2: Draw circuit diagram of Ohm's law with necessary equipments.

Q-3: How to connect Ammeter and Voltmeter.

Q-4: Write the properties of Ammeter & voltmeter.

Q-5: Write the uses of different meters

Q-6: Symbols of various meters.

Q-7: Write about DC & AC.

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IMPERIAL COLLEGE of ENGINEERING

(Affiliated by Rajshahi University Code: 385)

Department of CSE

Experiment no- 03

Date of Performance: 17.02.19

Date of Submission: 24.02.'19

Experiment Name:

Verification of series & parallel circuit configuration.

Course Code:	APEE 1132
Semester:	Odd
Part:	01

Remarks:

Submitted by,

Teresa Jency Bala

Roll: 13

ID: 19 38 52 01 13

Part-01, Odd Semester

Dept. of CSE

Submitted to,

Md. Abubakar Siddiq Abir, Lecturer, ICE.

Abir

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Experiment 03: Verification of series & parallel circuit configuration

3.1: Objectives:

1. To be introduced with series circuit.
2. To be introduced with parallel circuit.
3. To know about current flow and voltage difference in series and parallel circuit.

3.2.- Theory:

The voltage divider and current divider rules are used in order to determine the amount of voltage and current passing through the two resistances connected in series and parallel..

Series circuit: The circuit where resistances are connected in series is called series circuit. The circuit configuration:

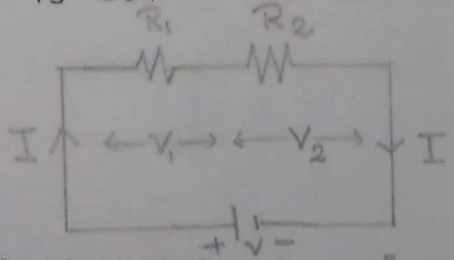
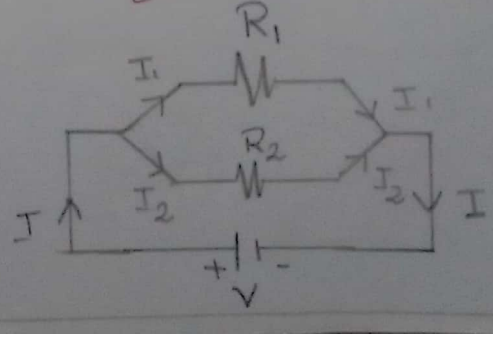


Figure-01: Series circuit

Parallel circuit: The circuit where resistance are connected in parallel is called parallel circuit. The circuit configuration:

Figure-02: Parallel circuit



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Voltage divider Rule:- The sum of individual voltage passing through the resistances connected in series is equal to the total voltage of the circuit.

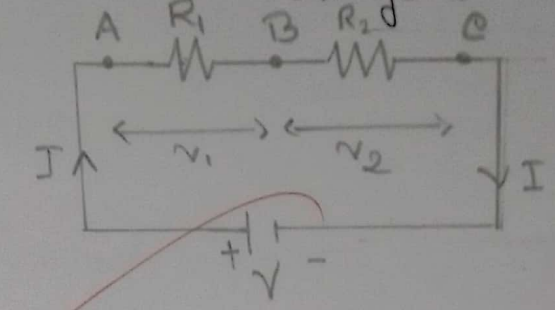

Figure-03: Here,
voltage across R_1, between A & B = V_1
voltage across R_2, between B & C = V_2

The total voltage,

$$V = V_1 + V_2$$

Total resistance,

$$R_S = R_1 + R_2$$

We know,

$$I = \frac{V}{R} = \frac{V}{R_1 + R_2}$$

For,

$$V_1 = IR_1$$

$$= \frac{V}{R_1 + R_2} \times R_1$$

$$\therefore V_1 = \frac{R_1}{R_1 + R_2} \times V \quad , \text{Similarly, } V_2 = \frac{R_2}{R_1 + R_2} \times V.$$

Current divider Rule:- The electrical current entering the node of a parallel circuit is divided into it's branches.

Total current,

$$I = I_1 + I_2$$

Total resistance,

$$R_P = (R_1^{-1} + R_2^{-1})^{-1}$$

$$= \frac{R_1 R_2}{R_1 + R_2}$$

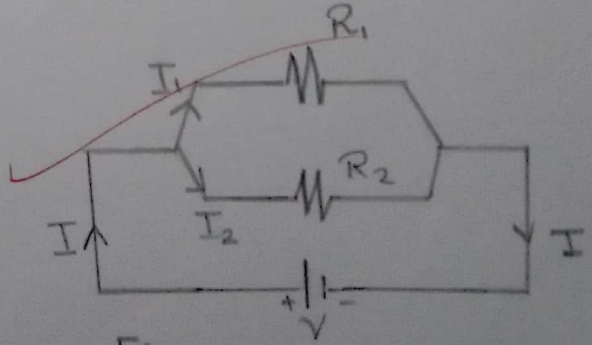

Figure-04: Here,
Current through $R_1 = I_1$
Current through $R_2 = I_2$

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We know, $I = \frac{V}{R}$ or, $V = IR$

$= I \cdot \frac{R_1 R_2}{R_1 + R_2}$ ---- (i)

For $I_1 = \frac{V}{R_1}$

$= \frac{I R_1 R_2}{R_1 + R_2} \times \frac{1}{R_1}$ [from (i)]

$= \frac{R_2}{R_1 + R_2} \times I$ Similarly, $I_2 = \frac{R_1}{R_1 + R_2} \times I$

3.3- List of Equipments:

Table-01 : Table of required equipments

Serial no.	Name of Element	Range	Quantity
01.	Bulb-01	100W-220V	1
02.	Bulb-02	40W-220V	1
03.	Flexible wire		2
04.	DC Power supply	(0-30)V	1
05	Switch (one-way)		3
06	Multimeter		1

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3.4- Experimental figure:

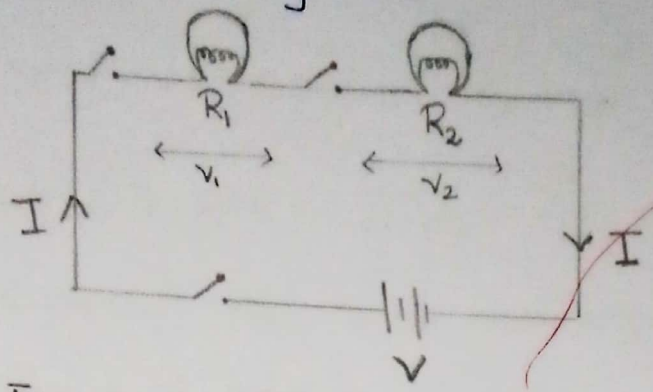

Figure-03: 2 bulbs connected in series

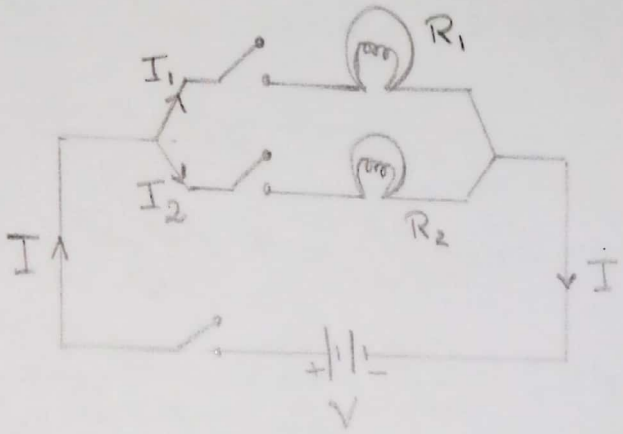

Figure-04: 2 bulbs connected in parallel

3.5- Experimental data:

Table-02: Experimental data for series circuit.

Serial no.	V (voltage)	V_1 (voltage)	V_2 (voltage)	I (Ampere)
01	21·4 V	0·050 V	0·111 V	0·344 A
02	25·3 V	0·12 V	0·19 V	1·085 A
03	29·5 V	0·031 V	0·193 V	0·488 A

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3.6- Calculation:

Bulb-01,

$P = 100W$, $V = 220V$, $\therefore R_1 = \frac{V^2}{P} = 484 \Omega$

Bulb-02,

$P = 40W$, $V = 220V$, $\therefore R_2 = \frac{V^2}{P} = 1210 \Omega$

In series circuit the same current flows through the individual resistances.

Case (01), the voltage, $V = 21.4$ Volt

$$I = \frac{V}{R_S} = \frac{V}{R_1 + R_2} = \frac{21.4}{484 + 1210} = \frac{21.4}{1694} = 0.012 \text{ A}$$

$$V_1 = \frac{R_1}{R_1 + R_2} \times V = \frac{484}{1694} \times 21.4 = 6.114 \text{ V}$$

$$V_2 = \frac{R_2}{R_1 + R_2} \times V = \frac{1210}{1694} \times 21.4 = 15.28 \text{ V},$$

Case (02), the voltage, $V = 25.3$ Volt

$$I = \frac{V}{R_S} = \frac{25.3}{1694} = 0.014 \text{ A}$$

$$V_1 = \frac{R_1}{R_1 + R_2} \times V = \frac{484}{1694} \times 25.3 = 7.22 \text{ V}$$

$$V_2 = \frac{R_2}{R_1 + R_2} \times V = \frac{1210}{1694} \times 25.3 = 18.07 \text{ V}$$

Case (03), the voltage, $V = 29.4$ Volt

$$I = \frac{V}{R_S} = \frac{29.4}{1694} = 0.017 \text{ A}$$

$$V_1 = \frac{R_1}{R_1 + R_2} \times V = \frac{484}{1694} \times 29.4 = 8.4 \text{ V}$$

$$V_2 = \frac{R_2}{R_1 + R_2} \times V = \frac{1210}{1694} \times 29.4 = 21 \text{ V}$$

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3.7- Discussion: The calculation with the experimental data don't match because the bulbs those we used for the experiment had 220Volt as potential difference. As our input voltage were just 21.4V, 25.3V, 29.5V which are very low compared to the original voltage, we had to get distinct values from the practical experiment with theoretical calculation.

3.8- Conclusion: The experiment for determining the individual voltage flow through the bulbs in series circuit and current flow through the bulbs in parallel circuit should be taken cautiously. The connection of the DC power supply with the bulbs & the switches should be made accurately to avoid miscalculation.

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Roll:13

V (volt)	V_1 (volt)	V_2 (volt)	I (Ampere)
21.4	0.050	0.111	0.344
25.3	0.12	0.19	1.085
29.5	0.031	0.193	0.488

Ali
17.2

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Assignment - 03 (Questions)

Q-1: What is Circuit ?

Q-2: How many kinds of circuit are there?

Q-3: What are the elements of circuit ?

Q-4: How many kinds of load ?

Q-5: What is electrical power & electrical energy ?

Q-6: What do you meah by '100W-220V' ?

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CSE

1st Year, Odd Semester.

Imperial College of Engineering

Assignment-03 Code: 385.

[Circuit Lab]

Submitted by,

Name: Teresa Jency Bala

Roll: 19 38 52 01 13

Subject: APEE 1132

Topic: Circuit, Circuit types, elements. Kinds of load, electric power & energy, '100W-220V'

Submitted to:

Md. Abu Bakkar Siddiq Abir, Lecturer.
ICE

Date: 24/02/19

Day: Sunday

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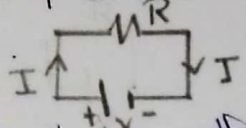
Q/A:

1. What is Circuit?

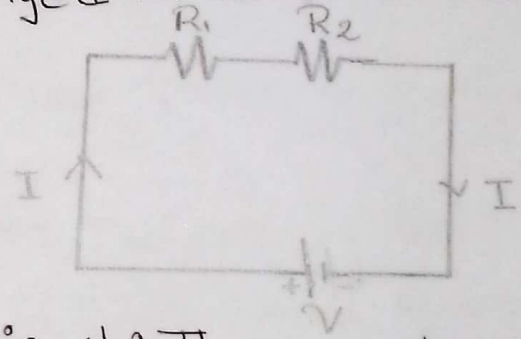
Ans: A device or system of devices, that allows electrical current to flow through it and allows voltage to occur across positive and negative terminal is called circuit.



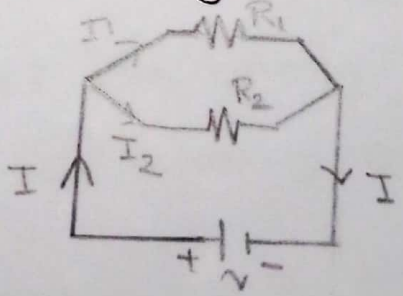
2. How many kinds of circuit are there?

Ans: There are 3 kinds of circuit. These are.

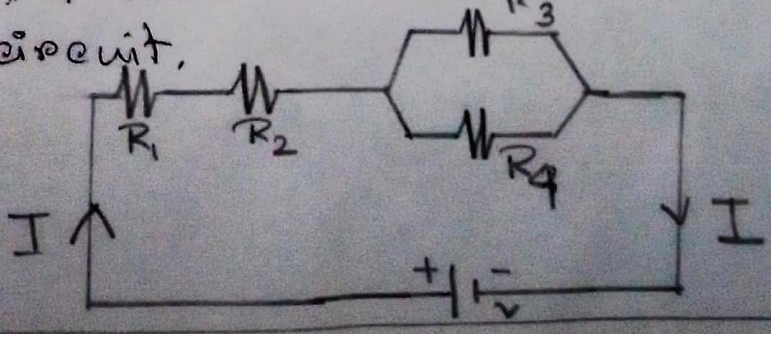
1. Series circuit: The circuit where all resistances are arranged in series is series circuit.



2. Parallel Circuit: The circuit where the resistances are arranged in parallel is parallel circuit.



3. Mixed Circuit: The circuit where both series and parallel process is used to join the resistances is mixed circuit.



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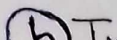
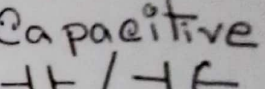
3. What are the elements of circuit ?

Ans: The elements of circuit are:

1) Voltage generator / Power load.
2) Switch.
3) Wire
4) Resistances.

4. How many kinds of load ?

Ans: There are three types of load.

ⓐ Resistive ⓑ Inductive  ⓒ Capacitive 

5. What is electrical power & electrical energy?

Ans:

Electrical power: The rate per unit time at which electrical energy is transferred by an electric circuit is called electrical power.

Electrical energy: The energy derived from electric potential energy or kinetic energy.

6. What do you mean by '100W-220V'?

Ans: By '100W-220V' we mean that the power of the substance i.e, bulb is 100 watt and potential difference between the two ends is 220 volts.

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IMPERIAL COLLEGE of ENGINEERING

(Affiliated by Rajshahi University Code: 385)

Department of CSE

Experiment no- 04

Date of Performance: 10-03-19

Date of Submission: 24-03-19

Experiment Name: Experiment on
a) Connection of wattmeter
b) How to identify CC & PC
c) Energy meter & calculation of electric bill

Course Code:	APE1132
Semester:	ODD
Part:	I

Remarks:

Abir 25.03.19

Submitted by,

Teresa Jeney Bala

Roll: 113

ID: 19 385 20 113

Part-01, Odd Semester

Dept. of CSE

Submitted to,

Md. Abu Baker Siddik Abir,

Lecturer, ICE

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Experiment - 04 : Experiment on a) Connection of Wattmeter
b) How to identify CC & PC
c) Energy meter & How to calculate electric bill.

4.1 : Objective

1. To understand connection mechanism of Wattmeter
2. How to identify CC & PC coil in wattmeter.
3. How to calculate electric bill and use of energy meter.

4.2 : Theory :

We know, power is the rate of doing work. Power is a scalar quantity. The SI unit of power is Watt (1 W = 1 J/sec). The device for measuring power consumption is Wattmeter. This device measures power in watt unit, $P = VI$ .i.e, both potential difference and Current can also be measured using .wattemeter.

There are two types of coils in the circuit configuration of wattmeter.

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They are:

a) CC → Current Coil

b) PC → Potential / Pressure coil.

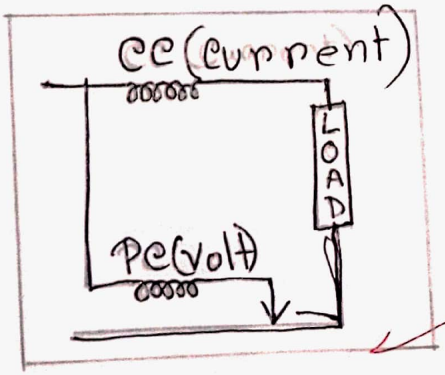
The capacity to do work is known as the energy used. The meter which measures this energy is called energy meter.

The equations for Power Calculation are:

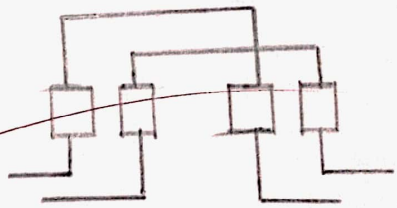
$$P = VI = I^2R = \frac{V^2}{R}$$

$$W = VIt = I^2Rt = \frac{V^2t}{R}$$

4.3 Experimental figure:



1- Figure: Wattmeter connection diagram



2-Figure: Circuit connection of energy meter,

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4.4: Experimental data tables:

Table-01: Rating of loads.

Load	Rating	Num
Light	220V - 0·3 A	05
Fan	220V - 5 A	02
TV	220V - 10A	01
AC	220V - 50A	01

Table-02: Resistance mapping of coil

Coil	Resistance
PC	$R_{PC} = 0·3\Omega$
PCC	$R_{PCC} = 2m\Omega = 2\times10^{-6}\Omega$

4.5: Calculation:

We know, $W = \frac{IVt}{1000}$ kwh, Bill = W × Per unit

Light, $W_1 = \frac{0·3\times220\times31\times24\times5}{1000} = 245·52$ kwh

Fan, $W_2 = \frac{5\times220\times31\times24\times2}{1000} = 1636·8$ kwh

TV, $W_3 = \frac{10\times220\times31\times24\times1}{1000} = 1636·8$ kwh

AC, $W_4 = \frac{50\times220\times31\times24\times1}{1000} = 8184$ kwh

$W = W_1 + W_2 + W_3 + W_4 = 11703·12$ kwh

Bill = W × Per Unit = 11703·12 × 5৳ = 58,515·6 Tk.

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4·6: Discussion: In identifying CC and PC coil of Wattmeter the Resistance of current coil is very low to pass maximum maximum current And of Potential coil the resistance is high to pass least current, $R_{pc} = 0.3\Omega$ & $R_{pc} = 2 \times 10^6 \Omega$.

here $I = \frac{V}{R}$ so, high resistance and low current Against low resistance & high current.

And electric bill is calculated with $W = \frac{IVT}{1000}$,

BOT = W × Bill unit

4·7: Conclusion: The wattmeter has connection of two types of coil CC & PC.

The energy meter is used to find the $W = IVT$ value, in Wh.

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Roll: 13

Load	Rating	Num
light	220V-0.3A	05
Fan	220V - 5A	02
TV	220V-10A	01
AC	220V-50A	01

light, $W_1 = \frac{0.3 \times 220 \times 31 \times 24 \times 5}{1000} = 245.52$ kwh

Fan, $W_2 = \frac{5 \times 220 \times 31 \times 24 \times 2}{1000} = 1636.8$ kwh

TV; $W_3 = \frac{10 \times 220 \times 31 \times 24 \times 1}{1000} = 1636.8$ kwh

AC, $W_4 = \frac{50 \times 220 \times 31 \times 24 \times 1}{1000} = 8184$ kwh

$\therefore W = W_1 + W_2 + W_3 + W_4 = (245.52 + 1636.8 + 1636.8 + 8184)$ kwh

$= 11703.12$ kwh

Bill = W x Per Unit = $11703.12 \times 5 = 58515.6$ Tk.

Table-02: Resistance mapping

Coil Name	Resistance
CC	$R_{CC} = 0.3\,\Omega$
PC	$R_{PC} = 2 \times 10^{-6}\,\Omega$ $2\,m\Omega$

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Assignment - 04 (Questions)

Q-1: What is Power factor?

Q-2: How many coils in wattmeter? What are they called?

Q-3: Draw the connection diagram of wattmeter

Q-4: Draw different loads vector diagrams

Q-5: What is energy meter?

Q-6: What is power factor equation?

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CSE

1st Year, Odd Semester.

Imperial College of Engineering.

Submitted by,

Name: Teresa Jency Bala

ID : 1938520113

Subject: APEE1132

Topic: Wattmeter, vector diagrams of loads, power factor

Assignment no - 04

Submitted to,

Abu Baker Siddik Abir, Lecturer.

Date: 25/03/19

Day : Monday

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1. What is power factor?

Ans: The ratio of actual power being used in a circuit expressed in watts or kilowatts, to the power that is apparently being drawn from a power source, expressed in volt-amperes or kilovolt-amperes.

2. How many coils in wattmeter?

Ans: There 2 coils in wattmeter. These are

a) CC or Current coil.

b) PC or Potential/Pressure coil.

3. Draw the connection diagram of wattmeter.

Ans: The connection diagram of wattmeter-

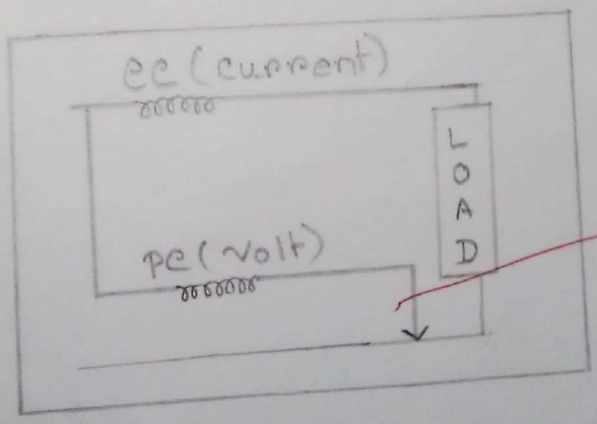

Figure: Wattmeter's connection diagram

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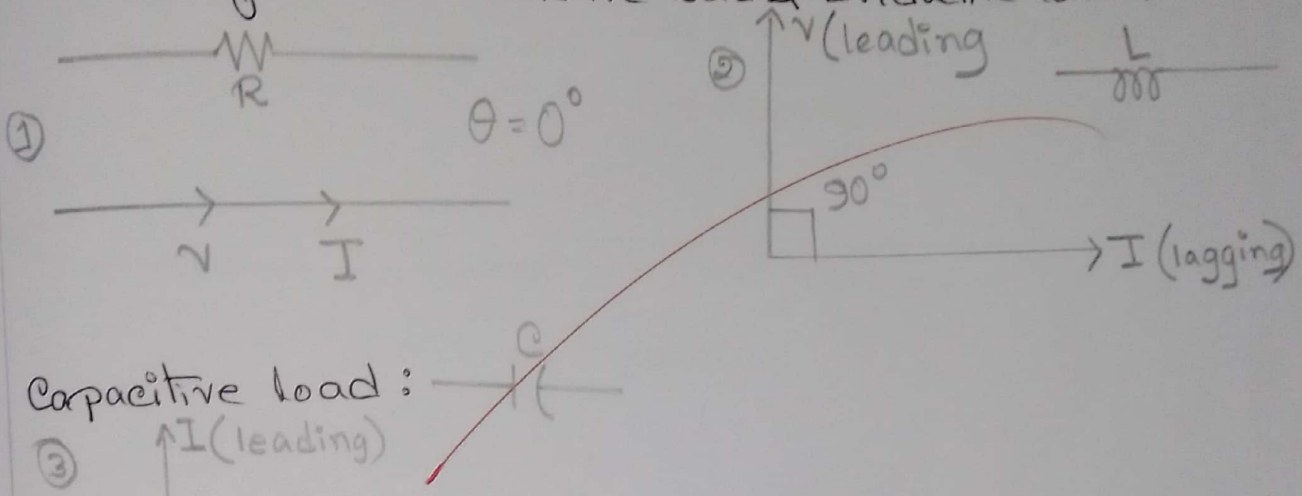
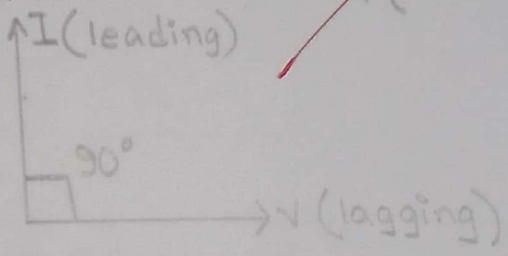
4. Draw different loads vector diagrams.

Ans: Loads are of 3 types. 1) Resistive, 2) Inductive & 3) Capacitive.

Vector diagram of resistive load & Inductive load:



Capacitive load:



5. What is energy meter?

Ans: The capacity to do work is known as the energy used. The meter which measures this energy is called energy meter.

6. What is the power factor equation?

Ans: Power factor, $\cos\theta = \frac{P}{VI}$; here, ratio of Power (Watts) divided by the product of voltage (V) & current (I). The range is $0 < \cos\theta < 1$.

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IMPERIAL COLLEGE of ENGINEERING

(Affiliated by Rajshahi University Code: 385)

Department of CSE

Experiment no- 05

Date of Performance: 03/03/19

Date of Submission: 10/03/19

Experiment Name: Experiment on RLC series circuit configuration.

Course Code:	APEE1132
Semester:	Odd
Part:	I

Remarks:

Abin

Submitted by,

Teresa Jency Bala

Roll: 13

ID: 19 38 52 01 13

Part-01, Odd Semester

Dept. of CSE

Submitted to,

Md. Abu Baker Siddik

Abin, Lecturer,

(ICE)

Imperial College of Engineering.

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Experiment - 05: Experiment on RLC series circuit configuration.

5.1: Objective:

1. To be introduced with RLC series circuit
2. To be introduced with impedance
3. Understand relation between impedance and frequency.
4. Know about capacitive and inductive reactance

5.2: Theory:

The circuit consisting of three different types of loads - resistive, inductive and capacitive are connected in series with each other and with power supply is called RLC circuit. The sum of the resistance, inductive reactance and capacitive is called impedence. The number of cycles through which an alternating current passes per second is called frequency. Denoted by f and unit Hz (Hertz).

Inductive reactance: The resistance of inductor when used in an AC circuit is called inductive reactance. Denoted as $X_L = \omega L$ (Ω). ω is angular frequency in coil. $\omega = 2\pi f$. $X_L = 2\pi f L$. L is load (Henry)

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Capacitive reactance: The internal resistance of the capacitance to the Alternating Current is capacitive reactance. It is denoted by X_c.

$X_c = \frac{1}{2\omega C}$ where ω is angular frequency ie $\omega = 2\pi f$ & C is capacitence (Faraday). $X_c = \frac{1}{2\pi f C}$.

5.3. List of Equipments:

Table-01: Requirement Equipments

Serial no.	Name of Equipment	Range	Quantity
01.	Inductive load (Electrical Ballast)		1.
02.	Capacitive load	2.5μF	1.
03.	Resistive load (Bulb)		1.
04.	Power meter (Power source)		1.
05	Wire		2
06	Multimeter		1.

5.4. Experimental figure:

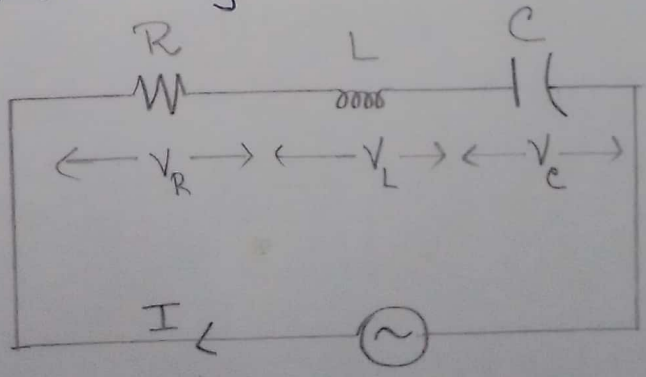

Figure-01: RLC series circuit.

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5.5: Experimental data:

Total Current = 0.142 Amp
Voltage = 205.5 V
Power = 25.9 W
Power factor = - 0.873

Potential difference of bulb, $V_R = 157.5$ V
Inductive Voltage, $V_L = 86.6$ V
Capacitive Voltage, $V_c = 180.6$ V
Standard frequency of BD, $f = 50$ Hz
Charge of Capacitor, $C = 2.5\ \mu F = 2.5 \times 10^{-6}$ F

5.6. Calculation:

Capacitive reactance, $X_c = \frac{1}{2\pi fc} = \frac{1}{2 \times 3.1416 \times 50 \times 2.5 \times 10^{-6}}$

$= 1273.23\ \Omega$

Inductive reactance, $R_L = X_L = \frac{V_L}{I} = \frac{86.6}{0.142} = 609.8\ \Omega$

Resistance, $R = \frac{V_R}{I} = \frac{157.5}{0.142} = 1109.15\ \Omega$

$\therefore$ Impedence, $Z = R + j(X_L - X_c)$

$= 1109.15 + j(609.8 - 1273.23)$

$= 1109.15 + j(-663.43)$

$= 1292.42 \angle -30'89$

5.7 Conclusion: From the experiment we can come to a conclusion that since X_c, X_L both depend on the frequency of the applied voltage. The sum up of resistive, inductive and capacitive load i.e impedence is also depended on the frequency. Where # as the resistive load resistance does not depend on frequency. So, by changing frequency of applied voltange the impedence can be changed.

5.8: Discussion: The impedence is the effective resistance from the combination of ohmic resistance and reactance of the RLC series circuit. Inductive reactiance and capa-citive reactance both depends on f. The connection of wire with power meter with the three loads should be made carefully. The multimeter reading should be taken with much attention.

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Roll-13

Exp: 04 - Experiment of RLC series Circuit.

Total Current = 0·142 Amp

Total Voltage = 205·5 V

Total Power = 25·9 W

Total Power factor = −0·873

$V_R = 157{\cdot}5\ V$

$V_L = 86{\cdot}6\ V$

$V_C = 180{\cdot}6\ V$

$V_L = IR_L$

$R_L = \frac{V_L}{I} = \frac{86{\cdot}6\ V}{0{\cdot}142\ Amp}$

$\therefore X_L = 609{\cdot}85\ \Omega$

$X_C = \frac{1}{2\pi f C}$

$= \frac{1}{2 \times 3{\cdot}1416 \times 50 \times 2{\cdot}5 \times 10^{-6}}$

$= 1273{\cdot}23\ \Omega$

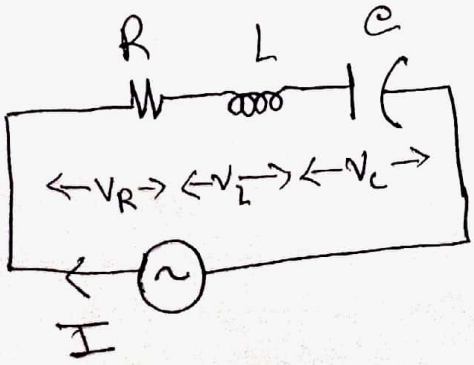
$R_R = \frac{V_R}{I} = \frac{157{\cdot}5\ V}{0{\cdot}142\ Amp}$

$= 1109{\cdot}15\ \Omega$

$\therefore$ Impedence, $Z = X_C + X_L + R_R$

$= (1273{\cdot}32 + 609{\cdot}85 + 1109{\cdot}5)\ \Omega$

$= 2992{\cdot}67\ \Omega$



Abir
03.03.19

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Assignment - 05

1. What is RLC circuit?
2. What is impedence?
3. What is frequency?
4. Define X_L & X_C with equations.
5. What is the unit of L & C?
6. Prove L is short and C is open. in DC.

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Assignment - 05 (Q/A)

1. What is a RLC circuit?

Ans: The circuit where three different type of load - resistive, inductive and capacitive are connected in series with power supply is RLC circuit.

2. What is impedence?

Ans: The impedence is the effective resistance from the combination of ohmic resistance and reactance of the RLC series circuit.

3. What is frequency?

Ans: The number of cycles through which an alternating current passes per second in frequency. Denoted as f & unit is Hertz (Hz)

4. Define X_L & X_C.

Ans: Inductive load reactance, X_L: The electrical resistance of inductor when used in an AC circuit is called inductive reactance. $X_L = \omega L\ (\Omega)$. The angular frequency, $\omega = 2\pi f$. $\therefore X_L = 2\pi f L\ (\Omega)$.

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Capacitive reactance; X_C : The internal resistance of the capacitive to the alternating current is called capacitive reactance. It is denoted by X_C. $X_C = \frac{1}{\omega C}$ (Ω). where ω is angular frequency i.e, $\omega = 2\pi f$. $\therefore X_C = \frac{1}{2\pi f C}$ (Ω)

5. What is the unit of L & C?

Ans:- The unit of inductive load Henry (H).
The unit of capacitance is Faraday (F).

6. Prove L is short and C is open in DC.

Ans:- There is no frequency of applied voltage in case of Direct current. We know,

Inductive reactance, $X_L = 2\pi f L$ (Ω)

Capacitive reactance, $X_C = \frac{1}{2\pi f C}$ (Ω)

In DC, frequency, $f = 0$,

$\therefore X_L = 0\ \Omega$ i.e, there is a short circuit for no resistance.

$\therefore X_C = \frac{1}{0} = \infty\ \Omega$ i.e, there is high infinity resistance and so its open circuit.

$\therefore$ L is short & C is open in DC circuit.

[Proved]

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IMPERIAL COLLEGE of ENGINEERING

(Affiliated by Rajshahi University Code: 385)

Department of CSE

Experiment no- 06

Date of Performance: 05-05-19

Date of Submission: 11-05-19

Experiment Name: Introduction with breadboard & color Code

Course Code:	APEE1132
Semester:	Odd
Part:	I

Remarks: Abir

Submitted by,

Teresa Jency Bala

Roll: 13

ID: 19 385 20 113

Part-01, Odd Semester

Dept. of CSE

Submitted to,

Md. Abu Baker Siddiki

Abir.

Lecturer, ICE

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Experiment - 06: Introduction with breadboard & color Code

6.1: Objective:

1. To be introduced with breadboard
2. How to ~~put~~ join different elements on breadboard to form a circuit.
3. To find the value of a resistor & it's tolerance by using color coding.

6.2: Introduction: A breadboard is a rectangu-lar plastic board with a bunch of tiny holes in it. These holes lets ~~you~~ it easy to insert electronic components to prototype an electronic circuit, like this example: Using a battery, switch, resistor and LED.

To use bread board the pins of electrical components or jumper wires are to be pushed inside the holes. The holes have spring in them to keep the components from falling out.

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A specific code for color used to indicate the values of rating and tolerance of electronic components, usually for resistor.

Table-1: Color Code table for Resistor

Color	Digit	Multiplier	Tolerance
Black	0	10^0	
Brown	1	10^1	±1%
Red	2	10^2	±2%
Orange	3	10^3	
Yellow	4	10^4	
Green	5	10^5	±0.5%
Blue	6	10^6	±0.25%
Violet	7	10^7	
Grey	8	10^8	
White	9	10^9	
Gold			±5%
Silver			±10%
None			±20%

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6.3: List of Equipments:

Table-2: Required Equipments

S.L	Name of Equipments	Quantity
01	Breadboard	01
02	Resistor	01
03	Wire	02
04	Power Supply(220V)	01

6.4: Experimental Figure:

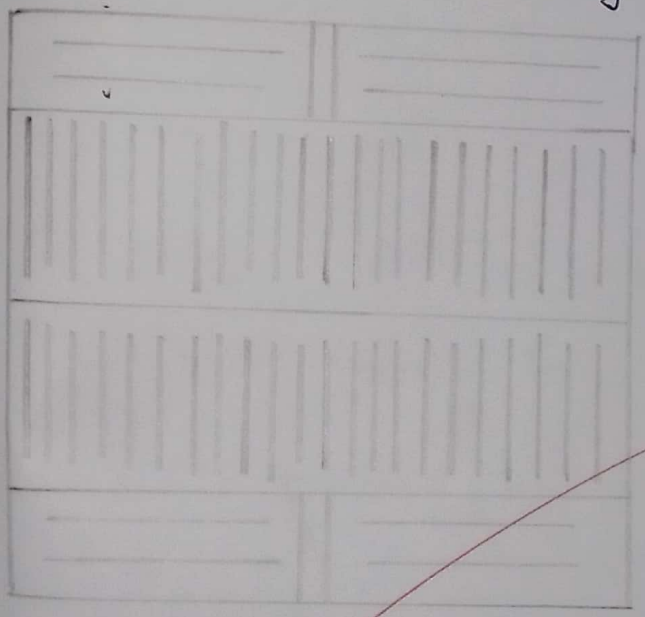

Figure-1: Internal diagram of breadboard

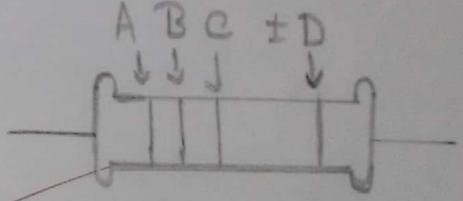

Figure-2: Resistance

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6.5 : Experimental data & Calculation

A resistor colored Red-Black-Golden-Golden.

Red = 2

Black = 0

Gray = 10^8

Gold = $\pm 5\%$

Color code = $20 \times 10^8 \pm 5\%$

6.6 : Conclusion :

To conclude, a breadboard is a very useful equipment for measuring DC voltage and total resistance. Therefore a circuit needs to be completed and closed in order to measure total resistance.

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IMPERIAL COLLEGE of ENGINEERING

(Affiliated by Rajshahi University Code: 385)

Department of CSE

Experiment no- 07

Performance Date: 11-05-19

Submission Date: 12-05-19

Experiment Name: Verify V-I Characteristics of p-n junction

Remarks:

Course Code:	APEE 1132
Semester:	Odd
Part:	I

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Part-01, Odd Semester

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Experiment - 7: Verify V-I Characteristics of P-N Junction.

7.1: Objective:

1. To measure values of V-I for it's curve for p-n junction diode
2. To understand characteristics of p-n junction.

7.2: Theory: A p-n junction diode is a simple electrical device formed of a junction of n-type and p-type semiconductor material. The primary function of diode is rectification and it allows current in one direction. There are two types of biasing in diode.

Forward bias: Initially no current flows due to barrier potential. As the applied potential increases the majority carriers of p-type semi-conductor i.e. holes starts carrying e^- and the knee voltage increases very sharply

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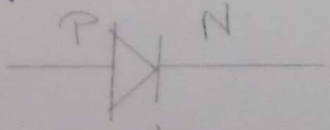
Reverse bias: The voltage where current don't increase is zenor voltage. At the moment where minor carriers moves at opposite direction the zenor breakdown occurs & current flows.

7.3 Experimental equipment list:

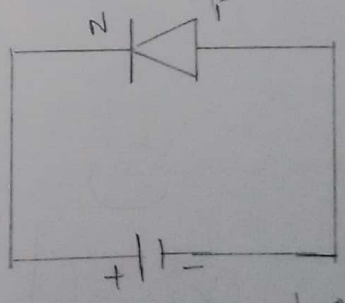
Table-01: List of equipments

SL	Name of Equipments	Quantity
01	Diode	01
02	Voltage Supplier	01
03	Bread board	01
04	Connecting wires	02
05	Multimeter/(Ammeter + Volt-meter)	02

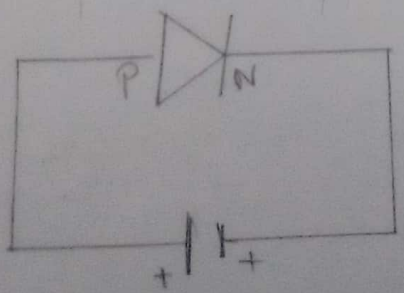
7.4 Experimental figures:



Diode



Reverse bias



Forward bias

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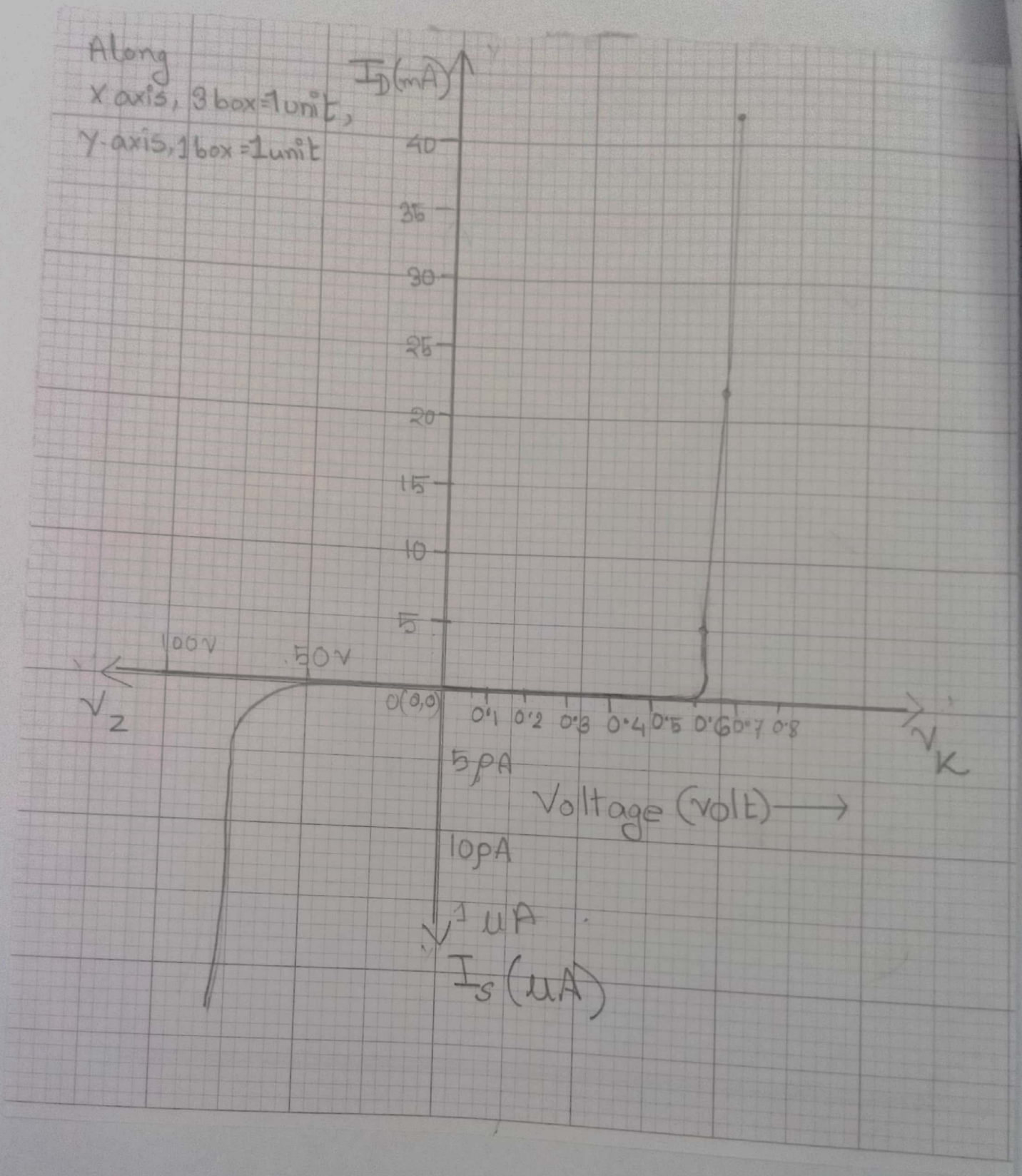

Figure: V-I Characteristics in graph of p-n junction.

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7·5 : Experimental data & Calculation:

V (Volt)	I (mAmp)
0	0
0·1	0
0·2	0
0·3	0
0·6	0
0·62	5
0·65	22
0·69	43

7·6 : Conclusion: The main objective was to obtain the V-I characteristics of P-N junction diode for forward bias circuit. The diode is very sensitive equipment. If the current limit exceeds the diode rating then the diode will damage.

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Experiment-7: Verify V-I Characteristics of PN Junction Diode

Voltage & Current reading.

V	I
0 V	0mAmp
0.1 V	0mAmp
0.2 V	0mAmp
0.3 V	0mAmp
0.6 V	0mAmp
0.62V	5mAmp
0.65V	22 mAmp
0.69V	43 mAmp

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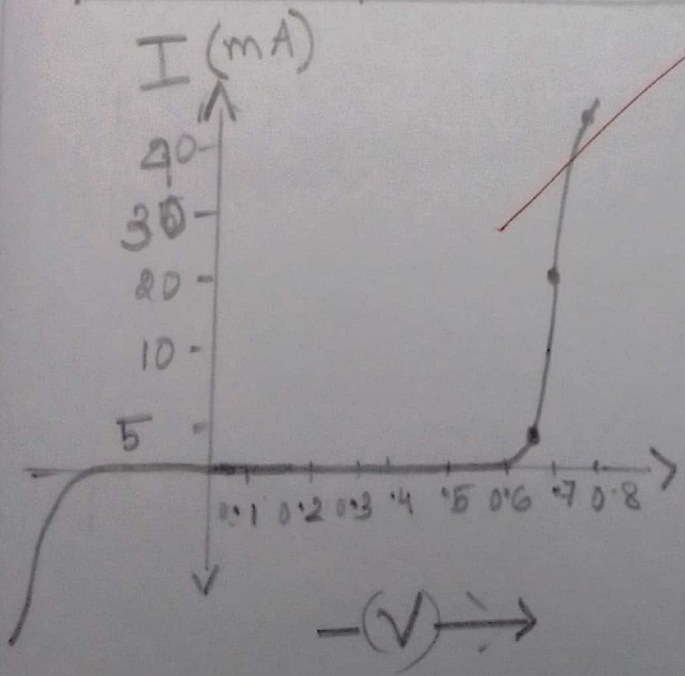

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