ATRIA INSTITUTE OF TECHNOLOGY

(Affiliated To Visvesvaraya Technological University, Belgaum)

Anandanagar, Bangalore-24

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

BASIC ELECTRICAL ENGINEERING LAB MANUAL

FIRST / SECOND SEMESTER (COMMON TO ALL BRANCHES)

SUBJECT CODE: 18ELEL 17/27

2020-21

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BASIC ELECTRICAL ENGINEERING LAB MANUAL

The Basic Electrical Laboratory Manual pertaining to I /II semester common to all Branches has been prepared as per VTU syllabus and all the experiments are designed, tested and verified according to the experiment list.

This manual typically contains practical/lab sessions related to DC circuits, AC circuits and Electrical machines covering various aspects related to the subject for better understanding. Students are advised to go through the manual thoroughly as it provides them practical insights.

Good Luck for your Enjoyable Laboratory Sessions

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BASIC ELECTRICAL ENGINEERING LABORATORY

Semester	: I/II	CIE Marks	: 40
Course Code	: 18ELEL17/27	SEE Marks	: 60
Teaching Hours/week (L:T:P)	: 0:0:2	Exam Hours	: 03
	Credits : 01		

Course Objectives:

- To provide exposure to common electrical components such as Resistors, capacitors and inductors, types of wires and measuring instruments.
- To measure power and power factor measurement of different types of lamps and three phase circuits.
- To explain measurement of impedance for R-L and R-C circuits.
- To determine power consumed in a 3 phase load.
- To determine earth resistance and explain methods of controlling a lamp from different places.

Orientation class for an exposure to:

- Resistors, capacitors, inductors, rheostats,diodes, transistors,types of wires, measuring instruments – voltmeter, ammeter, wattmeter, multi-meter, Regulated power supply, Function generator, oscilloscope, transformer, dc motor, synchronous generator, three phase induction motor etc.
- Basic safety precautions while dealing with electricity.

LIST OF EXPERIMENTS

1. Verification of KCL and KVL for DC circuits.
2. Measurement of current, power and power factor ofincandescent lamp, fluorescent lamp, and LED lamp.
3. Measurement of resistance and inductance of a choke coil using 3 voltmeter method.
4. Determination of phase and line quantities in three phase star and delta connected loads.
5. Measurement of three phase power using two wattmeter method.
6. Two way and three way control of lamp and formation of truth table.
7. Measurement of earth resistance.
8. Study of effect of open and short circuit in simple circuits.

Demonstration Experiments (for CIE only):

1. Demonstration of fuse and MCB separately by creating a fault.
2. Demonstration of cut-out sections of electrical machines (DC machines, Induction machines and synchronous machines).
3. Understanding ac and dc supply. Use of tester and test lamp to ascertain the healthy status of mains.
4. Understanding of UPS.

Revised Bloom's Taxonomy Levels L_1- Remembering, L_2- Understanding, L_3- Applying, L_4- Analysing

Course Outcomes:

At the end of the course the student will be able to:

- Identify the common electrical components and measuring instruments used for conducting experiments in the electrical laboratory.
- Compare power factor of lamps.
- Determine impedance of an electrical circuit and power consumed in a 3 phase load.
- Determine earth resistance and understand two way and three way control of lamps.

Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Individual and Team work, Communication

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part shall be made zero.

Experiment No-1

VERIFICATION OF KVL AND KCL FOR DC CIRCUITS

AIM: To verify Kirchhoff's Voltage Law (KVL) and Kirchhoff's current Law (KCL)

APPARATUS REQUIRED:

1. KCL/KVL Kit
2. Ammeter
3. Voltmeter
4. Connecting wires

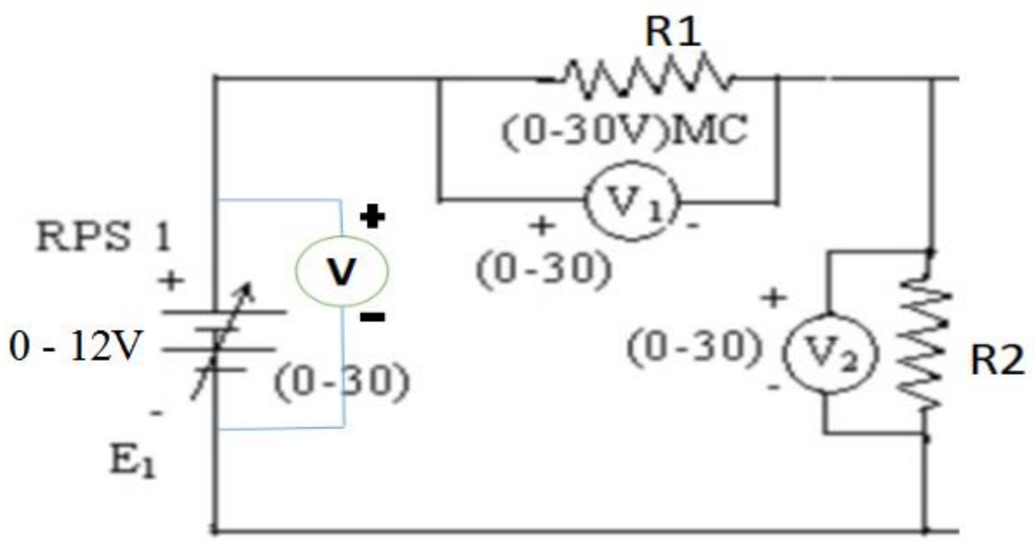
THEORY:

Kirchoffs Voltage law states that the algebraic sum of the products of current and resistance in each of the conductor in any closed mesh (or) path in a network plus the algebraic sum of the voltages in that path is zero

$$\sum IR + \sum V = 0$$

Kirchoffs current law states that the algebraic sum of the currents meeting at a point (or) junction is zero.or in any electrical network sum of the currents leaving from a point(node) is equal to the sum of currents entering the node.

CIRCUIT DIAGRAM OF KVL



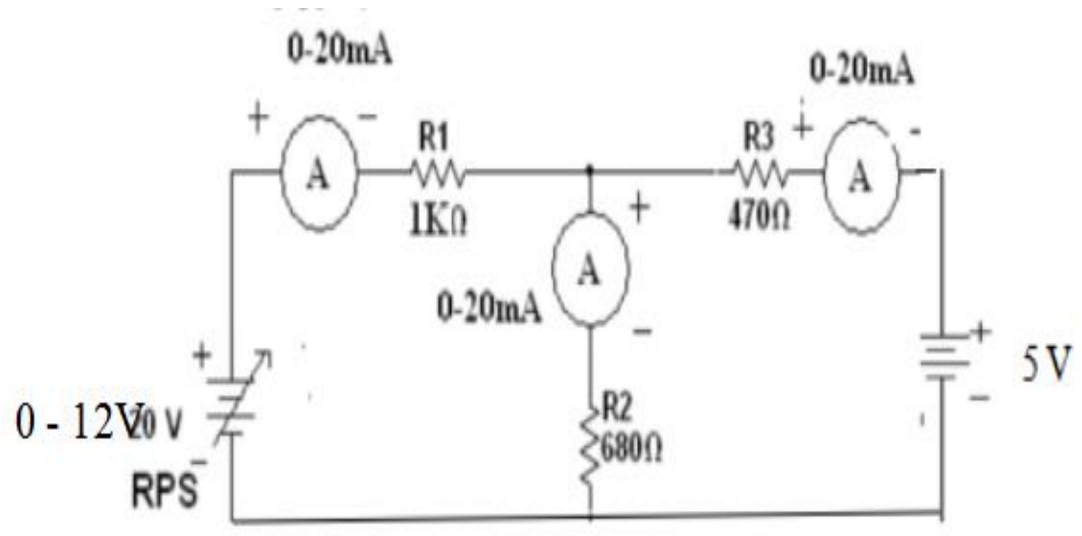
PROCEDURE (KVL) :

- Connect two different resistors and a supply and a current meter as shown in fig.
- Note that current flowing in the circuit.
- Find the values of IR_1, IR_2(or) measure the voltage drop across resistors and note them as V_1 and V_2.
- Note:Verify $IR_1 + IR_2 = V$ (or) $\mathbf{V = V_1 + V_2}$

TABULAR COLUMN OF KVL

Sl.No	V (volts)	V_1(volts)	V_2(volts)	$V=V_1+V_2$(volts)

CIRCUIT DIAGRAM OF KCL :



PROCEDURE (KCL):

- Connect circuit as shown in the diagram.
- Apply voltages V_1 and V_2.
- Observe that currents I_1 and I_2 are entering the point A whereas the current I_3 is leaving the point A.
- Note the currents I_1, I_2 and I_3 flowing in the circuit through the current meters.
- Now verify the current entering is equal to the currents leaving

TABULAR COLUMN OF KCL:

SL.NO	I_1 (amps)	I_2 (amps)	I_3 (amps)	$I_3 = I_1 + I_2$ (amps)

RESULT:

Hence KVL and KCL is verified

Experiment No-2

MEASUREMENT OF CURRENT, POWER AND POWER FACTOR OF INCANDESCENT LAMP, FLUORESCENT LAMP AND LED LAMP

AIM:

Measuring the parameters of current, power and power factor of different types of bulbs like incandescent lamp, fluorescent lamp, and LED lamp using the kit.

APPARATUS REQUIRED:

a). Parameters of lamps kit

b). AC Voltmeter, 300 V (Built in)

c). AC Ammeter, 2 A (Built in)

d). 1-ph. Wattmeter, 300 V, 1/ 2A.

THEORY:

To measure the parameter of current, power and power factor of the 3 types of bulbs like LED, CFL and Incandescent lamps can be observed by using the Physitech make Parameter of Lamps Kit. Place all the 3 lamps in the respective bulb holders provided on the kit. Connect the banana terminals of transformer output to the respective bulb holder terminals, which need to be tested with the help of patch chords. Connect the wattmeter current coil in series with output (lamp load) and connect the volt coil of the wattmeter across the output of the output terminals of the lamp which is in circuit.

Switch on the power by placing power chord in the 3 pin socket. Maintain 230 V AC in the input side and measure current in the ammeter. Note down the wattage reading in the wattmeter. The wattmeter reading is the power consumed by the corresponding lamp. The multiplication of input voltage 230 V and current shown in ammeter gives the power.

For incandescent lamp the cosine angle between voltage and current is Zero. Hence power factor is unity. The multiplication of voltage and current will give direct power consumed by the lamp.

The LED bulb and CFL bulbs are little inductive in nature, and hence power and power factor are to be measured by using the formula,

$$P = V\,I\,\cos Ø.$$

Hence, $\cos Ø = P/VI$

Where,

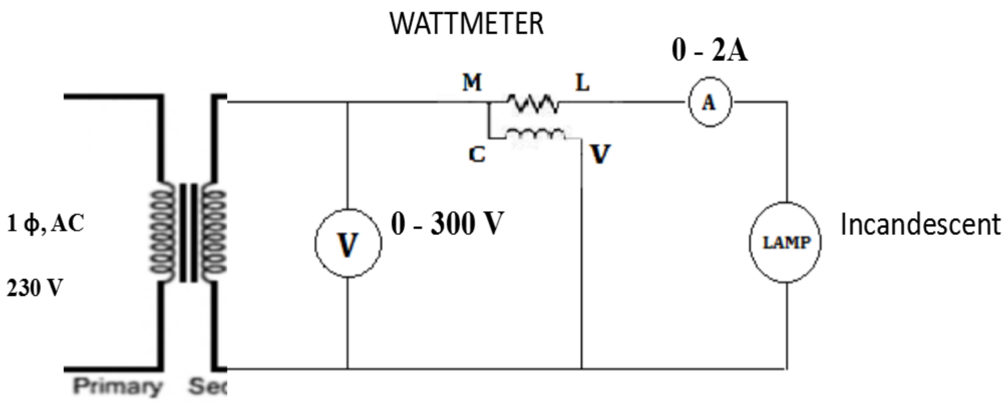
P is Power consumed by the lamp in watts (wattmeter reading),

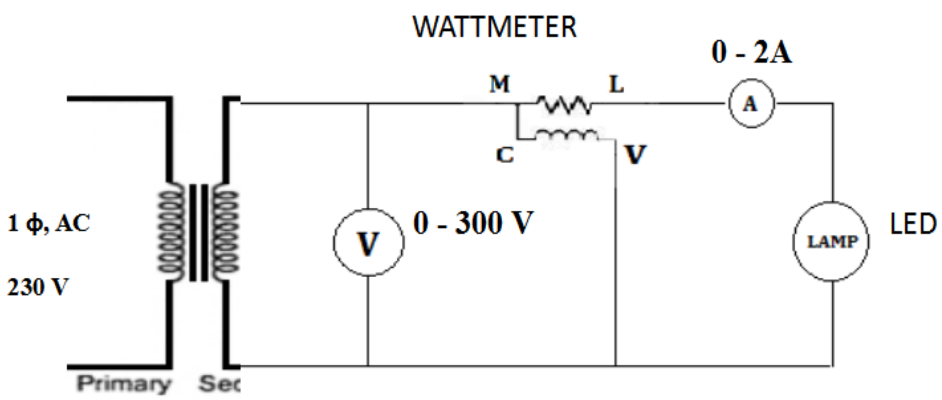
I is the current drawn by the lamp in amps (ammeter reading),

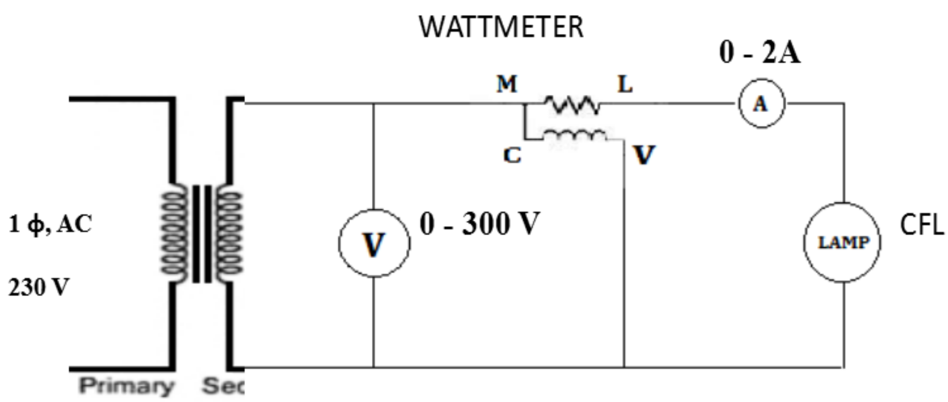
V is the voltage applied to the lamp in volts (voltmeter reading).

The power factor i.e. cosine angle Cos Ø can be achieved by calculating from the above formula.

CIRCUIT DIAGRAM:







PROCEDURE:

- Connect voltmeter across transformer secondary
- Connect ammeter in series with transformer secondary to lamp terminal (which is to be tested)
- Plug in the 3 pin power chord in to mains
- Connect the lamp which is to be tested across the secondary terminal
- Switch the corresponding lamp on / off switch
- Connect the wattmeter in series with the lamp circuit
- Switch on the rockery switch
- Note the readings of voltage, current and wattage
- Calculate the power factor

Repeat the same for all 3 lamps to be tested.

TABULATOR FORM:

SL.No	Lamp	V (volts)	I (Amps)	P (watts)	**Cos Ø = P / VI**
1	Incandescent lamp				
2	Fluorescent lamp				
3	LED lamp				

RESULT:

Measurement of the parameters of current, power and power factor of different types of bulbs like incandescent lamp, fluorescent lamp, and LED lamp using the kit is observed and achieved.

Experiment No-3

MEASURMENT OF PARAMETERS OF CHOKE COIL USING: 3-VOLTMETER METHOD

AIM: -**To Measure the parameters of a choke coil! Using 3-voltmeter method**

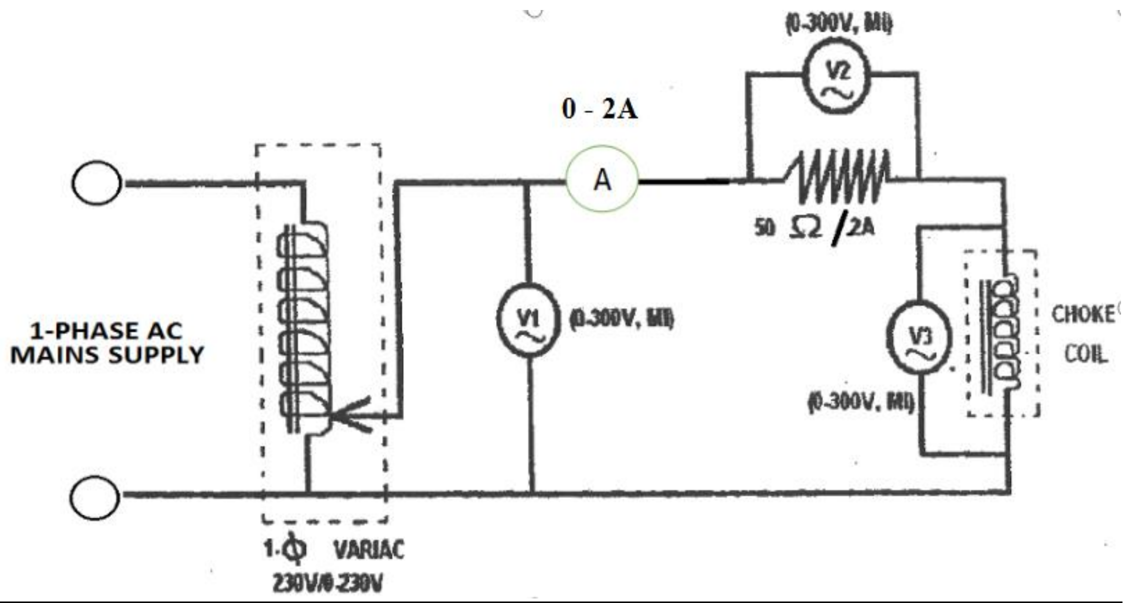
APPARATUS REQUIRED:-

S. No.	APPARATUS	RANGE	TYPE	QTY	REMARKS
1.	1-ph Variac, 2 A	230v/0- 270v	Continuously Variable	1	
2.	Rheostat	50 ohms/2A	Wire wound	1	
3.	Choke coil	----	—	1	
4.	Voltmeters	(0-300v)		3	
5.	Connecting wires				

THEORY:

Choke coil is highly inductive in nature, which is used in the applications where high voltage surge is needed for a short duration of time. It is generally used in the tube light circuit to give high voltage surge during starting and to maintain steady voltage during its operation.

CIRCUIT DIAGRAM;



PROCEDURE:-

- Connect the circuit as shown in figure.
- Switch ON the supply.
- Take the readings of 3-voltmeters at different supply voltages.
- Tabulate the readings and calculate the parameters of the choke coil.

TABULATOR FORM:

S.No	V, (volts)	V_2 (volts)	V_3 (volts)	Cos Φ	R_L(ohms)	X_L(ohms)	Z_L(ohms)	L (henry)

CALCULATIONS:-

$$V_1^2 = V_2^2 + V_3^2 + 2\, V_2\, V_3 \cos \Phi$$

$$\cos \Phi = (V_1^2 – V_2^2 – V_3^2) / (2\, V_2\, V_3)$$

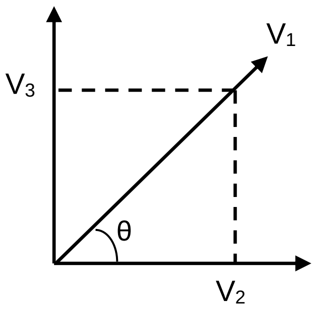
$$R_L = Z_L \cos \Phi$$

$$X_L = Z_L \sin \Phi$$

$$Z_L = V_3 / I \;\; \Omega$$

$$L = X_L / 2\, \pi f \;\; H$$

MODEL GRAPH:



PHASOR DIAGRAM

RESULT:- Thus the following choke parameters are measured by 3- voltmeter Method:

1) **The self inductance of choke coil = ________Henry**

II) **The internal resistance of the choke coil =_______ohms**

III) **Power factor of the choke coil = _________**

Experiment no-4

VOLTAGE AND CURRENT RELATIONSHIPS OF THREE PHASE STAR/ DELTA CIRCUITS

AIM:

To measure 3-ph. Star and delta voltages and currents by using 3-ph transformer and resistive loads.

EQUIPMENT REQUIRED:

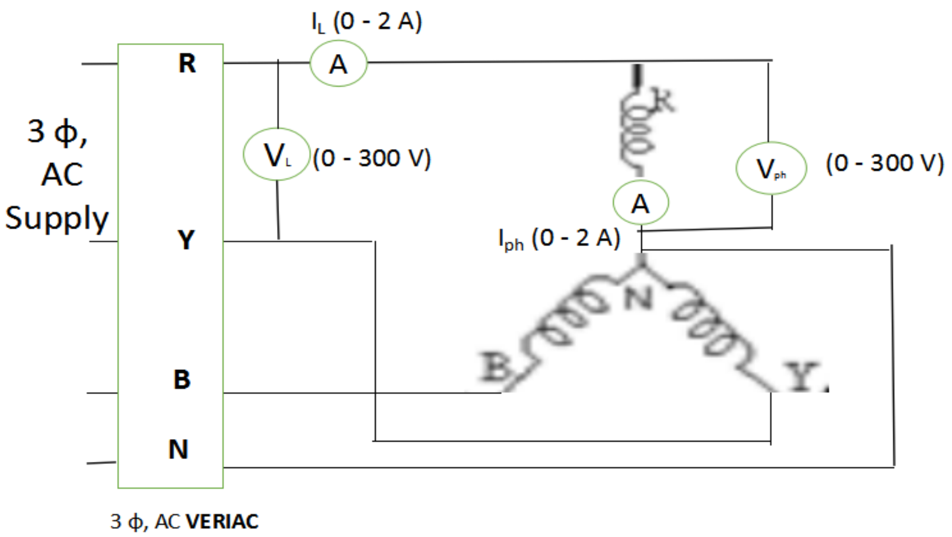
- 3-Phase transformer unit…..1 no
- AC Ammeters….3 no's.
- AC Voltmeters ….3no.
- Rheostats….3 no's.

INTRODUCTION:

The 3 phase transformer unit is so designed to observe the star/star, star/delta, delta/delta and delta/star configurations of 3-phase circuits. Any 3-phase circuits are to use one of the above configurations only. 415 V, 50 Hz, 3-phase supply is taken to the transformer as input and for the convenience and for most safety it is step downed to 50 V AC phase to phase. This 50 V AC phase to phase supply is taken as input to our 3-phase transformer to check the Voltage and Current relationships of three phase star/delta circuits. The voltmeter and ammeters are given to observe the relationship between voltage and current in star/delta circuits.

The fundamental principle of star connection is that voltages will divide by Γ3 times and current will remain same. In Delta configuration current will divide by Γ3 times and voltages will remain same.

CIRCUIT DIAGRAM OF STAR CONNECTION



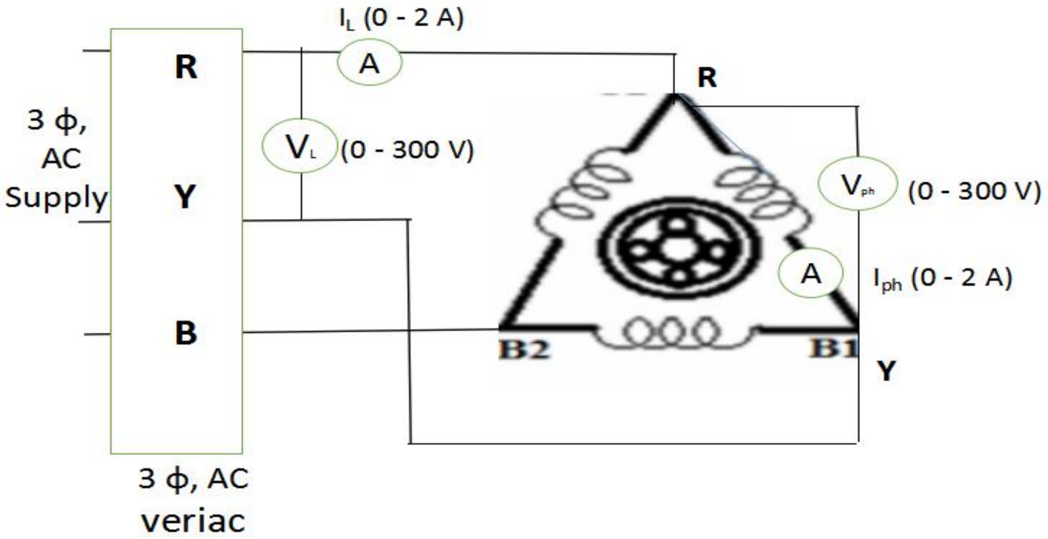
PROCEDURE:

- Connect the load with help of switches and patch chords.
- Connect the 3-phase unit
- Connect the voltmeter and ammeter to measure voltage and current
- Connect the circuit as shown in circuit star connections
- In star , $I_L= I_{ph}$ and $V_L=\Gamma 3V_{ph}$

TABULATOR FORM:

S.No	V_L (volts)	I_L (amps)	V_{ph} (volts)	I_{ph} (amps)	$V_L=\Gamma 3V_{ph}$(volts)

CIRCUIT DIAGRAM OF STAR CONNECTION



PROCEDURE:

- Connect the load with help of switches and patch chords.
- Connect the 3-ϕ unit
- Connect voltmeter and ammeter to measure Voltage and current.
- Connect the circuits as shown in circuit delta connections
- In delta connection,$V_L=V_{ph}$ and $I_L=\Gamma 3I_{ph}$

TABULATOR FORM:

S.No	V_L (volts)	I_L (amps)	V_{ph} (volts)	I_{ph} (amps)	$I_L=\Gamma 3 I_{ph}$(amps)

RESULT:

With the help of 3-phase transformer, the voltages and currents relationship in star / delta configurations can be observed and measured

Experiment no-5

MEASUREMENT OF POWER BY TWO WATTMETER METHOD

AIM:

3 phase, three wire power measurement by using two wattmeter **method for a balanced load in star connection**

APPARATUS REQUIRED:

WATT METERS UPF 600 V, 1/ 2 AMPS- 2No's

BALANCED RESISTIVE LOAD 3 phase, 3 A -1 No's

3- PHASE VARIAC 415V/ 470 V, 4A 1 No's

DIGITAL A.C VOLTMETERS 600V – 1 no

THEORY:

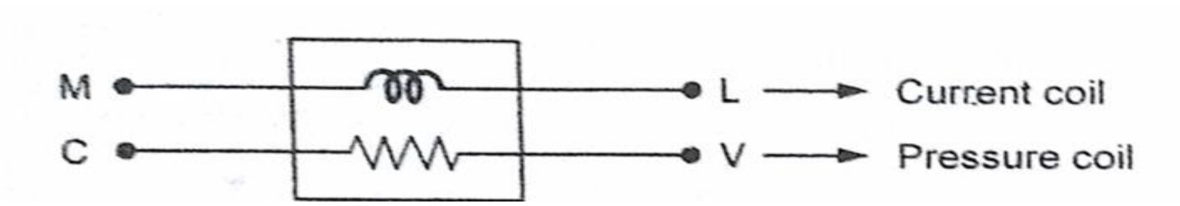
The method of connection of two wattmeters in two wattmeter method is:

- The current coils of the two wattmeters are connected in any two lines while the voltage coil of each wattmeter is connected between its own current coil terminal and the line without a current coil.

Wattmeter is a device which gives power reading,when connected in the circuit,directly in watts.

- It consists of two coils: i) Current coil ii) Pressure or Voltage coil.

The symbol of wattmeter is shown in the fig.



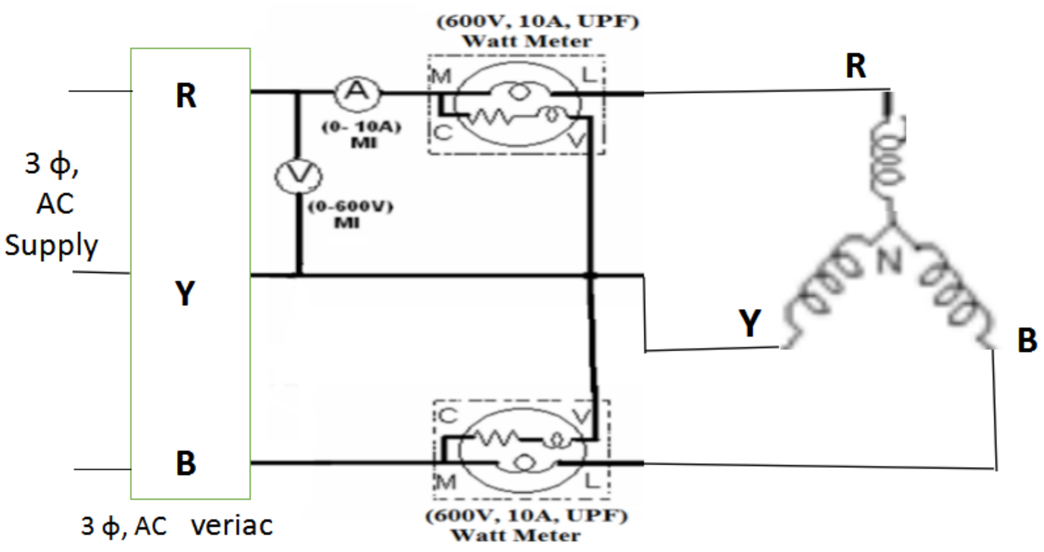
- If I_c is the current through its current coil(may be phase or line depends on its connection) and V_{pc} is voltage across its pressure coil(may be phase or line depends on its connection) then Wattmeter reading is

$$W = V_{pc} * I_c * \cos (I_c \wedge V_{pc}) \text{ watts}$$

Angle between V_{pc} and I_C is to be decided from the phasor diagram.

- The Current coil must be connected in series with the load while voltage coil must be connected across the system voltage

CIRCUIT DIAGRAM FOR STAR CONNECTED LOADS:



PROCEDURE:

- Connect the load with the help of switches and patch chords.
- Connect the 3-phase variac to the mains supply.
- Connect the voltmeter across 2 phases
- Connect the circuit as shown below either in star connection.

TABULATOR FORM:

SL.No	V_L (volts)	I_L (amps)	W_1(watts)	W_2(watts	P $=W_{1} + W_2$(watts)	P = Γ3 V_L I_{Lv} Cos Φ (watts)

RESULT:

Hence the power measured for a balanced load connected in star is the sum of both watt meters.

Experiment no-6

TWO-WAY and THREE-WAY SWITCH

AIM: To study the usage of two-way & three-way switch operation in electrical circuit (or) wiring.

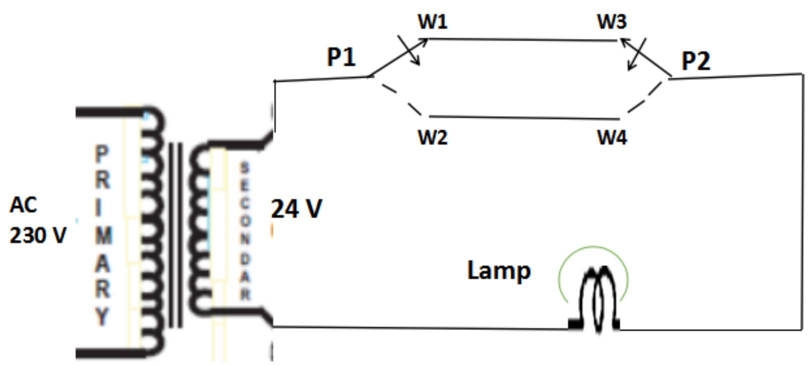
APPARATUS REQUIRED: 2-way study kit-1 No

3-way study kit-1 No

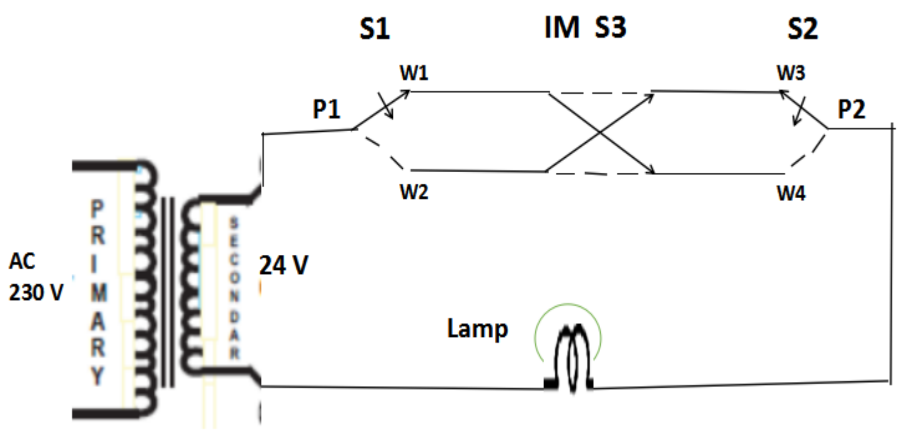
INTRODUCTION:

Two-way control is usually used for staircase lighting as it is commonly used for stair cases and corridor lighting. It consists of two way switches. A two way switch operated always in one of the two possible positions. Three-way switch is also a type of staircase wiring. It consists of two way switches A and B and one intermediate switch C which can control one lamp from three different places.

CIRCUIT DIAGRAM:



Circuit diagram of two-way switch



Circuit diagram of three-way switch

Truth table of Two-way switch:

S_1	S_2	LAMP
W_1	W_3	ON
W_1	W_4	OFF
W_2	W_3	OFF
W_2	W_4	ON

Truth table of Three-way switch:

Sl.No	Intermediate switch position	TWS_1	TWS_2	State of Lamp
1	Straight connection	W_1	W_3	ON
2		W_1	W_4	OFF
3		W_2	W_3	OFF
4		W_2	W_4	ON
5	Cross Connection	W_1	W_3	OFF
6		W_1	W_4	ON
7		W_2	W_3	ON
8		W_2	W_4	OFF

RESULT: The truth table of one lamp is controlled from two different places in two-way switch and three different places is verified.

Experiment no-7

STUDY OF EFFECT OF OPEN AND SHORT CIRCUIT IN SIMPLE AC CIRCUIT

AIM:

To study the effect of an open and short circuit in a simple AC circuit using a step down isolation transformer.

EQUIPMENT REQUIRED:

- Simple open and short circuit study kit built-in volt and ammeters ……………..01
- 1-phase, 230 V, AC, 230 V / 270 V, 2A variac……………01

INTRODUCTION:

In any circuit, there will be Open circuit condition, and Full or partial Load conditions. Sometimes due to short in the load or in the path of the circuit, short circuit may occur. In open circuit conditions, even if the load is not connected to the circuit, still there may be some currents will flow and which causes some losses in the circuit. This happens to maintain the circuit in hot condition. These are called no load losses due to impedance of the elements in the circuit. In short circuit condition, there may be a short in the elements of the circuit or may be a short in the circuit path, which causes the damage to the particular element or to entire circuit or to mains. Hence the particular short to be removed to protect the circuit and its elements. Due to short in the circuit, heavy currents may flow in the circuit and it causes the damage.

In general, the effect in open circuit is no load energy losses, which shall be optimum. Otherwise power losses will increase the power bill. The effect of short circuit is it will damage the particular element or entire circuit.

To study the effect in open and short circuit in a simple circuit, we have designed a small kit consisting of a step down transformer, since it is dangerous to short the direct 230 v to observe short circuit effect. Hence to simulate, we have designed the circuit on a simple 24 V supply. In open circuit, the no load current, voltage and power of the circuit can be measured by keeping the circuit in open condition.

In open circuit, keep the load terminals, i.e. 24 V terminals of transformer (secondary) in open condition. Observe the no load current and voltage.

In short circuit, we can`t directly short the output terminals, since it is dangerous to the equipment due to heavy current passes through circuit. It may cause circuit to burn, if proper protection is not taken. Hence by giving a small input voltage through a variac, we can observe the short circuit condition.

By using the following formula we can calculate the no load losses and short circuit losses.

$$P = V\ I\ \cos Ø$$

Where

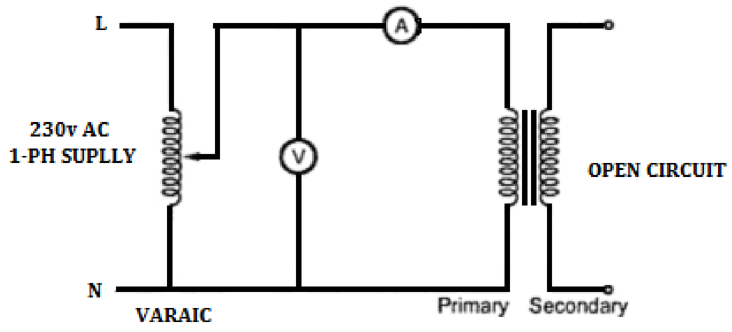
P is power consumed by the circuit
V is the open circuit voltage
I is the No load current
Cos Ø is the phase angle between voltage and current.
Since Resisitive load is used.Cos Ø is 1

Therefore
P = VI.
This is the no load losses.

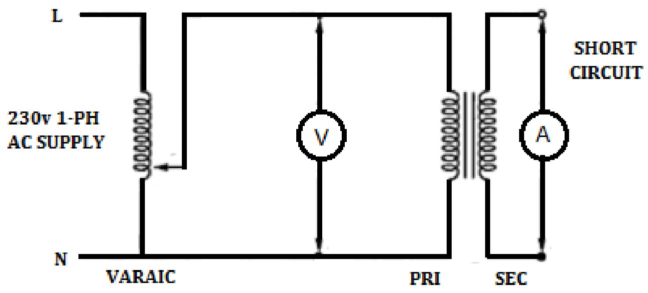
In short circuit, across output ammeter is only connected and which will have negligible impedance. Hence for resistive loads phase angle is zero
Therefore
P = VI
This gives us the short circuit losses in the circuit.

CIRCUIT DIAGRAM:

OPEN CIRCUIT DIAGRAM:



SHORT CIRCUIT DIAGRAM:



Precaution: In any case output shall not be short circuited by keeping the variac in higher position. It shall be kept zero and slowly to be increased till rated current is reached. Otherwise circuit will burn.

PROCEDURE:

To Study Open circuit:

- **Connect the auto transformer at input terminals of the kit. (primary of the transformer)**
- **Keep the variac in zero position**
- **Keep the rockery switch in off condition**
- **Keep the output terminals in open condition**
- **Connect the ammeter in series and voltmeter across the primary**
- **Connect the variac power chord to mains and switch on the mains**
- **Slowly increase the output of variac till 230 v is achieved**
- **Measure the ammeter and voltmeter reading**
- **Bring back the variac to zero and switch off the mains.**

To Study the short circuit:

- **Connect the auto transformer at input terminals of the kit. (primary of the transformer)**
- **Keep the variac in zero position**
- **Keep the rockery switch in off condition**
- **Keep the output terminals in short condition with the help of patch chord.**
- **Connect the ammeter in series across the output terminals i.e. across 24 V**
- **Connect the voltmeter across the primary**
- **Connect the variac power chord to mains and switch on the mains**
- **Slowly increase the output of variac till rated current, in this case 2 Amps is achieved**
- **Measure the voltmeter reading**

Bring back the variac to zero and switch off the mains

TABULAR DIAGRAM FOR OPEN CIRCUIT :

SL.NO	VOLTAGE(V)	CURRENT(I)	POWER(W)

TABULAR DIAGRAM FOR SHORT CIRCUIT:

SL.NO	VOLTAGE(V)	CURRENT(I)	POWER(W)

RESULT:

Power in open circuit =
Power in short circuit =

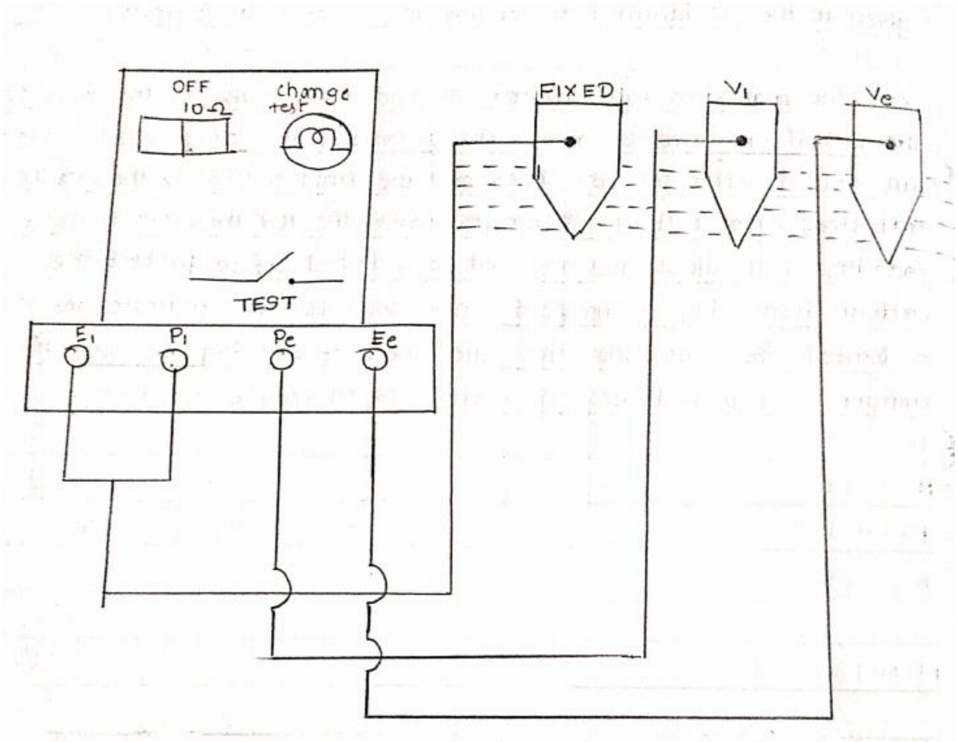
Experiment no-8

MEASUREMENT OF EARTH RESISTANCE

AIM: TO MEASURE THE EARTH RESISTIVITY

APPARATUS: EARTH TESTER-1 no
SPIKES-3 no
RODS, CONNECTING WIRES

CIRCUIT DIAGRAM:



THEORY:

Measurement of Earth Resistance: The provision of an electrode for an electrical system is necessitated by the following reasons:
1.All the parts of electrical equipment like casings of machines,switches and circuit breakers,tanks of transformers etc which have to be at earth potential must be connected to an earth electrode.the purpose of this is to protect the various parts of the installation, as well as the persons working against damage in case the insulation of a system fails at any point.By connecting these parts to an earthed electrode a continuous low resistance path is available for leakage currents to flow to earth .the current operates the protective devices and thus the faulty circuit is isolated in case a fault occurs.

2.The earth electrode ensures that in the event of overvoltage on the system due to lighting discharges or other system faults,those parts of equipment which are normally dead as far as voltages are concerned do not attain dangerously high potentials

3.In a three phase circuit the neutral of the system is earthed in order to stabilize the potential of the circuit with respect to earth.

An earth electrode will only be effective so long it has a low resistance to the earthy and can carry large currents without deteriorating. Since the amount of current which an earth electrode will carry is difficult to measure.the resistance value of the earth electrode is taken as sufficiently reliable indication of its effectiveness.the resistance of earth electrode should be low to give good protection and it must be measured.

The main factors on which the resistance of any earthing system depends are:
1.shape and material of earth electrode or electrodes used.
2.Depth in the soil at which the electrodes are burried.
3.Specific resistance of soil surrounding and in the neighbourhood of electrodes.the specific resistance of the soil is not constant but varies from one type of soil to another.the amount of moisture present in the soil effects its specific resistance and hence the resistance of earth electrode is not a constant factor but suffers seasonal variations.

The specific resistance of soils varies between wide limits and is very much dependent upon its moisture content.Approximate figures for specific resisttance of soil are 80 X $10^3\Omega$m for moist clay to 80 X $10^6\Omega$m for sand of normal moisture content. A decrease of moisture content of 30% is capable of producing an increase of 300 to 400% in specific resistance.thus it is necessary to make regular checks for earth resistance during the year round.

PROCEDURE:

- Put the two spikes acting as current and potential electrode in to the ground at a distance of 25m and 12.5m from earth electrode under test.
- Connect the two spikes to E2 and P2 terminals respectively.
- Short the P1 and E1 terminals of motor and connect it to the earth electrode under test.
- Place the megger on horizontal firm stud.
- Take down the 3 to 4 readings by keeping the distance same and placing the electrodes at the other positions.
- Take the average of these readings which is equal to earth resistance
- $\varsigma = 2\pi LR$

Tabular column:

Condition of soil	L=Length	R=Resistance	$\varsigma = 2\pi LR$
DRY			
WET			
SALTY			

RESULT: **The earth resistance of a soil with different conditions is measured experimentally.**

DEMO EXPERIMENTS

1. DEMONSTRATION OF FUSE, MCB BY CREATING A FAULT

AIM:

To observe the characteristics of Fuse and MCB like short circuit and over load functions by creating a fault in the circuit.

EQUIPMENT REQUIRED:

- Fuse and MCB demonstration kit-1no's
- Rheostat 3 ohms/ 8A.
- 200V AC digital voltmeter
- 10A AC digital ammeter

SPECIFICATION:

- Over load protection by using fuse, 5 amps
- Short circuit protection of MCB
- Over load protection of MCB for more than 6 amps

THEORY:

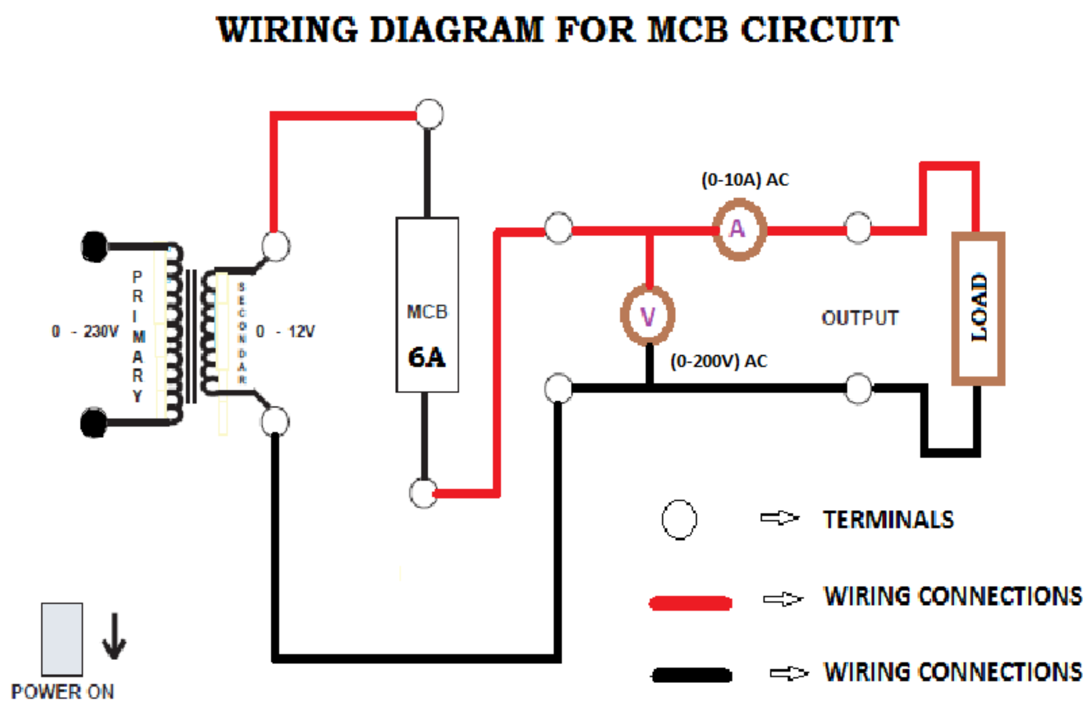
1) **MCB (Miniature Circuit Breaker is called as MCB** is an electromechanical device which protect an electric circuit from an over current. The over current, in an electrical circuit, may result from *short circuit, overload or faulty design*. An MCB is a better alternative to a Fuse since it does not require replacement once an overload is detected. Unlike fuse, an MCB can be easily operated and thus offers improved operational safety and greater convenience without incurring large operating cost.

Miniature Circuit Breakers are used to protect lower current circuits and have the following Specifications:

- Current rating – Amperes
- Short Circuit Rating - Kilo Amperes (kA)
- Operating Characteristics - B, C or D Curves

Miniature Circuit Breakers are usually available in the range of 0.5A to 100A.
An **MCB's** Short circuit rating is given in Kilo amps (kA), and this indicates the level of its ability to work. For example a domestic **MCB** would normally have a 6kA fault level, whereas one used in an industrial application may need a unit with a 10kA fault capability. MCB's are protective devices that are made to break the circuit in case of overload or Short circuit. For Overload protection they have Bi-metallic strip which causes the circuit to open. For short circuit it is Electromagnetic kind of thing.

WIRING DIAGRAM:



2.FUSE:

Fuses have a specific electric resistance value. When exposed to current, their temperature will rise depending on the load. Fuses with connection terminals made out of heat-resistant copper alloy are able to withstand a temperature of up to 140°C. If we assume a temperature of 80°C inside the engine compartment, this means the fuses can support a temperature increase of 60°C.

Time-current Characteristics of Fuses
Time-current characteristics are the most important specifications of fuses.

Fuses are designed to only withstand continuous current that is equivalent to their rated current. When the current flowing through a fuse exceeds the rated current, the fuse must cut off the current within a predetermined time interval, thus ensuring the current flow is interrupted.

For this reason, the melting time of a fuse when exposed to over current is specified by international and national standards for each type of fuse.

Time-current standard values specify an upper threshold for the melting time to prevent an over current from flowing continuously and resulting in fire or damage to connected electrical wiring and electric devices. This is the ultimate purpose of a fuse. At the same time, a lower threshold is specified to ensure the current is not interrupted during the initial rush at the start of the current flow, and thus ensure durability.

Time-current characteristics differ by fuse type. For example, motor circuits employ slow blow fuses (SBF) that feature a slow-blow mechanism to withstand the comparatively long current rush that is produced when a motor starts operating. It is common practice to use SBFs for circuits using motors of automatic wipers and power windows, and BFs for applications such as lamps.

The metal element inside a fuse is designed to melt through Joule heat produced by overcurrent, thus interrupting the current flow in the circuit. Because the Joule heat (I2Rt) required to melt the metal element differs based on the ambient temperature, the time at which the metal element in the fuse will reach its melting point will also vary. In other words, the actual capacity of a fuse will vary based on the ambient temperature.

UNIT DESCRIPTION:

The Fuse and MCB kit is so designed to observe the characteristics of Fuse and MCB during over load and short circuit conditions. In general the Fuse will have over load protection depending upon the time duration, how much time the over load is persisting. This depends basically on dI/dT rating of the fuse is used. This implies that the current rated is with respect to the time constant. The rate of change of current depends on the rate of change of time.

In general any MCB will be designed to protect the circuit from any short circuits and over loading. In our demonstration kit, we have used a 2 amps single pole MCB, and we can observe the over loading effect and short circuit protection by creating a fault in the circuit.

To demonstrate the MCB and Fuse characteristics, we have designed a low voltage and low power unit, since it is very dangerous in doing with high voltages and high power. We have used a small isolation transformer with 2 amps current and will be safe while performing over load and short circuit tests to check the Fuse and MCB. Similarly a 5 amps Fuse is also used in the kit to perform over load and short circuit tests in the kit.

RESULT: The MCB Switch tripps off when it exceeds the rating mentioned

2. DEMONSTRATION OF CUT-OUT SECTION OF ELECTRICAL MACHINES

2a) CUT SECTION OF DC SHUNT MOTOR:

Aim:

To check for working principle and viewing of cut section D.C shunt motor

Apparatus:

- D.C drive 0.5 HP, 220 V
- 0.5 HP D.C cut section motor

Specification:

- 220 VD.C shunt motor, 1500 RPM, 0.5 HP
- 220 V DC, 0.5 HP, 2 amps D.C drive

Description:

A **D.C motor** is of a class of any rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of D.C motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor.

D.C motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A D.C motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small D.C motors are used in tools, toys, and appliances. Larger D.C motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of D.C motors with A.C motors possible in many applications.

A coil of wire with a current running through it generates an electromagnetic field aligned with the center of the coil. The direction and magnitude of the magnetic field produced by the coil can be changed with the direction and magnitude of the current flowing through it.

A simple D.C motor has a stationary set of magnets in the stator and an armature with one or more windings of insulated wire wrapped around a soft iron core that concentrates the magnetic field. The windings usually have multiple turns around the core, and in large motors there can be several parallel current paths. The ends of the wire winding are connected to a commutator. The commutator allows each armature coil to be energized in turn and connects the rotating coils with the external power supply through brushes.

If external mechanical power is applied to a D.C motor it acts as a D.C generator, a dynamo. This feature is used to slow down and recharge batteries on hybrid cars and electric cars or to return electricity back to the electric grid used on a street car or electric powered train line when they slow down. This process is called regenerative braking on hybrid and electric cars. In diesel electric locomotives they also use their D.C motors as generators to slow down but dissipate the energy in resistor stacks. Newer designs are adding large battery packs to recapture some of this energy.

There are three types of electrical connections between the stator and rotor possible for D.C electric motors: series, shunt/parallel and compound (various blends of series and shunt/parallel) and each has unique speed/torque characteristics appropriate for different loading torque profiles/signatures.

Shunt connection:

In our experiment, we have used a D.C shunt motor.

A shunt D.C motor connects the armature and field windings in parallel or shunt with a common D.C. power source. This type of motor has good speed regulation even as the load varies, but does not have the starting torque of a series D.C motor.[4] It is typically used for industrial, adjustable speed applications, such as machine tools, winding/unwinding machines and tensioners.

Brushed DC electric motor

A brushed D.C electric motor generates torque from D.C power supply by using an internal mechanical commutation. Stationary permanent magnets form the stator field. Torque is produced by the principle that any current-carrying conductor placed within an external magnetic field experiences a force, known as Lorentz force. In a motor, the magnitude of this Lorentz force (a vector represented by the green arrow), and thus the output torque, is a function for rotor angle, leading to a phenomenon known as torque ripple) Since this is a two-pole motor, the commutator consists of a split ring, so that the current reverses each half turn (180 degrees).

The brushed D.C electric motor generates torque directly from D.C power supplied to the motor by using internal commutation, stationary magnets (permanent or electromagnets), and rotating electromagnets.

Advantages of a brushed D.C motor include low initial cost, high reliability, and simple control of motor speed. Disadvantages are high maintenance and low life-span for high intensity uses. Maintenance involves regularly replacing the carbon brushes and springs which carry the electric current, as well as cleaning or replacing the commutator. These components are necessary for transferring electrical power from outside the motor to the spinning wire windings of the rotor inside the motor.

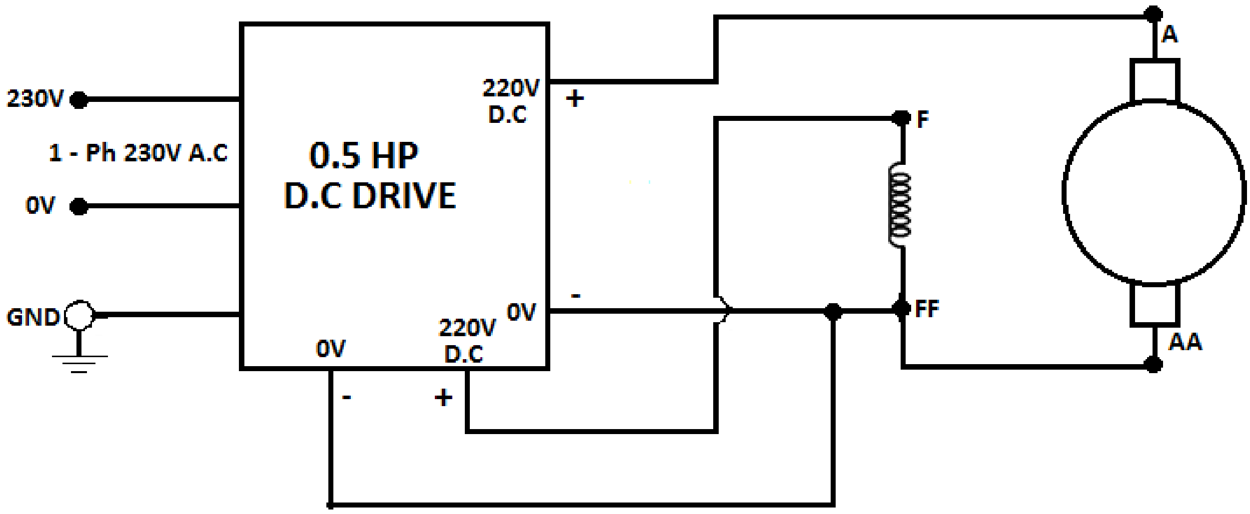
Brushes are usually made of graphite or carbon, sometimes with added dispersed copper to improve conductivity. In use, the soft brush material wears to fit the diameter of the commutator, and continues to wear. A brush holder has a spring to maintain pressure on the brush as it shortens. For brushes intended to carry more than an ampere or two, a flying lead will be molded into the brush and connected to the motor terminals. Very small brushes may rely on sliding contact with a metal brush holder to carry current into the brush, or may rely on a contact spring pressing on the end of the brush. The brushes in very small, short-lived motors, such as are used in toys, may be made of a folded strip of metal that contacts the commutator.

Procedure:

- Keep the on /off toggle switch in D.C drive unit in off position.
- Connect F and FF terminals of Drive unit to Motor F and FF terminals
- Connect A and AA terminals of Drive unit to Motor A and AA terminals
- Connect output terminals and A- AA terminals of D.C drive unit with patch chords
- Plug in 3 pin power chord in to 3 pin A.C supply.
- Keep potentiometer in 0 position
- Switch on the toggle switch
- Slowly increase the potentiometer till it reads 220 V D.C in voltmeter and motor starts rotating.

Wiring Diagram:

WIRING DIAGRAM OF D.C SHUNT MOTOR



Result:

The motor working principle is observed and viewed the different parts of motor through cut section.

2b. CUT SECTION OF 1 – PHASE & 3 – PHASE A.C MOTOR

CUT SECTION OF 1 – PHASE A.C MOTOR:

Aim:

To check for working principle and viewing of cut section of 1 – Phase A.C motor.

Apparatus:

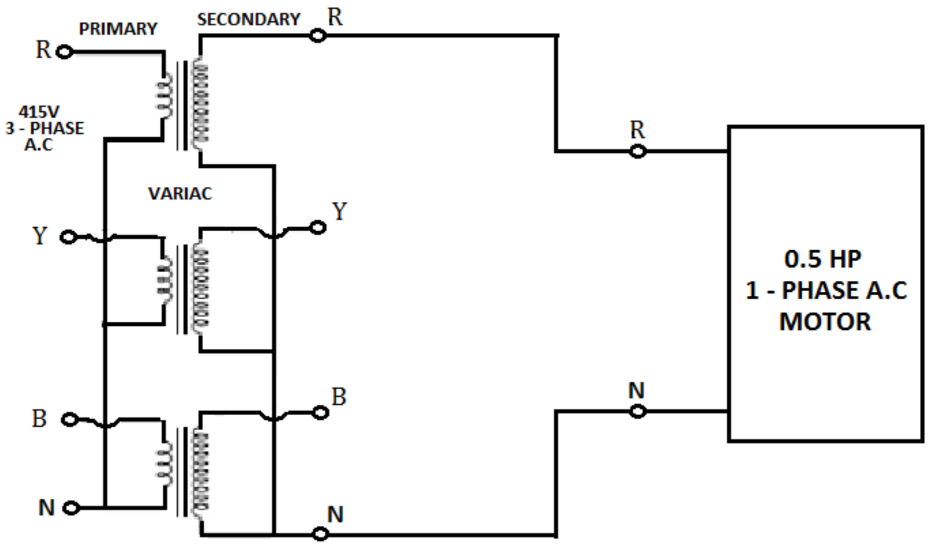
- 1 – Ph A.C, 230 V, 0.5 HP Motor, 1440 RPM
- 415 V AC, 3 Amps, 3-phase Auto transformer. (One phase and Neutral to be Used from 3-phase Variac)

Specification:

- 230 V A.C motor, 1440 RPM, 1-phase, 0.5 HP
- 415 V AC, 3-phase Auto transformer. (One phase and Neutral to be Used from 3-phase Variac)

Wiring Diagram:

1 - PHASE A.C MOTOR WIRING DIAGRAM



Procedure:

- Keep the variac knob in Zero position
- Connect one phase and Neutral from 3-phase variac output to the motor with the help of connecting wires
- Connect 3-phase variac input including with Neutral to the mains with the help of connecting wires.
- Slowly vary the voltage of 3-phase variac till it reaches up to 415 V AC.

- Motor starts running.
- Slowly decrease the voltage of 3-phase variac and bring back to Zero.
- Observe all the parts of AC motor through cut section view.

Result:

The motor working principle is observed and viewed the different parts of motor through cut section.

2 c).CUT SECTION OF 3 – PHASE A.C MOTOR:

Aim:

To check for working principle and viewing of cut section of 3 – Phase A.C motor.

Apparatus:

- 3 – Ph A.C, 415 V, 0.5 HP Motor, 1440 RPM
- 415 V AC, 3 Amps, 3-phase Auto transformer.

Specification:

- 415 V A.C motor, 1440 RPM, 3-phase, 0.5 HP
- 415 V AC, 3 Amps, 3-phase Auto transformer.

Description:

Basic **working principle** of an **Induction Motor**: (for both 1-phase and 3-phase):

In a DC **motor**, supply is needed to be given for the stator winding as well as the rotor winding. But in an **induction motor** only the stator winding is fed with an **AC** supply. Alternating flux is produced around the stator winding due to **AC** supply. The magnetic field comes from the stator, which is a permanent magnet, while you feed the **electric** power to the coil that makes up the rotor. The interaction between the permanent magnetic field of the stator and the temporary magnetic field produced by the rotor is what makes the **motor** to rotate.

The two main types of AC motors are induction motors and synchronous motors. The induction motor (or asynchronous motor) always relies on a small difference in speed between the stator rotating magnetic **field** and the rotor shaft speed called slip to induce rotor current in the rotor AC winding.

Induction Motors are the most commonly used motors in many applications. These are also called as **Asynchronous Motors**, because an **induction motor** always runs at a speed lower than synchronous speed. Synchronous speed means the speed of the rotating magnetic field in the stator.

There are basically 2 **types of induction motor** depending upon the type of input supply - (i) Single phase induction motor and (ii) Three phase induction motor or they can be divided according to type of rotor - (i) Squirrel cage motor and (ii) Slip ring motor or wound type.

- Alternating flux is produced around the stator winding due to AC supply. This alternating flux revolves with synchronous speed. The revolving flux is called as "Rotating Magnetic Field" (RMF).
- The relative speed between stator RMF and rotor conductors causes an induced E.M.F in the rotor conductors, according to the Faraday's law of electromagnetic induction. The rotor conductors are short circuited, and hence rotor current is produced due to induced E.M.F. That is why such motors are called as **induction motors**.
  (This action is same as that occurs in transformers, hence induction motors can be called as **rotating transformers**.)
- Now, induced current in rotor will also produce alternating flux around it. This rotor flux lags behind the stator flux. The direction of induced rotor current, according to Lenz's law, is such that it will tend to oppose the cause of its production.
- As the cause of production of rotor current is the relative velocity between rotating stator flux and the rotor, the rotor will try to catch up with the stator RMF. Thus the rotor rotates in the same direction as that of stator flux to minimize the relative velocity. However, the rotor never succeeds in catching up the synchronous speed. This is the **basic working principle of induction motor** of either type, single phase of 3 phase.

Synchronous Speed:

The rotational speed of the rotating magnetic field is called as synchronous speed.

$$Ns = \frac{120 \times f}{P} \quad \text{(RPM)}$$

Where,
Ns = Synchronous speed of Motor.
f = Frequency of the supply
P = Number of poles.

Slip:

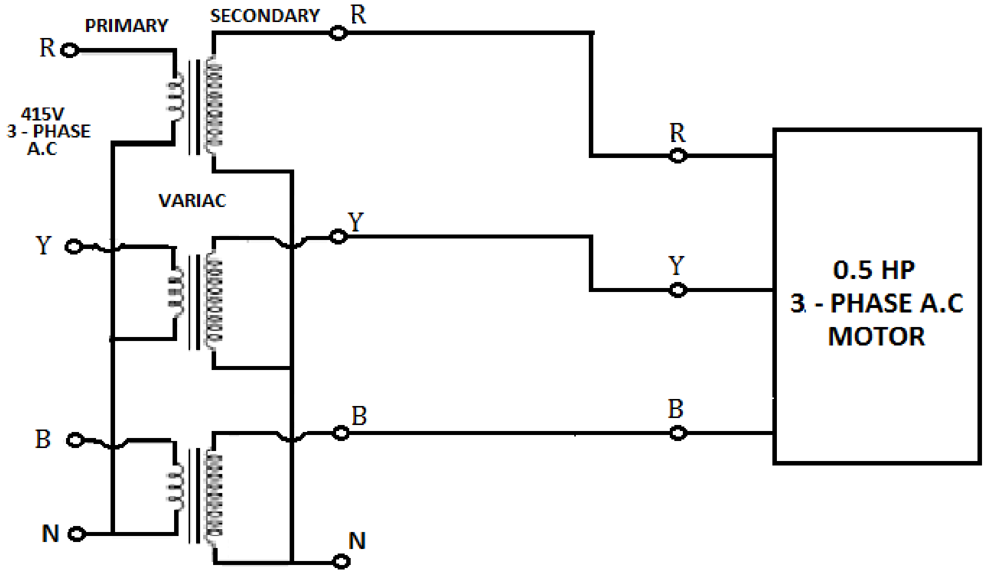
Rotor tries to catch up the synchronous speed of the stator field, and hence it rotates. But in practice, rotor never succeeds in catching up. If rotor catches up the stator speed, there wont be any relative speed between the stator flux and the rotor, hence no induced rotor current and no torque production to maintain the rotation. However, this won't stop the motor, the rotor will slow down due to lots of torque, the torque will again be exerted due to relative speed. That is why the rotor rotates at speed which is always less the synchronous speed.

3The difference between the synchronous speed (N_s) and actual speed (N) of the rotor is called as slip.

$$\% \text{ slip } \quad s = \frac{Ns - N}{Ns} \times 100$$

Wiring Diagram:

3 - PHASE A.C MOTOR WIRING DIAGRAM



Procedure:

- Keep the variac knob in Zero position
- Connect 3-phase variac output to the motor with the help of connecting wires
- Connect 3-phase variac input including with Neutral to the mains with the help of connecting wires.
- Slowly vary the voltage of 3-phase variac till it reaches up to 415 V AC.
- Motor starts running.
- Slowly decrease the voltage of 3-phase variac and bring back to Zero.
- Observe all the parts of AC motor through cut section view.

Result:

The motor working principle is observed and viewed the different parts of motor through cut section.

2 d)CUT SECTION OF SYNCHRONOUS MOTOR:

Aim:

To check the working principle and viewing of cut section of Synchronous motor.

Apparatus:

- 1 HP, 3-phase, 415 V AC synchronous cut section motor
- 3-phase, 3 amps, 415 V AC Auto Transformer

Specification:

- 1 HP, 3-phase, 415 V AC synchronous cut section motor

3-phase, 3 amps, 415 V AC Auto Transformer

Description:

Synchronous Motors:

This motor is called so because the speed of the rotor of this motor is same as the rotating magnetic field. It is basically a fixed speed motor because it has only one speed, which is synchronous speed and therefore no intermediate speed is there or in other words it's in synchronism with the supply frequency. Synchronous speed is given by

$$N_s = \frac{120 \times f}{P} \quad \text{(RPM)}$$

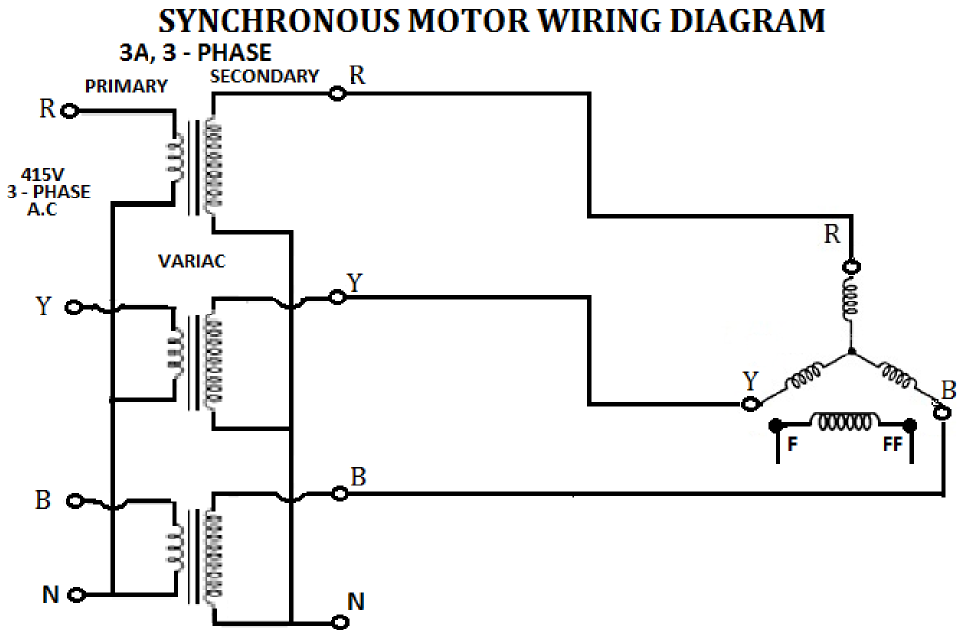
Where,
Ns = Synchronous speed of Motor.
f = Frequency of the supply
P = Number of poles.

Application:

1. Synchronous motor having no load connected to its shaft is used for power factor improvement. Owing to its characteristics to behave at any electrical power factor, it is used in power system in situations where static capacitors are expensive.
2. Synchronous motor finds application where operating speed is less (around 500 rpm) and high power is required. For power requirement from 35 kW to 2500 KW, the size, weight and cost of the corresponding three phase induction motor is very high. Hence these motors are preferably used. Ex- Reciprocating pump, compressor, rolling mills etc

.

Wiring Diagram:



Procedure:

- Keep the variac knob in Zero position
- Connect 3-phase variac output to the motor with the help of connecting wires
- Connect 3-phase variac input including with Neutral to the mains with the help of connecting wires.
- Slowly vary the voltage of 3-phase variac till it reaches up to 415 V AC.
- Motor starts running.
- Slowly decrease the voltage of 3-phase variac and bring back to Zero.
- Observe all the parts of AC motor through cut section view.

Result:

The motor working principle is observed and viewed the different parts of motor through cut section

3. UNDERSTANDING AC AND DC SUPPLY USE OF TESTER AND TEST LAMP TO ASCERTAIN THE HEALTHY STATUS OF MAINS

OBJECTIVE:

To test and understand the healthy status of AC and DC circuits by using tester and test lamp.

EQUIPMENT REQUIRED:

- AC and DC testing kit with built-in volt and ammeter.
- Tester and Test lamp
- High wattage resistor (15 ohms/10 watt) to simulate fault.

SPECIFICATION:

- 230 V AC, 1-phase, 50 Hz/24V AC, 2 amps AC and DC experimental Kit
- Tester for mains (24V)
- Test Lamp 24V to test Healthy status of AC & DC
- 200 V AC & DC digital voltmeter with selector switch
- 2 amps AC & DC digital ammeter with selector switch
- 4.7 K, 5 watt Wire wound resistor to create fault / leakage.

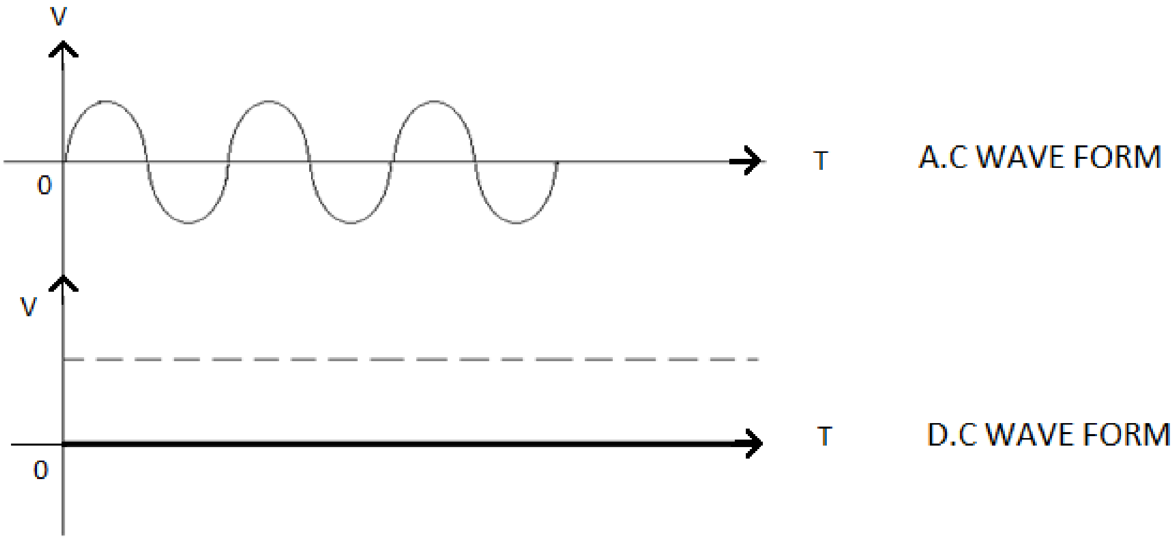
INTRODUCTION:

Direct Current (D.C.): It is a form of electrical current or voltage that flows around an electrical circuit in one direction only, making it a "Uni-directional" supply.

Generally, both DC currents and voltages are produced by power supplies, batteries, dynamos and solar cells to name a few. A DC voltage or current has a fixed magnitude (amplitude) and a definite direction associated with it. For example, +24V represents 24 volts in the positive direction, or -24V represents in the negative direction.

We also know that DC power supplies do not change their value with regards to time; they are a constant value flowing in a continuous steady state direction. In other words, DC maintains the same value for all times and a constant uni-directional DC supply never changes or becomes negative unless its connections are physically reversed.

DC CIRCUIT AND WAVEFORM:

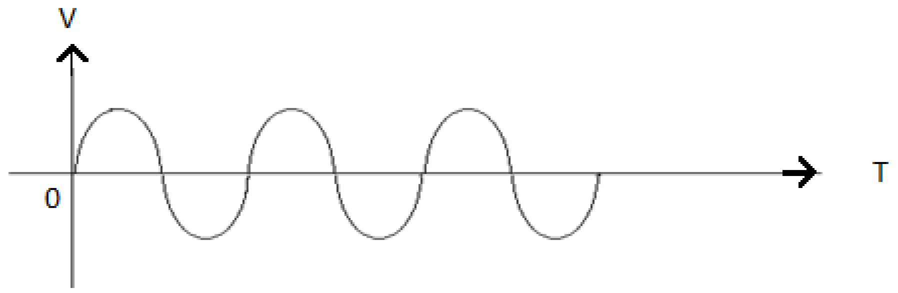


An alternating function or **AC Waveform** on the other hand is defined as one that varies in both magnitude and direction in more or less an even manner with respect to time making it a "Bi-directional" waveform. An AC function can represent either a power source or a signal source with the shape of an *AC waveform*.

The term AC or to give it, its full description of Alternating Current, generally refers to a time-varying waveform with the most common of all being called a **Sinusoid** better known as a **Sinusoidal Waveform**. Sinusoidal waveforms are more generally called by their short description as **Sine Waves**. Sine waves are by far one of the most important types of AC waveform used in electrical engineering.

The shape obtained by plotting the instantaneous ordinate values of either voltage or current against time is called an **AC Waveform**. An AC waveform is constantly changing its polarity every half cycle alternating between a positive maximum value and a negative maximum value respectively with regards to time with a common example of this being the domestic mains voltage supply we use in our homes.

AC CIRCUIT WAVEFORM:



Alternating voltages and currents can`t be stored in batteries or cells like direct current (DC) can, it is much easier and cheaper to generate these quantities using alternators or waveform generators when they are needed. The type and shape of an AC waveform depends upon the generator or device producing them, but all AC waveforms consist of a zero voltage line that divides the waveform into two symmetrical halves. The main characteristics of an **AC Waveform** are defined as:

AC WAVEFORM CHARACTERISTICS

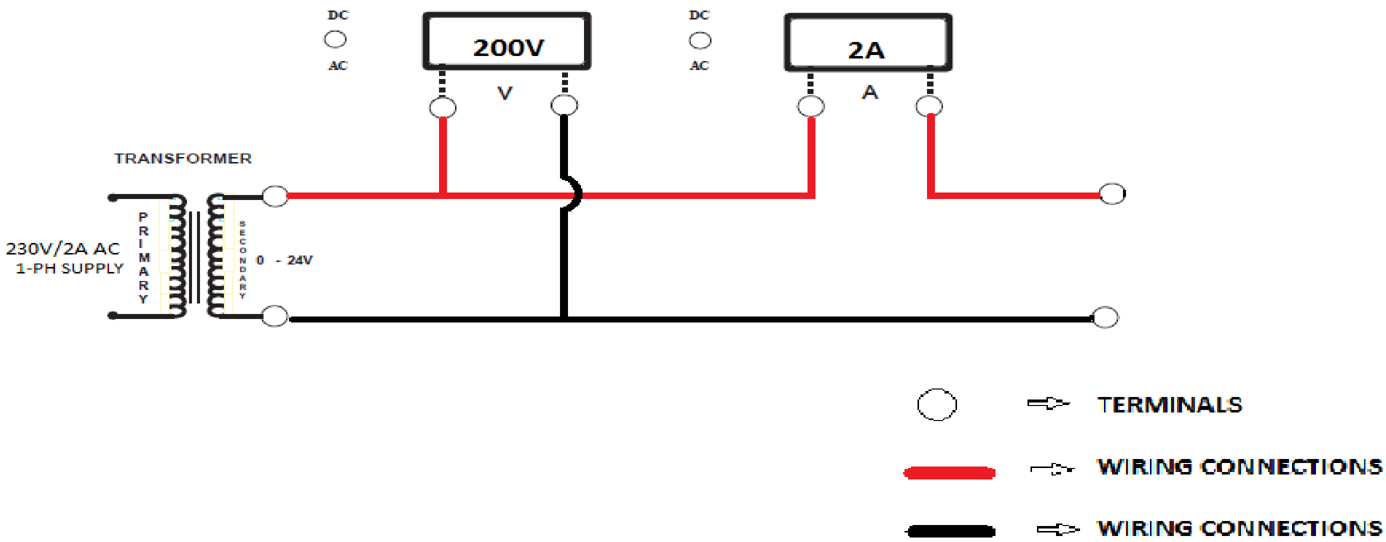
- The Period, (T) is the length of time in seconds that the waveform takes to repeat itself from start to finish. This can also be called the *Periodic Time* of the waveform for sine waves, or the *Pulse Width* for square waves.

- The Frequency, (f) is the number of times the waveform repeats itself within a one second time period. Frequency is the reciprocal of the time period, ($f = 1/T$) with the unit of frequency being the *Hertz*, (Hz).

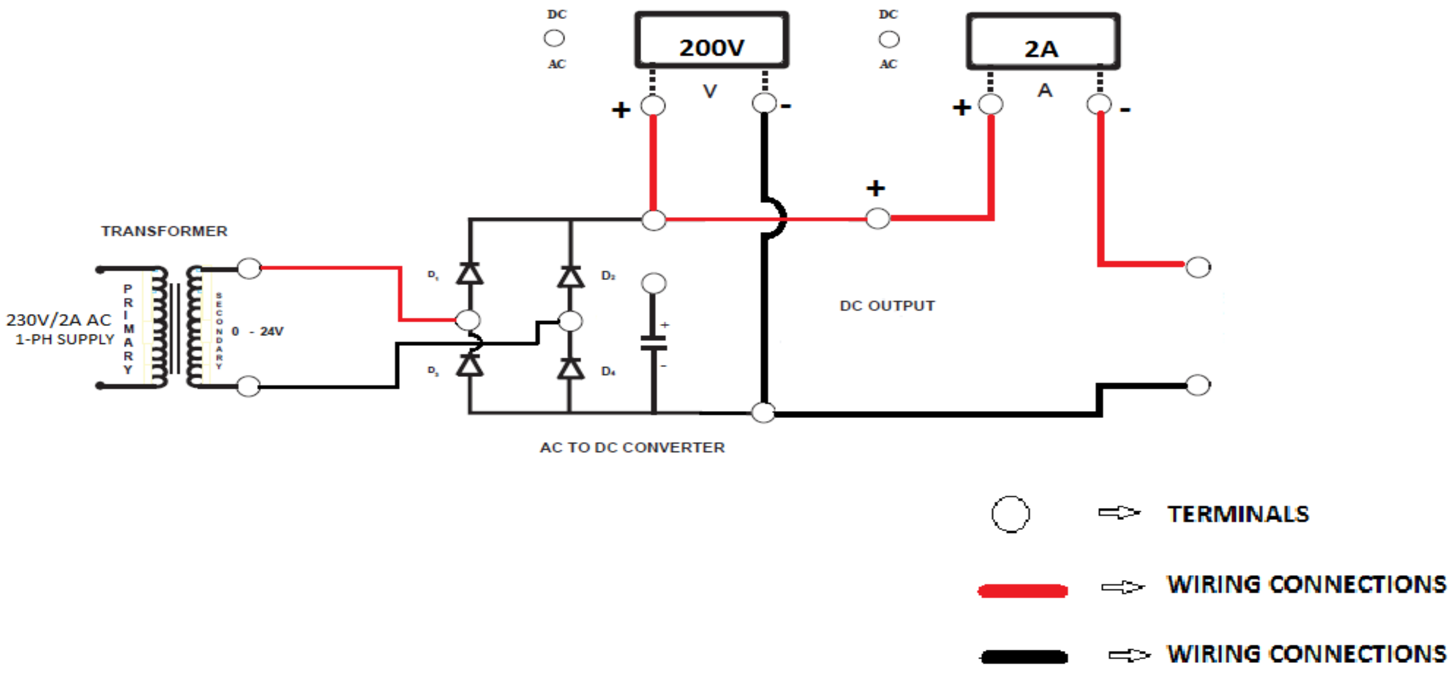
- The Amplitude (A) is the magnitude or intensity of the signal waveform measured in volts or amps. The most common periodic signal waveforms that are used in Electrical and Electronic Engineering are the Sinusoidal Waveforms.

WIRING DIAGRAM:

WIRING DIAGRAM FOR AC STUDY KIT



WIRING DIAGRAM FOR DC STUDY KIT



DESCRIPTION OF THE UNIT:

The simple AC and DC study kit is so designed to study the AC and DC circuits and to understand the healthy status of the mains with the help of tester and test lamp. This is designed on 24 V step down transformer since it is dangerous to operate on line voltages.

This is unit is having a transformer, a basic half wave diode bridge to generate DC source. The 24 v output from secondary is to be connected to the DC Bridge and the DC output is taken at load terminals.

In general if any leakage occurs, then there will be a potential between neutral and earth. If earth terminal is not properly grounded, then this leakage will appear between neutral and earth.

To simulate this, the 24 v point can be grounded through a high value resistor and the leakage can be observed with the help of tester and test lamp. If earth point is properly grounded then this leakage is arrested.

In the similar way, the DC output leakage can also be simulated by connecting high value resistor between + ve point to ground terminal. Then there will be a leakage current between + ve to earth. This can be observed.

If proper earth connection is given, then the mains will be maintained in healthy status. Any leakage results in to loss of power and affects the healthy status of the mains.

PROCEDURE FOR TESTING AC CIRCUIT:

- Connect Voltmeter across secondary of the transformer
- Keep the selector switch in AC mode
- Connect the 3-pin power chord in the mains supply
- Switch on the Power by switching on rockery switch
- Check the Voltage across secondary of the transformer and observe 24 V AC
- Connect the 24 v bulb across the secondary
- Check for the light glowing which denotes Mains healthy status.
- Connect high wattage resistor across 24 V terminal to earth terminal. Leakage current and voltage occurs.
- Check the leakage with tester and test lamp
- Switch off the kit

PROCEDURE FOR TESTING DC CIRCUIT:

- Connect Voltmeter across the DC output
- Keep the selector switch in DC mode
- Connect the 3-pin power chord in the mains supply
- Switch on the Power by switching on rockery switch
- Check the Voltage across the DC output terminals
- Connect the 24 v bulb across the DC output terminals
- Check for the light glowing which denotes DC healthy status.
- Connect high wattage resistor across 24 V DC + ve terminal to earth terminal. Leakage current and voltage occurs.
- Check the leakage with tester and test lamp
- Switch off the kit

RESULT: Healthy status of AC and DC circuit is checked.

4. UNDERSTANDING OF UPS

(UN-INTERRUPTED POWER SUPPLY)

AIM:

To study and understand the functionality of a UPS (uninterrupted power supply).

APPARATUS REQUIRED:

- UPS (uninterrupted power supply) kit
- Battery 12V, 26 AH
- 60 w Bulb, holder with power chord for loading

SPECIFICATION:

Mains	:	230v AC, 1-phase, 50 Hz
DC input	:	12v DC
Output	:	230v AC, Sine Wave
Bulb	:	60 watt bulb with holder and 3-pin plug
Input range	:	230v ± 10% AC

DESCRIPTION:

The UPS (uninterrupted power supply) will have generally three sections - Mains, battery and inverter, which are explained as follows.

a. **Mains:** Mains to charge the battery and to connect the load when mains are in healthy condition.
b. **Battery:** Battery/dc input is connected to the inverter input and will be inverted to ac form dc, when mains is failed to keep continuous supply to the load without interruption.
c. **Inverter:** Inverter will invert the dc input supply form battery to ac output to keep the load continuity without any interruption.

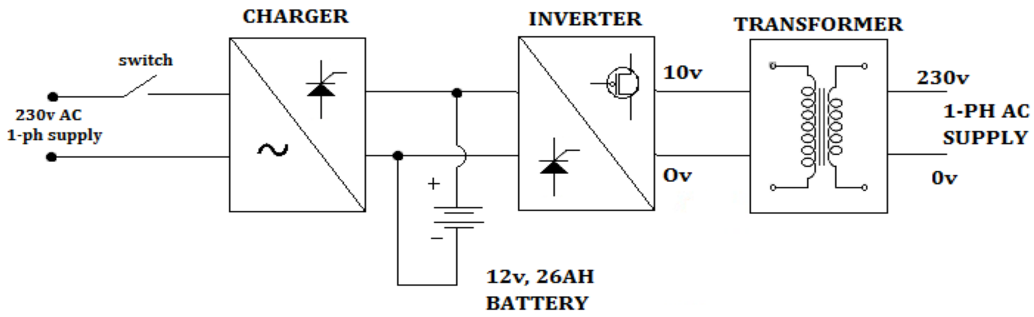
PRINCIPLE OF OPERATION:

UPS is so designed to supply the load without any interruption whenever mains is available output load works on mains only in the absence of mains the inverter in the **UPS** (uninterrupted power supply) will switch over to the battery connected to it and inverts the dc to ac and take over the load without any interruption the changeover will be taken place within 3s time.

The **UPS** (uninterrupted power supply) will have switching devices and our kit or unit **MOSFETS** are used the **MOSFET** gate pulse is generated in the control card and **MOSFETS** are switched at more than 10 kHz frequency. The sine wave generated in the control card will be amplified and is given to the isolation transformer to get 230v ac output.

The mains on and inverter on indicate that **UPS** (uninterrupted power supply) is connected to the mains and inverter also working on mains only when mains fail only inverter on LED glows and that implies **UPS** (uninterrupted power supply) is the working on battery when battery discharges below the 10v then low battery indication will glows and **UPS** (uninterrupted power supply) will be switched off to protect the battery from deep discharge the over load LED will indicates that **UPS** (uninterrupted power supply) is loaded the more than the rated hence it will trip the **UPS** (uninterrupted power supply) the charger on LED indicates that battery is in charge condition.

BLOCK DIAGRAM OF UPS (UNINTERRUPTED POWER SUPPLY):



PROCEDURE:

- Connect the battery positive to positive terminals of the two way closed connectors.
- Connect the battery negative to negative terminals of the two way closed connectors.
- Insert the 3-pin power chord of the bulb into 3-pin socket given on the UPS front panel.
- Plug in the 3-pin power chord of UPS (uninterrupted power supply) into mains supply.
- Switch on the inverter on switch into on condition.
- Observe the load bulbs on when inverter is on condition.
- Switch off the mains and observe the bulbs still glowing on battery without interruption.

RESULT:

Hence when mains available bulb will glow on mains and a main is failed bulb is still glowing on inverter without interruption this is the UPS (uninterrupted power supply) function.

ELE lab viva questions

1. Twelve volts is applied across a resistor. A current of 3 mA is measured. What is the value of the resistor?

2. What is a Transformer

3. Ohm's law describes how current is related to voltage and resistance. TRUE/FALSE

4. Define Form Factor

5. What is back emf in DC motor

6. What is Current Divider Rule (CDR)?

7. Explain Kirchoff's Current Law (KCL)

8. What is Earthing.

9. What is Auto-Transformer.

10. Write the EMF equation of Transformer.

11. For inductor power factor lags TRUE/FALSE

12. What is Turn Ratio in transformer

13. Name the factors that affect earth resistivity

14. How Eddy current loss can be minimized .

15. What is an earth electrode

16. What is the purpose of laminating the core in a Transformer

17. Write the difference between Fuse and Breaker .

18. Mention the advantages of fuse .

19. What is MCB .

20. What is Eddy current loss .

21. Why commutator is used in DC machine .

22. What is the function of carbon brushes in DC generator.

23. What are Slip rings .

24. Why an induction motor never runs at synchronous speed .

25. What is the necessity of starter in DC motor .

26. Why an induction motor is called as rotating Transformer .

27. How will you change the direction of rotation of DC motor.

28. Write the EMF equation of DC generator.

29. Write the armature torque equation of DC motor .

30. What is Slip .

31. Write the equation for Rotor frequency of induction motor .

32. Define ohm's law .

33. Define KVL .

34. List the properties of ideal Transformer .

35. Write the advantages of three phase AC circuits over single phase AC circuits .

36. What is phase sequence .

37. Define pitch factor.

38. Define winding factor .

39. Define RMS value .

40. Define Power factor .

41. In resistor voltage and current are in-phase TRUE/FALSE.

42. For capacitor voltage lags current . TRUE/FALSE .

43. Define reactive power & write its unit.

44. Define active power & write its unit .

45. Define Inductance & write its unit.

46. Define Impedence & write its unit .

47. Could you measure Voltage in series

DEPARTMENT VISION & MISSION

VISION

To become a pioneer in developing competent professionals with societal and ethical values through transformational learning and interdisciplinary research in the field of Electronics and Communication Engineering.

MISSION

The department of Electronics and Communication is committed to:

M1: Offer quality technical education through experiential learning to produce competent engineering professionals.

M2: Encourage a culture of innovation and multidisciplinary research in collaboration with industries/universities.

M3: Develop interpersonal, intrapersonal, entrepreneurial and communication skills among students to enhance their employability.

M4: Create a congenial environment for the faculty and students to achieve their desired goals and to serve society by upholding ethical values.