ELECTRICAL ENGINEERING PRACTICE

INTRODUCTION

Electric power is supplied for commercial and residential use in three phases with a neutral. Some of the low power consumption residential connections will have only a single phase with a neutral. The single-phase AC supply is 230V but a three-phase supply is 440V.

SAFETY MEASURES

1. Use approved tools, equipments and protective devices.
2. Do not work under poor light or when you are tired.
3. Do not work in damp areas or in wet shoes or clothes.
4. Keep tools and equipments clean and in good working condition.
5. Read all instructions carefully before using the appliances.
6. To prevent electrical hazards, DO NOT immerse appliances in water or Other liquids.
7. Always unplug an appliance before cleaning, or whenever it is not in use. Ensure That you pull by the plug and not the cord.
8. DO NOT operate any appliance with a damaged cord or plug.
9. Always use an appliance on a dry, level surface.
10. Keep appliances away from heated surfaces and open flames.
11. Check the electric power supply from the switch position.

TOOLS USED IN WIRING

PLIERS

Pliers are used to cut wire and also to hold it. Pliers have an insulated handle. Long nose pliers are used to hold wires in small space and also to tighten or loose small nuts.

SCREW DRIVERS

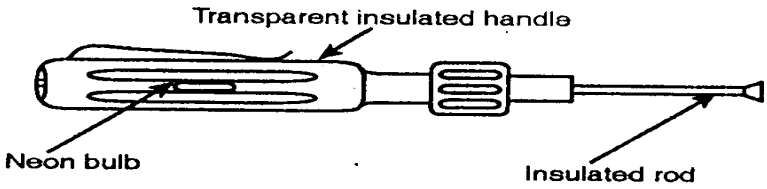
Screw drivers are used to tighten screws in the switches and electrical machines. Screw drivers of various sizes are used. Normally screw drovers used in electrical work are insulated.

HAMMERS

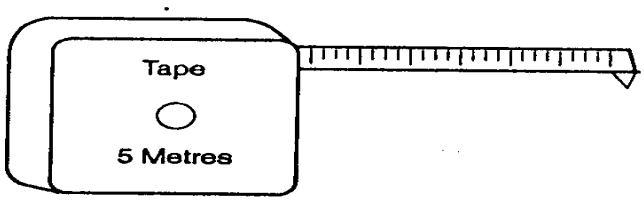
Ball peen and claw hammers are commonly used in electrical work where greater power is required striking.

HACKSAW

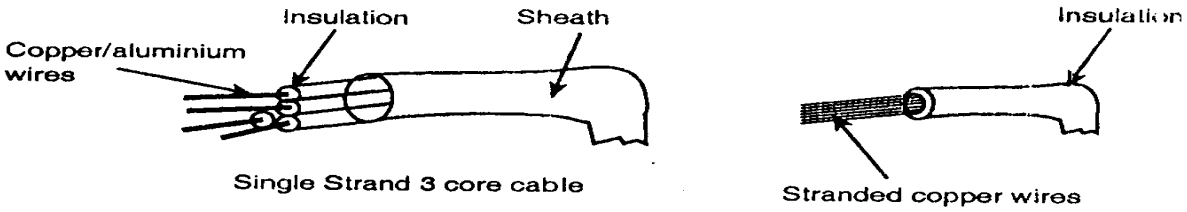
A hacksaw is used to cut cable armour, conduit pipes, etc. it has a frame where the blade is tightened by means of a wing nut.



Line Tester



Measuring Tape



Cables/Wires

LINE TESTER

A line tester is used to check the electric supply in the line or phase wire. It has a small neon bulb which indicates the presence of power supply. It can also be used as a screw driver to tighten small screws in switches.

MEASURING TAPE

A measuring tape is used to measure the length of the wire and also to mark the positions of the switches and other electrical fittings.

WIRES

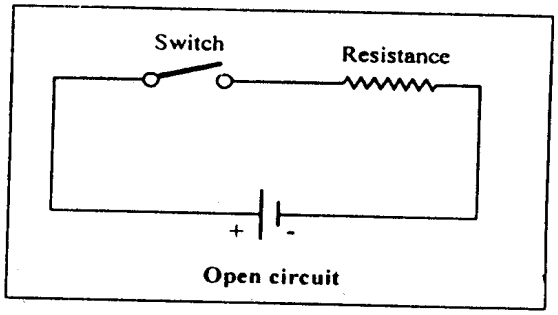
An electric wire is a copper or aluminium insulated wire and has one or more twisted stands. Vulcanized Indian Rubber (VIR) wire, cotton flexible or rubber flexible wire and poly vinyl chloride (PVC) wires are commonly used in house wiring.

TYPES OF CIRCUIT

There are three types of circuits. They are

- Open circuit
- Closed circuit
- Short circuit

OPEN CIRCUIT

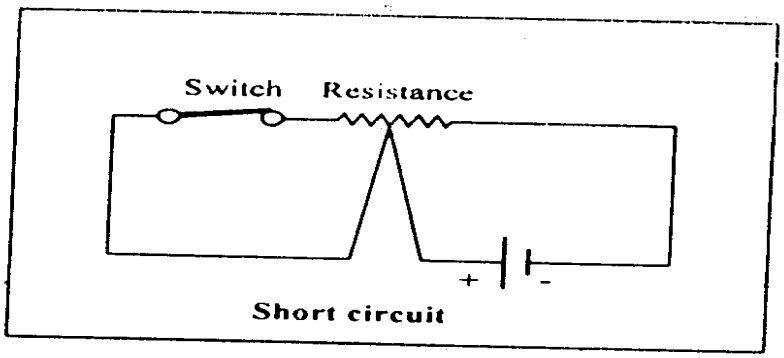


If the switch used in the circuit is in 'off' position, then the circuit is said to be open circuit. There will not be any flow of current in open circuit.

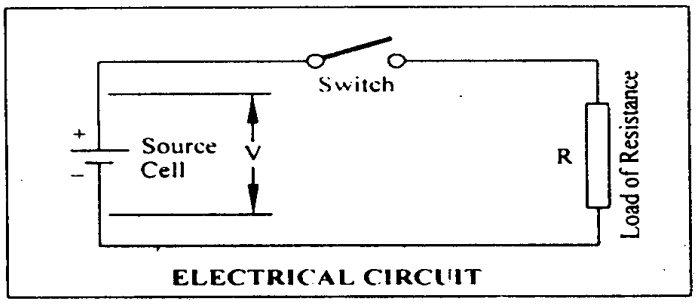
CLOSED CIRCUIT

If the switch used in the circuit is in 'on' position, then the circuit is said to be closed circuit. There will be normal flow of current in closed circuit.

SHORT CIRCUIT



When the positive terminal and negative terminal of any circuit comes in contact and very high current flows through the circuit, then it is called as short Electrical Circuit.



An electrical circuit should consist of the following.

- An energy source is used to provide the voltage needed to force the current Through the circuit.
- Conductor is used through which the current can flow.
- A load (resistor) is used to control the amount of current and to convert the Electrical energy into other forms.
- A control device (switch) is used to start or stop the flow of current.

TYPICAL LIGHTING CIRCUITS

- House – wiring is as simple as one lamp is controlled by one switch or may be a special requirement of controlling one lamp from two or more number Of places.Such type of circuits is used for staircase, bedroom and corridor lighting Systems. The basic principle involved in such circuits and the requirement of additional special accessories are discussed below:

BEDROOM LIGHTING

A bedroom requires one lamp at the dressing table controlled by a switch and one lamp just above the bed which may require dual control by two 2 way switches, one provided near the entrance (door) and the other provided above the bed. The circuit which describes the lighting in bedroom is as follows:

WIRING

WIRING METHODS

A circuit is a path along which the electric current flows from the negativeSide of the power source to the positive side. There are three types of electrical circuit.

(i) Series circuit

(ii) Parallel circuit

(iii) Combination of series and parallel circuit.

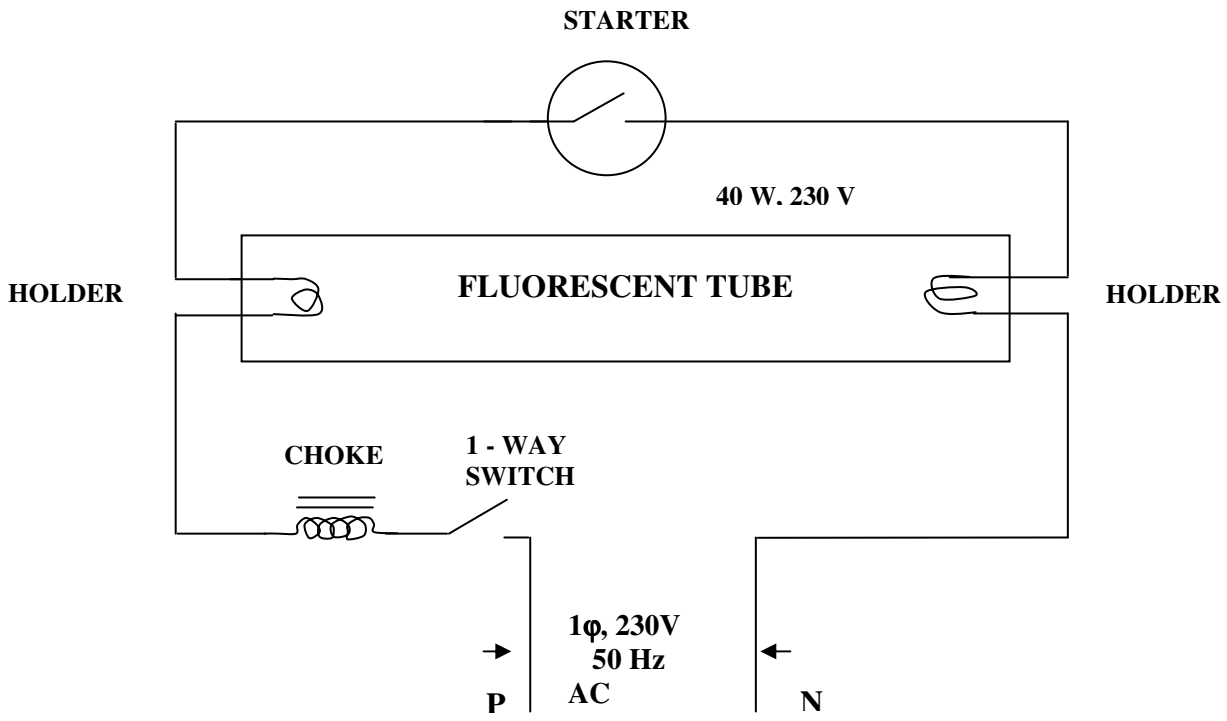
SERIES CIRCUIT

The series circuit provides a single, continuous path through which current flows. In this the devices are connected one after another and the current flows through them until it returns to the power source. The circuit is shown in fig ….. Hence, even when one device breaks down the remaining devices will not operate because the circuit is broken.

PARALLEL CIRCUIT

In parallel circuit the devices are connected side by side so that, current flows in a number of parallel path. The parallel circuit is shown in fig.In this type of circuit each device is connected across the power source so that even if one device breaks down, the other devices continue to operate. Hence this type of circuit is used in home wiring.

DIAGRAM - TUBE LIGHT



EX.NO : 1

FLUORESCENT LAMP WIRING

Aim :

To prepare wiring for a fluorescent tube light with switch control.

Tool Required :

1. Screw driver 2. Hammer 3. Pliers 4. Line tester

Components Required :

1. Switch 2. Tube light with fitting 3. Joint clips
4. Wires 5. Screws 6. Switch board

Working of the Fluorescent Tube Light :

The fluorescent lamp circuit consists of a choke, a starter, a fluorescent tube and a frame. The length of the commonly used fluorescent tube is 100 cm; its power rating is 40 W and 230V. The tube is filled with argon and a drop of mercury. When the supply is switched on, the current heats the filaments and initiates emission of electrons. After one or two seconds, the starter circuit opens and makes the choke to induce a momentary high voltage surge across the two filaments. Ionization takes place through argon and produces bright light.

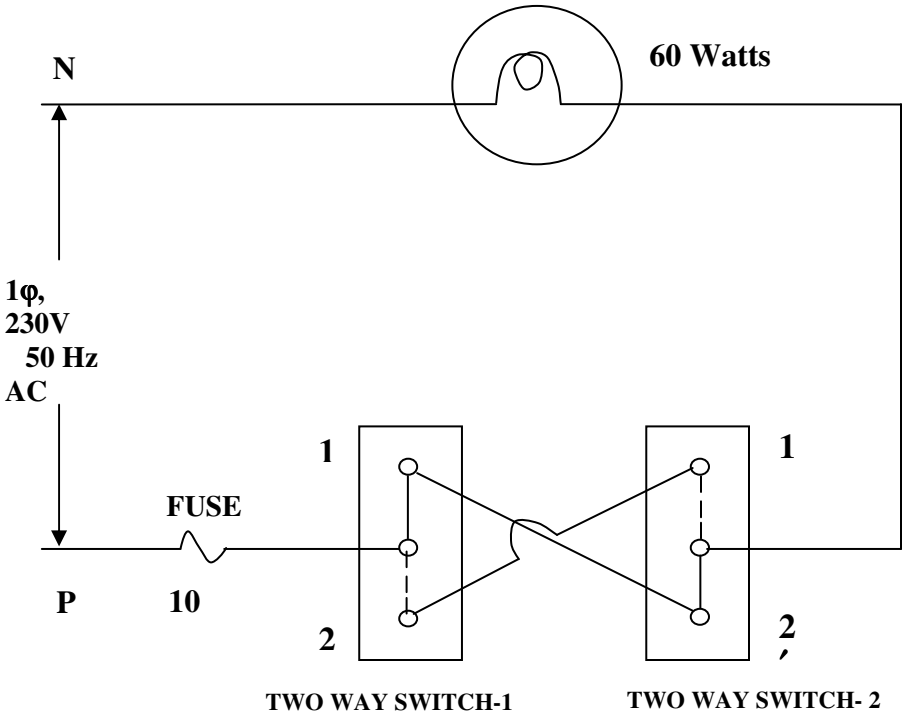
Procedure :

1. Mark the switch and tube light location points and draw lines for wiring on the wooden board.
2. Place wires along the lines and fix them with the help of clips.
3. Fix the switch and tube light fitting in the marked positions.
4. Complete the wiring as per the wiring diagram.
5. Test the working of the tube light by giving electric supply to the circuit

Result :

The wiring for the tube light is completed and tested.

CIRCUIT DIAGRAM --STAIRCASE WIRING



SWITCH POSITION		LAMP CONDITION
SWITCH- 1	SWITCH- 2	
1	1′	OFF
1	2′	ON
2	1′	ON
2	2′	OFF

EX.NO : 2

STAIR CASE WIRING

Aim :

To wire for a stair case arrangement using a two-way switch.

Tool Required :

1.Screw driver 2.Hammer 3.Pliers 4.Line tester

Components Required :

1. Two-way switches
2. Bulb holders
3. Bulbs
4. Joint clips
5. Wires
6. Screws
7. Ceiling rose and
8. Switch board

Procedure :

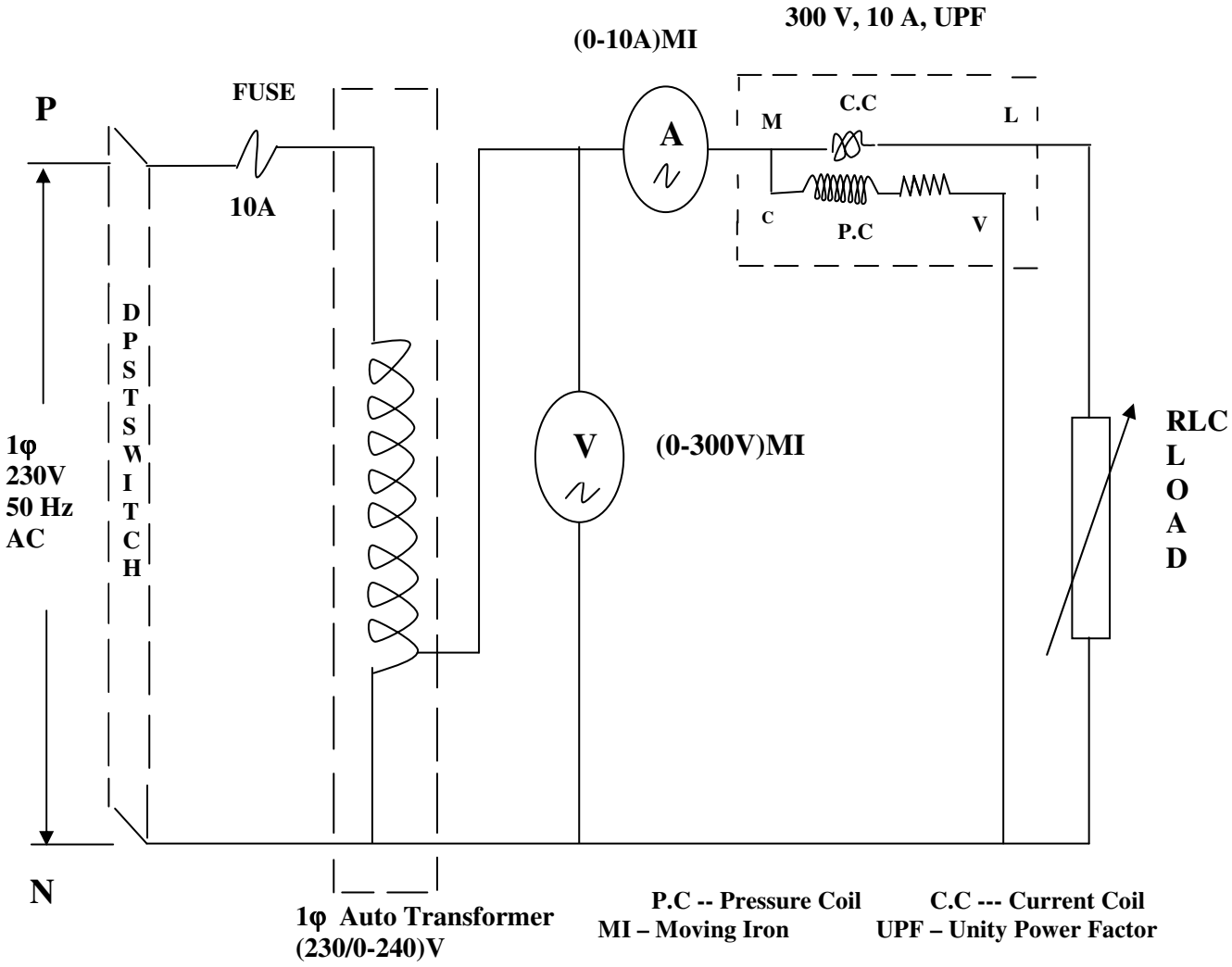
1. Mark switch and bulb location points and draw lines for wiring on the wooden Board.
2. Place wires along the lines and fix them with the help of clips.
3. Fix the two-way switches and bulb holder in the marked position on the wooden Board.
4. Complete the wiring as per the wiring diagram.
5. Test the working of the bulbs by giving electric supply to the circuit.

Result :

The staircase wiring is completed and tested.

CIRCUIT DIAGRAM

MEASUREMENT OF ELECTRICAL QUANTITIES



EX.NO : 3

MEASUREMENT OF ELECTRLCAL QUANTITIES-VOLTAGE CURRENT, POWER & POWER FACTOR IN RLC CIRCUIT

Aim :

To measureelectrical quantities for the given single phase circuit.

Apparatus:

SL.NO.	Components Required	Range	Type	Quantity
1	Ammeter	(0-10)	MI	1
2	Load	Variable	RLC	1
3	Volt meter	(0-300)	MI	1
4	Watt meter	300V, 10A	UPF	1
5	Autotransformer	1KVA 230/(0-240) V	1PH	1

Formulas :

Apparent Power = VI (Voltmeter reading x Ammeter reading)

Real Power = VICosΦ (Watt meter reading)

Power factor (CosΦ) = Real Power / Apparent Power

Indicated Power = Observed reading X Multiplying factor

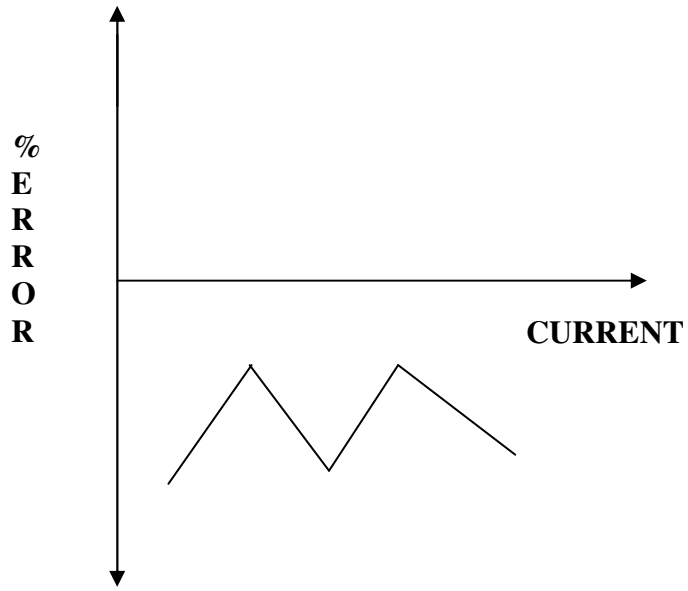
% Error = (Indicated Power –Actual Power) x100 /Actual Power

Actual Power = Voltmeter reading x Ammeter reading x Power factor

TABULAR COLUMN

S.NO	Volt meter readings (Volts)	Ammeter readings (Amps)	Watt meter readings (Watts)		Power factor	% Error
			Observed reading	Indicated reading		

MODEL GRAPH



Procedure :

1.Connections are given as per the circuit diagram

2.Set the rated voltage by adjusting Auto transformer

3.Obser the meter readings for various loading conditions.

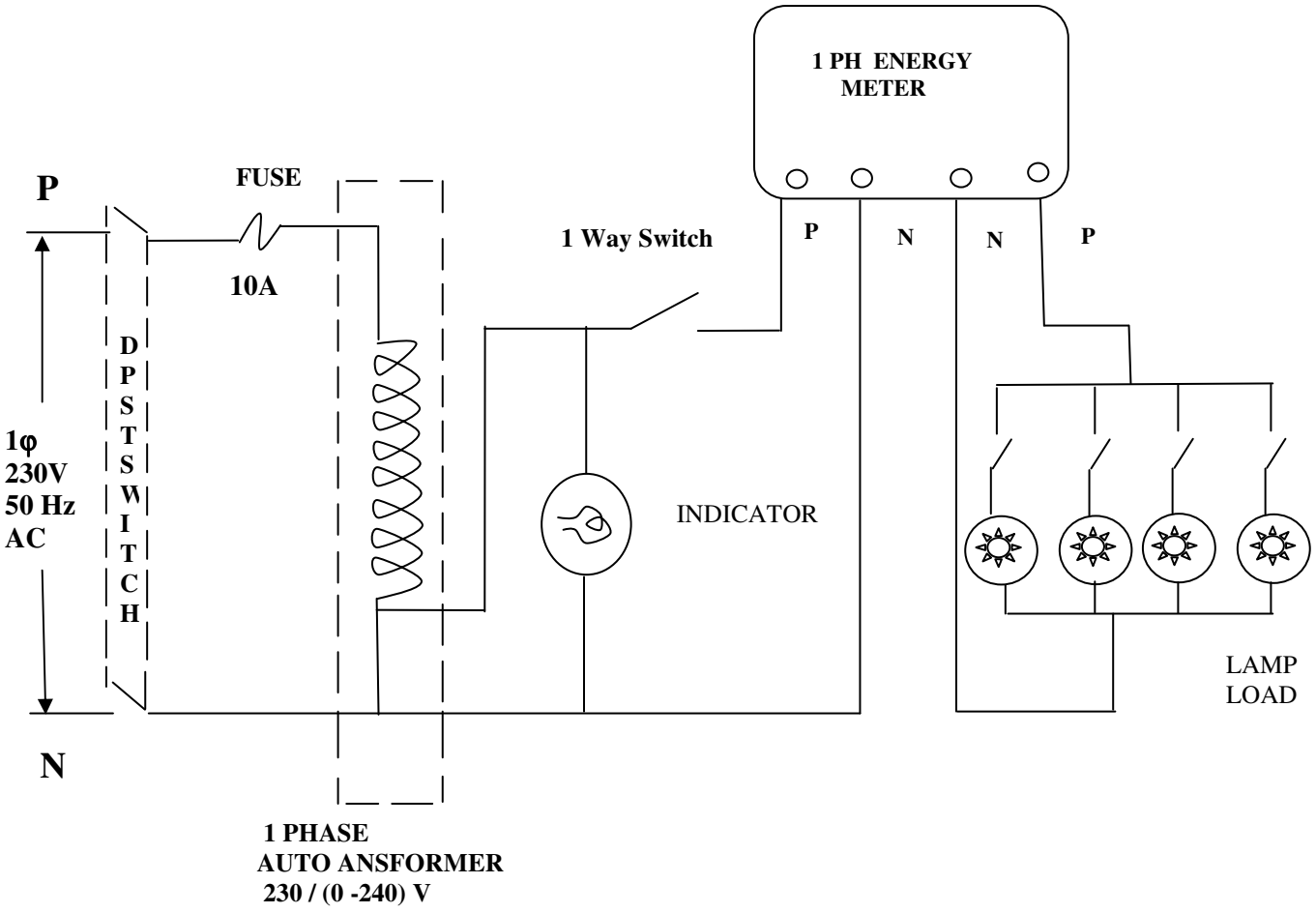
4.Calculate the error and plot the graph between %error and current value.

Result:

Thus electrical quantities like Voltage, Current, Power and Power factor Values measured

CIRCUIT DIAGRAM

RESIDENTIAL WIRING USING FUSE, SWITCH, INDICATOR,LAMP AND ENERGYMETER



EX.NO. 4

RESIDENTIAL HOUSE WIRING USING FUSE, SWITCH, INDICATOR, LAMP AND ENERGY METER.

Aim :

To prepare residential wiring using Fuse, Switch, Indicator, Lamp and Energy meter .

Apparatus Required:

SL.NO.	Components Required	Range	Quantity
1	One way Switch	----	1
2	Energy Meter	1 Ph	--
3	Indicator	-----	1
4	Lamp	----	1
5	Wires	----	Required amount

Procedure:

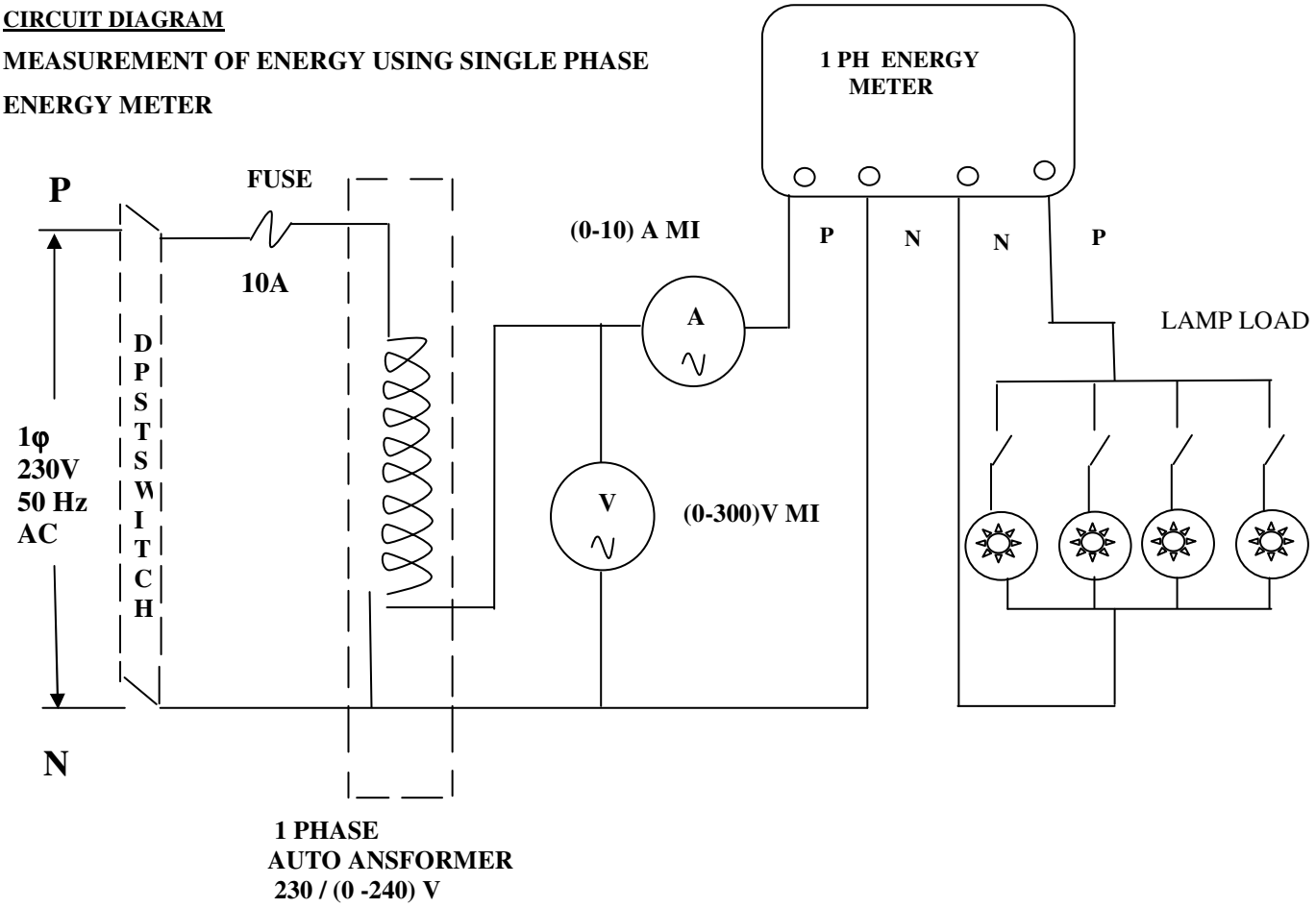
1. Connections are given as per the circuit diagram.
2. When the Switch is Closed ,the Lamp will glow and the metering is running .
3. The corresponding readings are noted from energy meter by observing number of cycles of the disc for a particular time period.

Result:

Thus the residential wiring is implemented and tested for its operation.

CIRCUIT DIAGRAM

MEASUREMENT OF ENERGY USING SINGLE PHASE ENERGY METER



EX.NO: 5

MEASUREMENT OF ENERGY USING SINGLE PHASE ENERGYMETER

Aim :

To measure Energy consumed in a single phase circuit using Energy meter.

Apparatus required :

SL. NO.	Components Required	Range	Type	Quantity
1	Ammeter	(0-10)	MI	1
2	Load	------	LAMP	--
3	Volt meter	(0-300)	MI	1
4	Energy Meter	1 Ph,300V, 10A	--	1
5	Autotransformer	1KVA 230/(0-240) V	1PH	1

Formula used :

1200 Rev= 1kwhr

1Rev=1x1000x3600/1200= 3000Watt-sec

For N Rev Indicated energy (E_i) = N x 3000 Watt-sec

% Error = $(E_i-E_a)x100/Ei$

Calculated energy $E_a = (V_L x I_L)$ x t Watt-sec

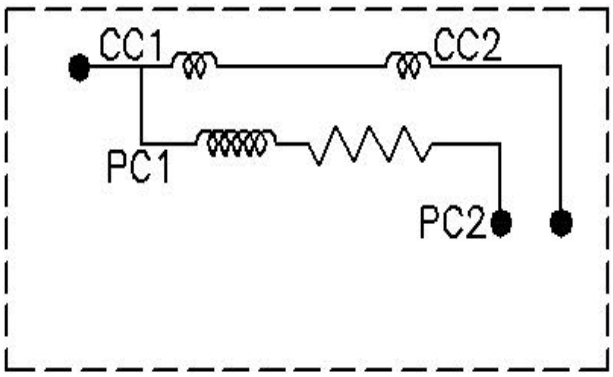
Where

V_L –Load voltage

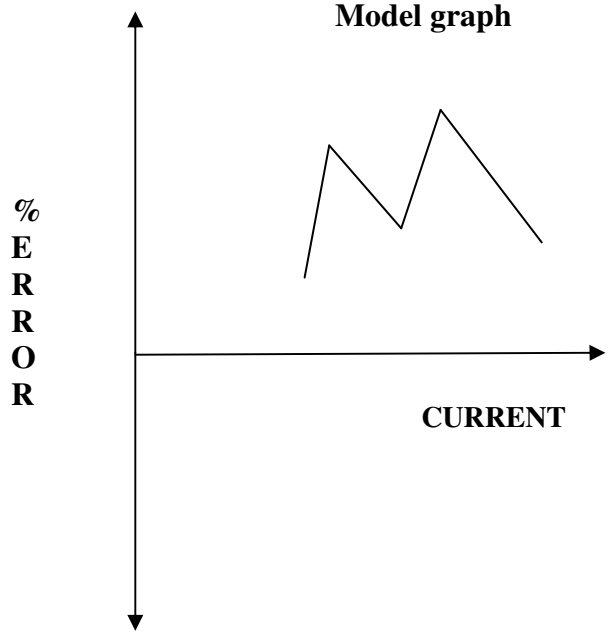
I_L-Load current

Energy meter constant = ----------(Rev/sec)

ENERGY METER INTERNAL CONNECTION



Model graph



TABULATION

S.NO	Volt meter readings (Volts)	Ammeter readings (Amps)	Time taken for 5 Rev(Sec)	Calculated Energy (E_a)	Indicated Energy (E_i)	% Error

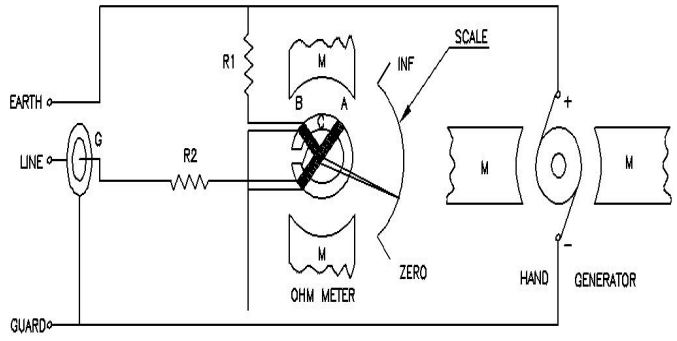
Procedure :

1.Connections are made as per circuit diagram.
2.Supply is switched on and load is applied and Ammeter, Voltmeter readings and time taken by thediscs for particular number of revolution are noted using stop watch.
3.Step 2 is repeated for various load conditions.
4.% Error is calculated

RESULT:

Thus energy consumed in a single phase circuit is measured

CIRCUIT DIAGRAM FOR MEGGER



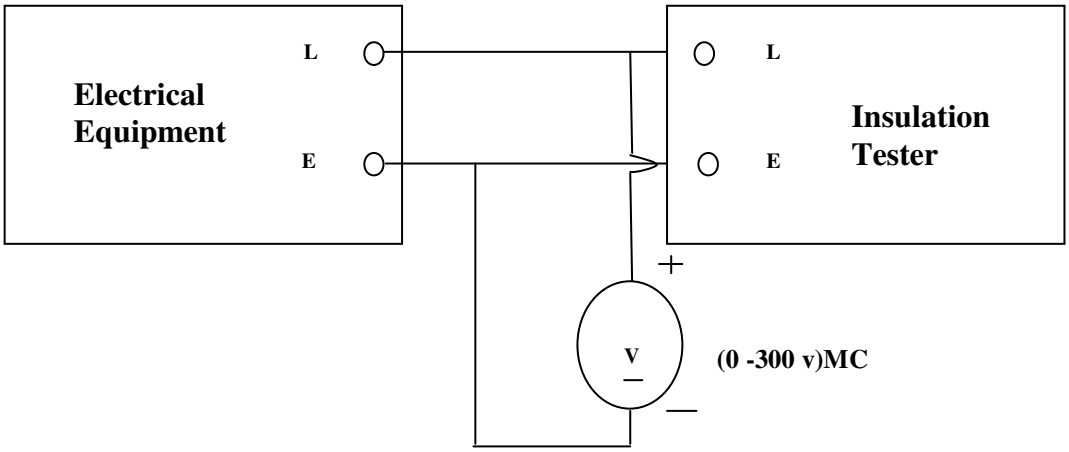
R1,R2 – Resistors

M – Magnet

A,B,C – Position of the Coils

S.NO	Volt Meter reading(V)	Resistance values (Ohm)
1		
2		
3		
4		
5		

Average = --V Average= -- Ohms
VoltageResistance



L- LINE E- EARTH

EX.NO : 6

MEASUREMENT OF RESISTANCE TO EARTH OF AN ELECTRICAL EQUIPMENT

Aim :

To measure the Earth Resistance of given Electrical Components

Apparatus Required:

S.NO.	Components Required	Range	Quantity
1.	Insulation Tester(Megger)	1000V,(0-200)MW	1
2.	Any Electrical equipment (Transformer, Cables)	-----	-----

Procedure:

1. Connections are given as per the circuit diagram.
2. The required Voltage is generated with the help of Hand driven Generator (Megger).
3. The insulation resistance of the given equipment is directly readfrom the display of Megger.

Result:

Thus the insulation Resistance of the given Electrical Equipment wasmeasured using Insulation tester.