



SNS COLLEGE OF TECHNOLOGY

Coimbatore – 35

Engineering Practices Laboratory

Electrical

StudyZone

<http://studyzone.dgpride.com>

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STUDY OF ACCESSORIES, TOOLS USED IN WIRING & SAFETY PRECAUTIONS

AIM:

To study the various types of accessories and tools used in house wiring.
To study safety precautions for electrical engineering practice

ACCESSORIES REQUIRED:

Switch, Lamp Holder, Lamp holder adopter, Ceiling roses, Mounting blocks, Socket outlets, Plugs, Main switch, Distribution fuses boards.

TOOLS REQUIRED:

Cutting pliers, Flat nose pliers, Screwdriver, Neon tester, Hammer, knife, Poker, Pincer, Center punch, twist drill, Soldering rod.

ACCESSORIES:

Switch

A switch is used to make or break an electric circuit. Under some abnormal conditions it must retain its rigidity and keep its alignment between switchblades and contacts correct to a fraction of centimeter.

Lamp Holders

A lamp holder is used to hold the lamp required for lighting purposes.

Lamp Holder Adopter

It is used for tapping temporary power for small portable electric appliances from lamp holders. Such a practice is not advised.

Ceiling Roses

It is an end point of an electrical wire, which provides a cover to the wire end. These are used to provide a tapping to the lamp holder through the flexible wire or a connection to a fluorescent tube or a ceiling fan. It consists of a circular base and a cover made of Bakelite.

One end of the plates is connected to supply and the other end to a flexible wire connected to appliances.

Mounting Blocks

These are nothing but wooden round blocks. They are used in conjunction with ceiling roses, batten holder, surface switches, ceiling switches, etc.

Socket Outlets

It is a wiring accessory to which electrical appliances are connected for power supply. These have insulated base with molded or socket base having three terminal sleeves. The two thin terminal sleeves are meant for making connection to the load circuit wires and the third terminal sleeve, larger in cross section, is used for an earth connection.

Plugs

These are used for tapping power from socket outlets. Two-pin plugs and three-pin plugs are commonly available.

Main Switch

This is used at the consumer's premises so that he may have self-control of the entire distribution circuit. This switch is a master control of all the wiring circuit made in the building. The different classifications are double poled and triple poled switches.

Distribution Fuse Boards

In industries or in very big buildings, where a number of circuits are to be wired, and distribution fuse boards are used. They are usually iron clad and are designed with a large space for wiring and splitting the circuits. The fuse bank in the distribution board can easily be removed.

Fuse

A fuse is a protective device, which is connected such that the current flowing through the protected circuit also flows through the fuse. There is a resistive link inside the fuse body that heats or melts up when current flows through it. If the current is beyond the permissible limit, the resistive link burns open, which stops all current to flow in the circuit. At this condition we say that the fuse is blown.

Earthing

When a wire is connected from the ground to the outer metal casing of the electrical appliances, then it attains zero potential and the appliance is said to be earthed and this process is known as earthing.

Purpose of Earthing

A protective earth (PE) connection ensures that all exposed conductive surfaces are at the same electrical potential as the surface of the Earth, to avoid the risk of electrical shock if a person touches a device in which an insulation fault has occurred. It ensures that in the case of an insulation fault (a "short circuit"), a very high current flows, which will trigger an over-current protection device (fuse, circuit breaker) that disconnects the power supply.

TOOLS:

Cutting Pliers

They are used to cut the wires, nipping by hand and twisting the wires and also to hold them. Long nose pliers are used to hold the wires in small space and also to tighten and loosen small nuts.

Nose Pliers

Long nose pliers are used to hold the wires in small space and also to tighten and loosen small nuts.

Screw Driver

They are used to drive and tighten screws into pointed holes in the switches and electrical machines. They are generally insulated.

Hammer

Ball peen and claw hammers are commonly used in electrical work where greater power is required in striking. It is best suited for riveting purposes in sheet metal works.

Line Tester

It 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.

Knife

It is generally used for removing the insulation from the wire. The closing type knife is always preferred.

Poker

It is a long sharp tool used for making pilot holes in wood before fixing and tightening wood screws.

Pincer

The pincer is used for extracting nails from the wood.

Center Punch

When a hole is to be drilled in a material, the center punch is always used for making the starting hole.

Twist Drill

It is used for drilling holes into metals and woods.

Soldering Rod

It is used for soldering wires to small joints with solder. It consists of pointed oval Cu bit fixed to an iron rod, which is heated by an electric element only.

SAFETY PRECAUTIONS:

- While work on electrical installations, wear always rubber shoes and avoid loose shirting.
- Do not work on live circuits, if unavoidable use rubber gloves, rubber mats etc.
- Use wooden or PVC insulated handle screwdrivers when working on electric circuits.
- Do not touch bare conductors
- Replace or remove fuses only after switching OFF the circuit switches.
- Never extend wiring by using temporary wiring.
- Stand on rubber mats while working or operating switch panels, control gears etc.
- Always use safety belts while working on poles or high rise points.
- Do not connect earthing to the water pipe lines.
- Only skilled persons should do electric work.
- Wear all the protective clothing and use all the necessary safety equipment.
- In case of any person suffered by electrical shock and if the victim is still in contact with the supply, break the contact either by switching off or by removing the plug or pulling the cable free.
- Do not give an unconscious person anything to eat or drink and do not leave an unconscious person unattended.

- First restore the normal breathing to the victim and ensure that the patient can breathe normally unaided. Then we can render other first aids.

RESULT:

Thus a study on the various types of accessories, tools used in house wiring and safety precautions for electrical engineering practice was studied.

RESIDENTIAL HOUSE WIRING USING SWITCHES, FUSE, INDICATOR, LAMP AND ENERGY METER

AIM:

To construct residential house wiring using switches, fuse, indicator, lamp and energy meter.

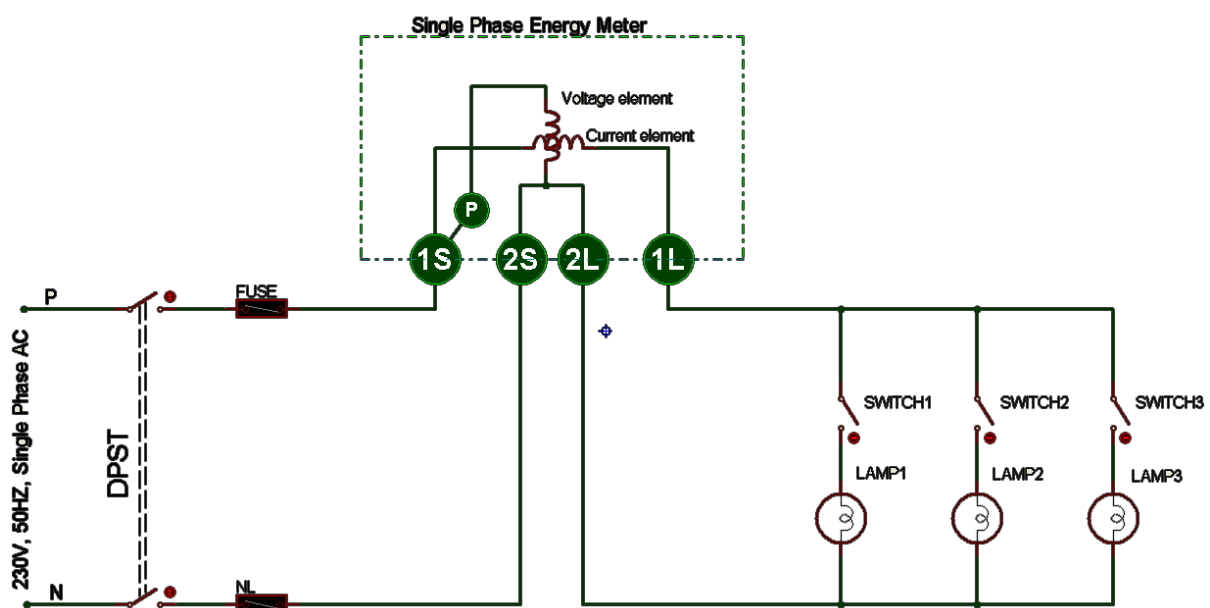
MATERIALS REQUIRED:

S.No.	Components	Description	Quantity
1.	Lamp	230V, 40W	3
2.	Indicator	230V	1
3.	Lamp Holder		3
4.	Fuse		1
5.	One way Switch		3
6.	Wires	230V, 5A	Req.
7.	PVC Pipes & Fittings		Req.

TOOLS REQUIRED:

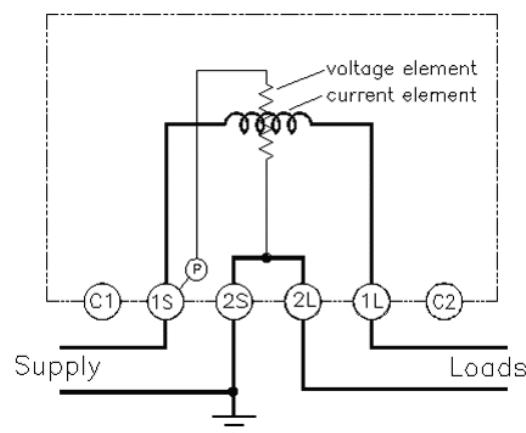
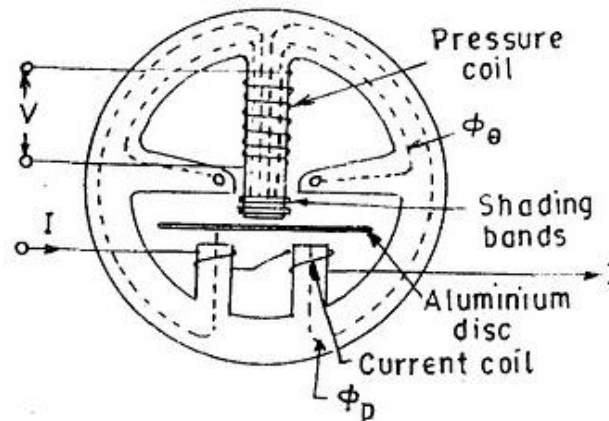
S.No.	Components	Quantity
1.	Pliers	1
2.	Knife	1
3.	Side Cutter	1
4.	Screw Driver	1

CIRCUIT DIAGRAM:



THEORY:

The energy meter consists of an aluminum disc mounted on a light alloy shaft. This disc is positioned in the air gap between series and shunt magnets. The upper bearing of the rotor (moving system) is a steel pin located in a hole in the bearing cap fixed to the top of the shaft. The rotor runs on a hardened steel pivot, screwed to the foot of the shaft. A jewel bearing supports the pivot. A pinion engages the shaft with the counting or registering mechanism.



PROCEDURE:

1. Collect the materials required for this experiment.
2. Draw the layout of the given circuit diagram in the circuit board.
3. Fix the necessary materials, by using drilling machine in the layout board.
4. The lamps are fixed on the lamp holders.
5. Connections are checked and supply is given.
6. Switches are operated to see the output of the lamp.

PRECAUTIONS:

- The metal covering of all appliances are to be properly earthed in order to avoid electrical shock due to leakage or failure of insulation.
- Every line has to be protected by a fuse of suitable rating as per the requirement.

FUSE RATING CALCULATIONS:

Power drawn by the circuit = $40W \times 3 = 120W$

Voltage of circuit = 230V

$$P = VI \cos \phi$$

Assuming $\cos \phi = 1$

Current in the circuit = Power/ Voltage = $120\text{W} / 230\text{V} = 0.52\text{A}$

Fuse rating of the circuit = rounding off the current to the nearest 5 = 5A

(Normally fuses are available in the ratings of 5A, 10A and etc.)

RESULT:

Thus the single-phase wiring has been constructed, tested and the results are tabulated.

FLUORESCENT LAMP WIRING

AIM:

To construct a Fluorescent tube wiring.

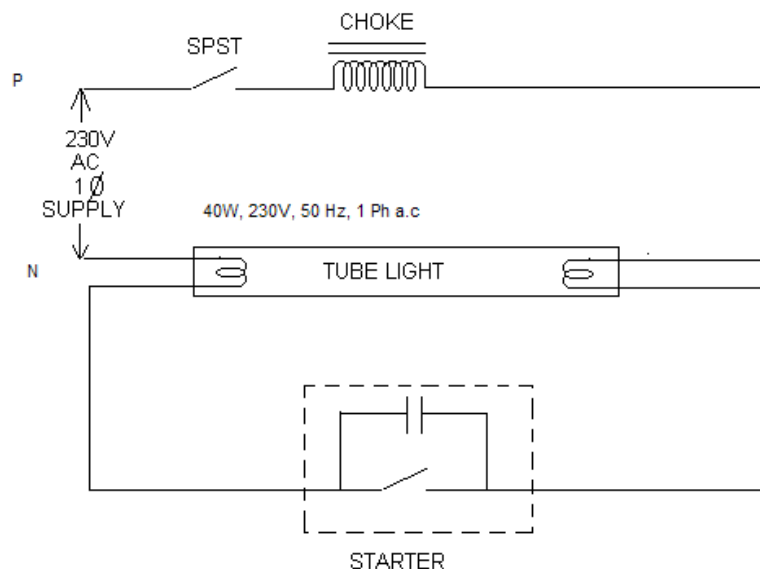
MATERIALS REQUIRED:

S.No.	Components	Description	Quantity
1.	Fluorescent Lamp (Tube Light)	230V, 40W	1
2.	Lamp Holder		1
3.	Choke		1
4.	One way Switch		1
5.	Starter		1
6.	Screw and Nuts		Req.
7.	Connecting Wires	230V, 5A	Req.

TOOLS REQUIRED:

S.No.	Components	Quantity
1.	Pliers	1
2.	Knife	1
3.	Side Cutter	1
4.	Screw Driver	1

CIRCUIT DIAGRAM:



THEORY:

The fluorescent tubes are available in lengths of 0.61m and 1.22m. The tubes are coated from inside with phosphorous, which is used to convert ultra violet radiations into visible light and to give the required colour sensation. A choke is used to give a

transient high voltage so as to initiate the electron movement. With the switch S closed, the circuit gets closed. The current flows through the choke and the starter. The starter suddenly breaks thereby breaking the circuit. Due to high inductive property of the choke, a transient high voltage is available across the filaments. Hence electrons are emitted and travel through the tube. Such a continuous flow of electrons produces the sensation of light to human eyes.

PROCEDURE:

- The tube light wiring is made as per the wiring diagram.
- Supply is given and circuit is checked.

FUSE RATING CALCULATION:

Power drawn by the circuit = $40\text{W} \times 1 = 40\text{W}$

Voltage of circuit = 230V

$P = VI \cos \phi$

Assuming $\cos \phi = 1$

Current in the circuit = $\text{Power} / \text{Voltage} = 40\text{W} / 230\text{V} = 0.174\text{A}$

Fuse rating of the circuit = rounding off the current to the nearest 5 = 5A

(Normally fuses are available in the ratings of 5A , 10A and etc.)

RESULT:

Thus the fluorescent tube wiring has been constructed and the working is tested.

STAIRCASE WIRING

AIM:

To setup a staircase wiring using the given lamp, controlled by switches.

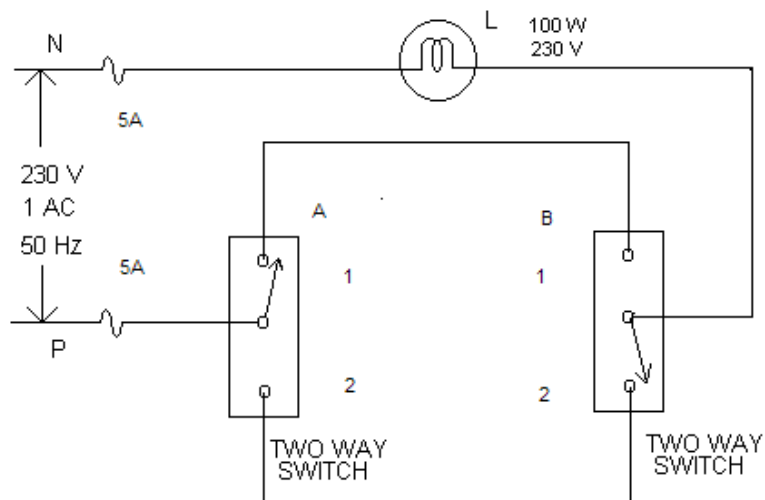
MATERIALS REQUIRED:

S.No.	Components	Description	Quantity
1.	Lamp	230V, 40W	1
2.	Lamp Holder		1
3.	PVC Pipes & Fittings		Req.
4.	Two-way Switch		2
5.	Screw and Nuts		Req.
6.	Connecting Wires	230V, 5A	Req.

TOOLS REQUIRED:

S.No.	Components	Quantity
1.	Pliers	1
2.	Knife	1
3.	Side Cutter	1
4.	Screw Driver	1

CIRCUIT DIAGRAM:



S.No.	Switch A	Switch B	Lamp State
1.	OFF (1)	OFF (1)	
2.	OFF (1)	ON (2)	
3.	ON (2)	OFF (1)	
4.	ON (2)	ON (2)	

PROCEDURE:

- Collect the materials required for this experiment.
- Draw the layout of the given circuit diagram in the circuit board.
- Fix the necessary materials, by using drilling machine in the layout board.
- One end of the lamp holder is connected to neutral point and another point is connected at the center of the two-way switch B.
- The center of the switch A is connected to the phase line.
- The connection of the other two ends of two-way switch is connected as follows.
The point 1 of switch A is connected to point 1 of switch B and point 2 of A is connected to 2 of B.
- The given lamp is fixed on the lamp holders.
- Controlling the switches, the circuit is checked and results are tabulated.

FUSE RATING CALCULATION:

Power drawn by the circuit = $100\text{W} \times 1 = 100\text{W}$

Voltage of circuit = 230V

$P = VI \cos \phi$

Assuming $\cos \phi = 1$

Current in the circuit = $\text{Power} / \text{Voltage} = 100\text{W} / 230\text{V} = 0.435\text{A}$

Fuse rating of the circuit = rounding off the current to the nearest 5 = 5A

(Normally fuses are available in the ratings of 5A , 10A and etc.)

RESULT:

Thus the staircase wiring has been constructed, tested and the results are tabulated.

MEASUREMENT OF ELECTRICAL QUANTITIES – VOLTAGE, CURRENT, POWER & POWER FACTOR IN RLC CIRCUIT

AIM:

To measure real power, reactive power, power factor and impedance RLC circuit using voltmeter and ammeter.

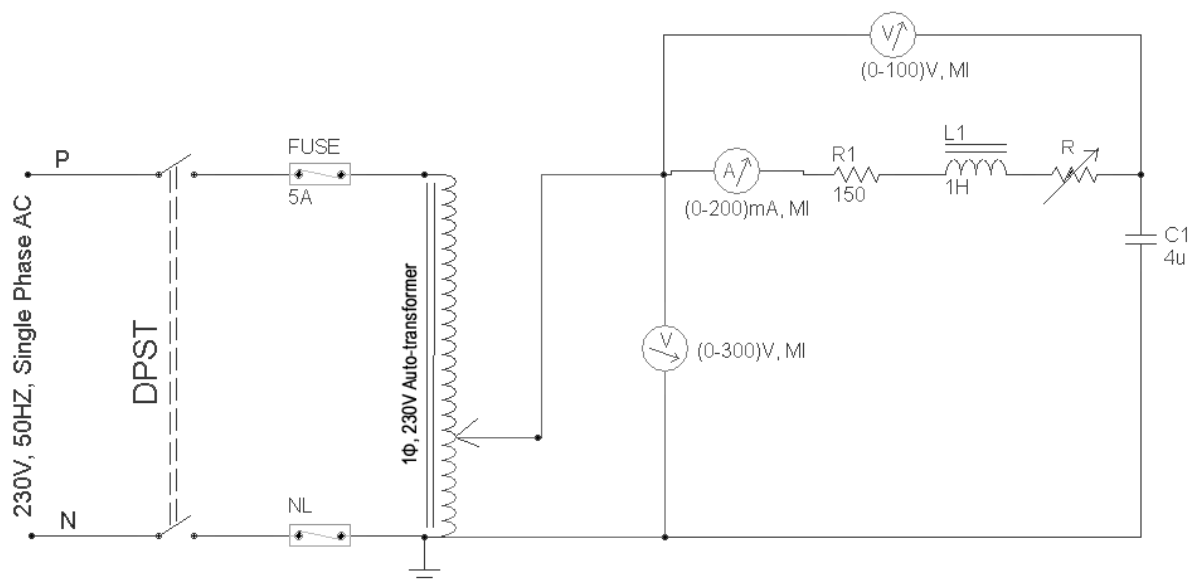
MATERIALS REQUIRED:

S.No.	Components	Description	Quantity
1.	Auto-transformer	1 Φ	1
2.	Rheostat	200 Ω , 2A	1
3.	DCB	10 μ F, 4 μ F	2
4.	DIP	1H	1
5.	Voltmeter	(0-150)V	1
6.	Ammeter	(0-200)mA	1
7.	Connecting Wires		Req.

TOOLS REQUIRED:

S.No.	Components	Quantity
1.	Pliers	1
2.	Knife	1
3.	Side Cutter	1
4.	Screw Driver	1

CIRCUIT DIAGRAM:



PROCEDURE:

1. Connect the RLC circuit as shown in circuit diagram.
2. After verification of circuit close the DPST switch.
3. Precaution set the auto transformer to minimum position.
4. Vary the auto transformer such that 200 mA of current flows through ammeter.
5. Note down drop across R, R-L and C also current in the circuit.
6. Readings are tabulated.
7. Bring the auto transformer to original position before opening DPSTS.
8. Calculate power factor ($\cos\phi$), impedance (Z), real power (P), reactive power (Q), and total power(S).

CALCULATION:

V_1 = Supply voltage = IZ in volts

V_C = Drop across capacitor = IX_C in volts

V_R = Drop across resistor = IR in volts

V_L = Drop across inductor = IX_L in volts

V = Drop across R, L & C = $I\sqrt{(R_1 + R)^2 + (X_L - X_C)^2}$ in Volts

I = V/Z in Amps –Current through RLC network

1. $X_C = 1 / (2 \pi f c)$ in ohms
2. **Power factor** $\cos \phi = R / Z$ (p.f.)
3. **Impedance** $Z = \sqrt{(R_1 + R)^2 + (X_L - X_C)^2}$
4. **Real power** $P = I^2 (R_1 + R)$ in Watts
5. **Reactive power** = $I^2 [X_L - X_C]$ in VAR
6. **Total power** $S = P + jQ = \sqrt{P^2 + Q^2}$ in VA
7. Impedance $Z = V/I$ in ohms
8. Real Power $P = VI \cos \phi$ in Watts
9. Reactive Power $Q = VI \sin \phi$ in VAR
10. **Total power** $S = P + jQ = \sqrt{P^2 + Q^2}$
11. **Power factor** $\cos \phi = (V_R + V_r)/V$

RESULT:

The voltage, current, power and power factor of the series RLC circuit are determined.

MEASUREMENT OF ENERGY USING SINGLE PHASE ENERGY METER

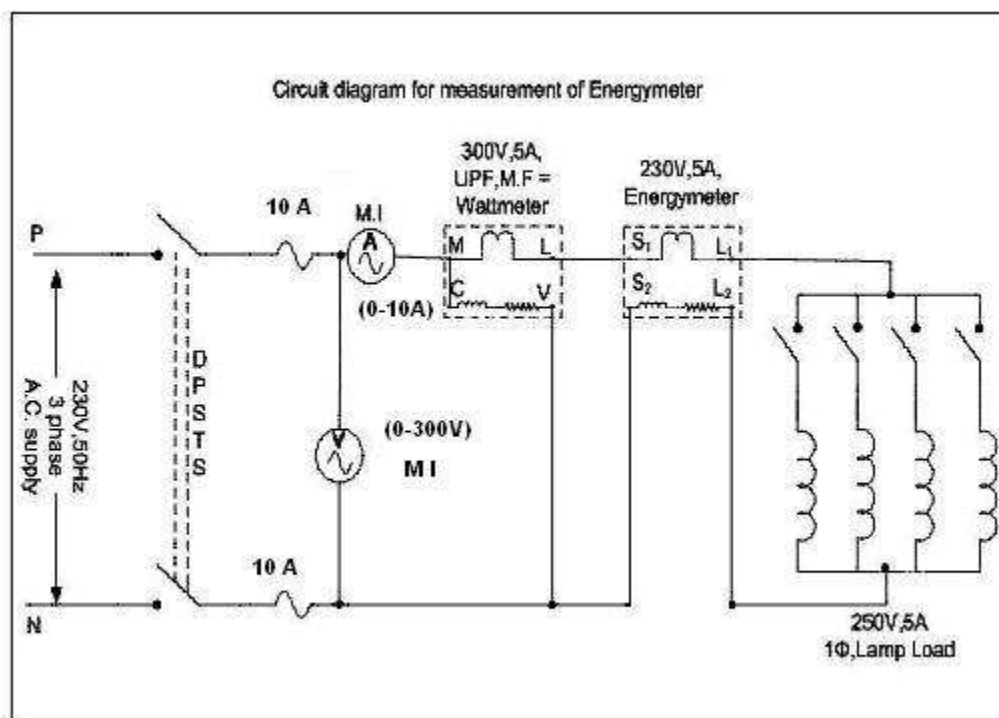
AIM:

To measure the energy using single phase energy meter at UPF load condition.

APPARATUS REQUIRED:

S.No.	Components	Description	Quantity
1.	Voltmeter	(0-300)V, MI	1
2.	Ammeter	(0-5)A, MI	1
3.	Wattmeter	300V, 5A	1
4.	Energy Meter	1 Φ , 230V	1
5.	1 Φ Variable Resistive load	kW	1
6.	Connecting Wires	-	Req.
7.	Stop Clock	-	1

CIRCUIT DIAGRAM:



PRECAUTIONS:

- There should be no load at the time of starting.
- The connections must be made proper for UPF.

PROCEDURE:

1. The connections are made as per the circuit diagram.
2. The DPST switch is closed and the supply is affected and load is adjusted to full load value.
3. The time taken for 10 revolutions of the aluminum disc in the energy meter is noted.
4. The error is calculated if it is more than +3% the brake magnet is adjusted such that the error is within +3%.
5. The load is reduced in steps and for each step, step #. 3 is repeated and the %error is calculated.

FORMULAE USED:

Energy meter specification = 1200 rev/Kwhr, (i.e) 1200rev =1 Kwhr

1rev = 1Kwhr/1200 = (3600 * 100) / 1200 = 3000 Watt – sec

For UPF conditions, Power calculated from energy meter reading = 3000 / (time taken for 10 rev)

$$\% \text{Error} = \frac{(\text{Power calculated from energy meter reading}) - (\text{Wattmeter reading})}{(\text{Wattmeter reading})} \times 100$$

TABULAR COLUMN:

S. No.	Ammeter Reading (A)	Time for 10 revolutions (sec)	Wattmeter Reading (W)		Power from Energy meter (W)	% Error
			Observed Value	Actual Value		
1.						
2.						

RESULT:

Thus the energy is measured using single phase energy meter and the %error is calculated.

MEASUREMENT OF RESISTANCE TO EARTH OF AN ELECTRICAL EQUIPMENT

AIM:

To measure the earthing resistance using megger.

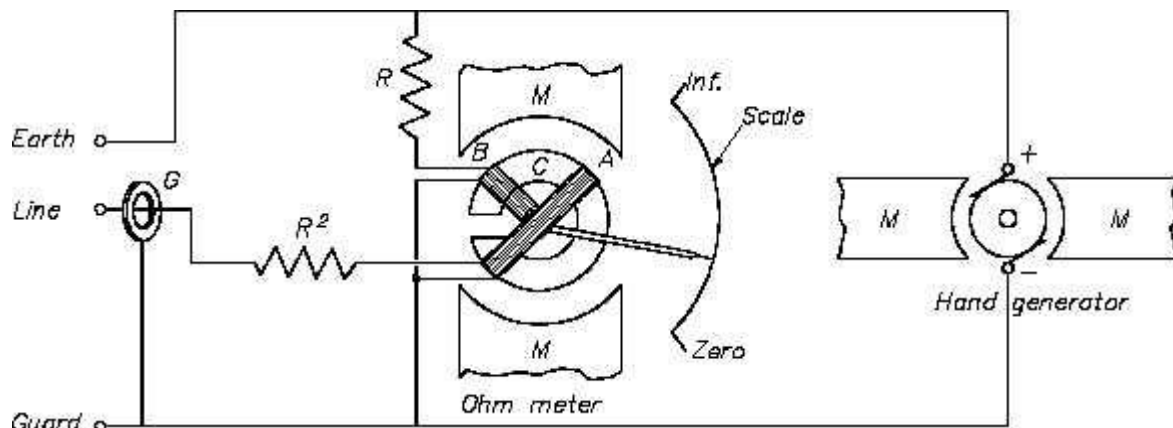
MATERIALS REQUIRED:

S.No.	Components	Description	Quantity
1.	Megger	-	1
2.	Rod	-	1
3.	Connecting Wires	-	1

TOOLS REQUIRED:

S.No.	Components	Quantity
1.	Hammer	1

CIRCUIT DIAGRAM:



THEORY:

Earthing means generally connected to the mass of the earth. It shall be in such a means as to ensure at all times an immediate & safe discharge of electric current due to leakage, fault etc. All metallic parts of every electrical insulation such as conduit, metallic sheathing, metallic panels, motor, gear, Transformer regulator shall be earthed using continuous bus wire if one earth bus for installation is found impracticable more than one earthing system shall be introduced the earthing conductors when taken outdoors to the earthing point, shall be incased in pipe securely supported and continued up-to point not less than 0.3m below the ground. No joints are permitted in earth bus whenever there is lighting conductors system installed in a building. Its earthing shall not be bonded to the earthing of electric installation. Before the electric supply on apparatus is energized all earthing system shall be tested for electrical resistance to ensure efficient earthing. It shall not be more than 2ohms including the ohmic value of earth electrode.

PROCEDURE:

1. Collect the materials required for this experiment.
2. The terminal of ohmmeter E is first connected to earth.
3. The two earth rods are fixed to feet away from the ohmmeter so that they form a triangle with base 50 feet.
4. The wires are connected to each rod and the ohmmeter terminals are shown.
5. The ohmmeter is ranked and the readings are taken.

TABULAR COLUMN:

S.No.	Distance between Electrodes (Feet)	Resistance (Ohms)
1.		
2.		
3.		

RESULT:

The earth resistance was measured in the given area.