

WORKSHOP
DIGITAL CONTENT
Electrical 3rd Sem



Practical-1

Study of Electrical Safety Measures

Study of IE Rules for Safety Measures

The Indian Electricity Rules 1956 has laid down rules regarding Installation, Commissioning, testing, Safety measures etc. during transmission and distribution of electrical Power. Some of the IE Rules 1956 regarding safety Measures are discussed below.

Rule 29. Construction, installation, protection, operation and maintenance of electric supply lines and apparatus-

All electric supply lines and apparatus shall be of sufficient ratings for power, insulation and estimated fault current and of sufficient mechanical strength, for the duty which they may be required to perform under the environmental conditions of installation, and shall be constructed, installed, protected, worked and maintained in such a manner as to ensure safety of [human beings, animals and property].

Rule 30. Service lines and apparatus on consumer's premises-

The supplier shall ensure that all electric supply lines, wires, fittings and apparatus belonging to him or under his control, which are on a consumer's premises, are in a safe condition and in all respects fit for supplying energy and the supplier shall take due precautions to avoid danger arising on such premises from such supply lines, wires, fittings and apparatus.

Rule 31. Cut-out on consumer's premises-

The supplier shall provide a suitable cut-out in each conductor of every service-line other than an earthed or earthed neutral conductor or the earthed external conductor of a concentric cable within a consumer's premises, in an accessible position. Such cut-out shall be contained within an adequately enclosed fireproof receptacle.

Rule 32. Identification of earthed and earthed neutral conductors and position of switches and cut-outs therein. Where the conductors include an earthed conductor of a two-wire system or an earthed neutral conductor of a multi-wire system or a conductor which is to be connected thereto, the following conditions shall be complied with-

An indication of a permanent nature shall be provided by the owner of the earthed or earthed neutral conductor, or the conductor which is to be connected hereto, to enable such conductor to be distinguished from any live conductor. Such indication shall be provided-

Rule 33. Earthed terminal on consumer's premises-

The supplier shall provide and maintain on the consumer's premises for the consumer's use a suitable earthed terminal in an accessible position at or near the point of commencement of supply as defined under rule 58.

Provided that in the case of medium, high or extra-high voltage installation the consumer shall, in addition to the afore mentioned earthing arrangement, provide his own earthing system with an independent electrode.

Rule 34. Accessibility of bare conductors- Where bare conductors are used in a building, the owner of such conductors shall-

- (a) Ensure that they are inaccessible;
- (b) Provide in readily accessible position switches for rendering them dead whenever necessary; and
- (c) Take such other safety measures as are considered necessary by the Inspector.

Rule 35. Danger Notices- The owner of every medium, high and extra-high voltage installation shall affix permanently in a conspicuous position a danger notice in Hindi or English and the local language of the district, with a sign of skull and bones.

- (a) Every motor, generator, transformer and other electrical plant and equipment together with apparatus used for controlling or regulating the same;
- (b) All supports of high and extra-high voltage overhead lines which can be easily climb-upon without the aid of ladder or special appliances;

Rule 36. Handling of electric supply lines and apparatus-

- (1) Before any conductor or apparatus is handled adequate precautions shall be taken, by earthing or other suitable means, to discharge electrically such conductor or apparatus, and any adjacent conductor or apparatus if there is danger there from, and to prevent any conductor or apparatus from being accidentally or inadvertently electrically charged when persons are working thereon.
- (2) No person shall work on any live electric supply line or apparatus and no person shall assist such person on such work, unless he is authorised in that behalf, and takes the safety measures approved by the Inspector.
- (3) Every telecommunication line on supports carrying a high or extra-high voltage line shall, for the purpose of working thereon, be deemed to be a high voltage line.

Rule 37. Supply to vehicles, cranes, etc.- Every person owning a vehicle, travelling crane or the like to which energy is supplied from an external source shall ensure that it is efficiently controlled by a suitable switch enabling all voltage to be cut off in one operation and, where such vehicle, travelling crane or the like runs on metal rails, the owner shall ensure that the rails are electrically continuous and earthed.

Rule 44. Instructions for restoration of persons suffering from electric shock-

Instructions, in English or Hindi and the local language of the district and where Hindi is the local language, in English and Hindi for the restoration of persons suffering from electric shock, shall be affixed by the owner in a conspicuous place in every generating station, enclosed sub-station, enclosed switch-station and in every factory as defined in clause (m) of section 2 of the Factories Act, 1948 (63 of 1948) in which electricity is used and in such other premises where electricity is used as the Inspector or any officer appointed to assist the Inspector may, by notice in writing served on the owner, direct.

Rule 45. Precautions to be adopted by consumers electrical contractors, electrical workmen and suppliers-

No electrical installation work, including additions, alterations, repairs and adjustments to existing installations, except such replacement of lamps, fans, fuses, switches, low voltage domestic appliances and fittings as in no way alters its capacity or character, shall be carried out upon the premises of or on behalf of [consumer, supplier, owner or occupier] for the purpose of supply to such any [consumer, supplier, owner or occupier] except by an electrical contractor licensed in this behalf by the State Government and under the direct supervision of a person holding a certificate of competency and by a person holding a permit issued or recognised by the State Government.

Rule 46. Periodical inspection and testing of consumer's installation-

Where an installation is already connected to the supply system of the supplier, every such installation shall be periodically inspected and tested at intervals not exceeding five years either by the Inspector or any officer appointed to assist the Inspector or by the supplier as may be directed by the State Government in this behalf or in the case of installations belonging to, or under the control of the Central Government, and in the case of installation in mines, oilfields and railways by the Central Government.

Safety Measures

1. Electric shocks can be avoided by following proper safety measures.
2. In case of electric shock if a person is still in contact with a live wire, switch "off" the main supply immediately if possible. Insulate with the help of dry board or thick dry newspaper before attempting to get the person clear. Don't touch the body. Pull the person by clothes, if they are dry or remove with the help of a piece of dry wood.
3. Don't forget to put on safety belt before starting work above ground level i.e. on pole.
4. Beware of live wire or bare conductor.
5. When a ladder is in use, it must be held from slipping by at least one helper.
6. Never tamper unnecessarily with any electrical apparatus.
7. Before switching on current to any portable equipment make sure that it is properly earthed and insulation is sound.
8. Never disconnect a plug point by pulling the flexible wire.
9. Never touch an overhead line unless it is made sure, that it is dead and properly earthed.
10. Never energize a line unless it is sure that all is clear and there is no one working on it.
11. Always switch off the main switch before replacing a blown fuse.
12. Never tamper with electric protective or inter-locking gearing unless by an authorised personnel.
13. Always maintain earth connections in satisfactory conditions. Safety depends on good earthing.
14. While handling table fan or any other appliances be sure that it is disconnected. Switching off may not be enough.
15. When batteries are being charged in a room, always maintain good ventilations.
16. In case of fire on electrical installations, do not throw water on equipment, because water is a good conductor of electricity.
17. While making electrolyte for batteries always add acid to water.
18. In case of fire disconnect the supply immediately.
19. Do not use a fire extinguisher on electricity unless it is suitable for that purpose.
20. Rubber mats should be placed in front of electrical boards and switch boards.

Shock Treatment : When a person gets electric shock, following points are considered to safe guard the life of effected person.

1. **Switching off the supply:** When ever a person comes in contact with the live wire, switch off the supply immediately if it is nearby. If the switch is at far distance pull the plug out, or cut the wire with insulated pliers.

2. **Removing the person from the contact of current:** Push a person with dry stick of wood or pull him from the clothes, if they are dry. Remove him from the contact of current without touching his body.

If the voltage is 440 volts, efforts should be made to free the person from contact with the live wire after protecting one self with any dry insulating material, but in case of high voltage switching off the supply is must.

3. Removing the person from fire: If a person clothes catches fire, tear the clothes and wrap in a blanket or coat then roll him on the ground to extinguish the fire.

4. Treatment of Burn: If there are burns on the body of the person who received a shock use proper oil or ointment on them and cover them with proper dressing. Send for a doctor.

5. Artificial Respiration: If the person is not breathing immediately start artificial respiration untill the medical aid arrives. There are several methods of artificial Respirations.

(a) Method 1

1. Lay the person on his stomach with his face down side. Loosen his clothes, so that he / she should not have difficulty in breathing. More over the person should be laid in such a manner that no pressure effect the burns on the body.
2. Kneel over the person's back and place both hands on his back near the lowest ribs with fingers parallel to the spine.
3. Now press gradually and slowly for about 3 sec leaning forward. Keep the person warm through out.
4. Relax the pressure slowly and come to initial position for about two seconds without lifting hands from the position.
5. Repeat the process 12-15 times in a minute till the breathing of the person is restored.
6. Do not feed liquid until the person regains consciousness.

Method 2 (Mouth To Mouth Method)

This method is used if the patient has suffered chest injuries.

1. Make the victim lad on his back and ensure that there is nothing in the mouth of the victim which would block the passage of air.
2. Put one hand under victim neck and with the other hand lift his chin pointing upward.
3. Shut the nostrils of the victim and put the hand tightly over the mouth of the victim. Now blow vigorously so as to expand the chest of the victim.
4. Remove your mouth to let returning air escape.
5. Repeat the process every 3 to 4 seconds. To avoid direct contact with the mouth of the victim make use of handkerchief.
6. This method supplies 10-12 times more volume of air into person.



Method 3 (Silvester's method)

In case of burns on the chest avoid laying the person with his front downward. To make the breathing normal follow the following steps.

1. Lay the patient on his back.
2. Put a pillow beneath shoulder. Roll up a coat and loosen the clothes around chest and stomach.
3. Remove all the tight clothings from the patient.
4. Raise his shoulder on a cushion or folded clothing, so that his head hangs forward. Maintain a free entrance of air into the patient's windpipe.
5. With the help of someone, draw the tongue forward as far as possible with a handkerchief.
6. Draw the patient's arm upward, outwards and towards you with a sweeping movement, pressing his elbows towards the ground. This causes respiration.
7. Bring his arms back along the same route.
8. Press them firmly against the front and the ribs of his chest. This causes expiration.
9. Repeat these cycles of movement smoothly and rhythmically about twelve times per minute till the patient begins to breathe by himself. Figs. 1.3 and 1.4 respectively shows the artificial respiration method.



Fig. 1.3 : Artificial Respiration (Step-I)



Fig. 1.4 : Artificial Respiration (Step-II)

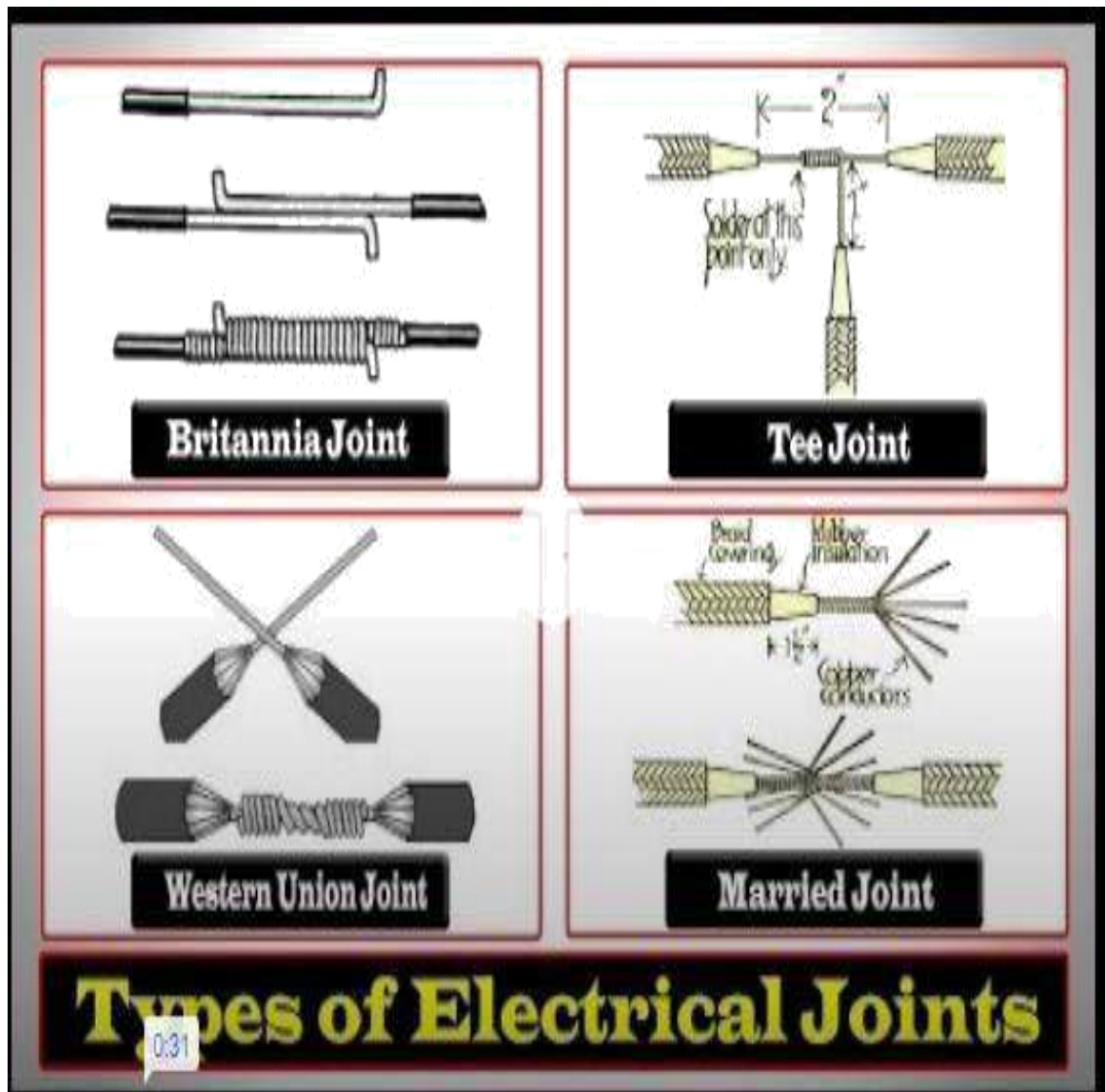
Shock Treatment including First Aid

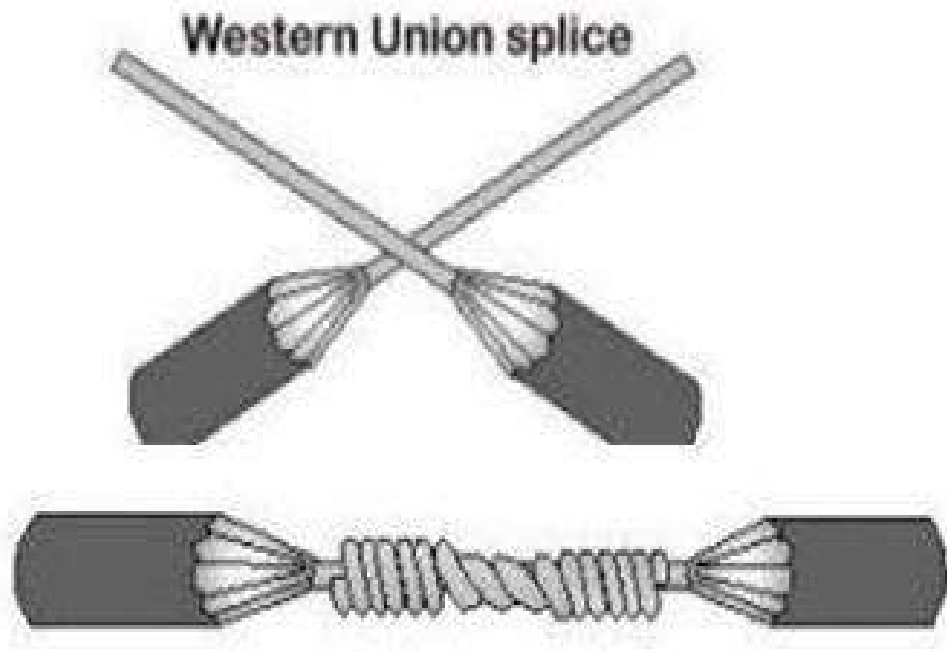
Treatment of burn : In case a person receives electrical shock and there is fire and burns on the body then following steps should be taken

- (a) Help the person "stop, drop, and roll" to smother flames.
- (b) Remove hot or burned clothing. If clothing is sticking to skin, cut or tear around it.
- (c) If the victim has a burn, remove the clothing from the burned area (unless it's stuck to the skin) and rinse it in cool, running water. Cover the burn with a dressing.
- (d) Remove constrictive clothing immediately.
- (e) Take off jewellery, belts, and tight clothing. Burns can swell quickly.
- (f) Hold burned skin under cool (not cold) running water or immerse in cool water until pain subsides.
- (g) Cover with sterile, non-adhesive bandage or clean cloth.
- (h) Do not apply butter or ointments, which can cause infection.
- (i) Give over-the-counter pain reliever such as ibuprofen (Advil, Motrin), acetaminophen (Tylenol), or naproxen (Aleve).

Practical-2

To make wire joints





Western union splice joint

This is a straight joint used for small solid cables

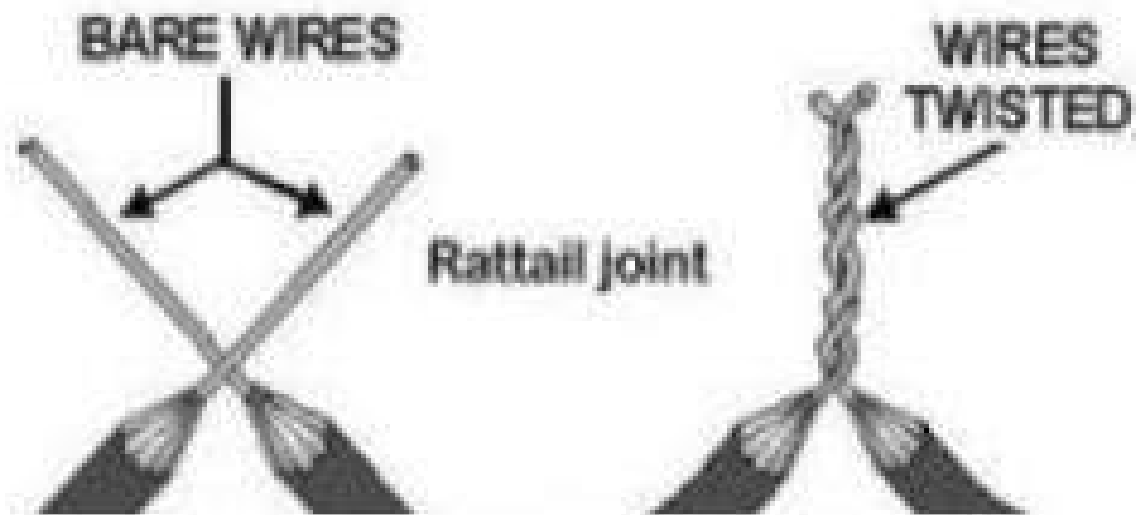
1. Remove the insulation
2. Bring the two conductors to a crossed position and then make a long bend or twist in each wire.
3. Wrap the end of one of the wires around the straight portion of the other wire, and then do the same for the other wire. Repeat this for about four or five times.
4. Press ends of the wires down close to the straight portions of the wire to prevent the ends from piecing through the insulation tape.
5. Insulate the joint using the tape

Rattail joint/ Twisted sleeve joint

The rattail joint is usually used in the junction boxes. It allows the connection of branch or multiple circuits in buildings.

To create the joint,

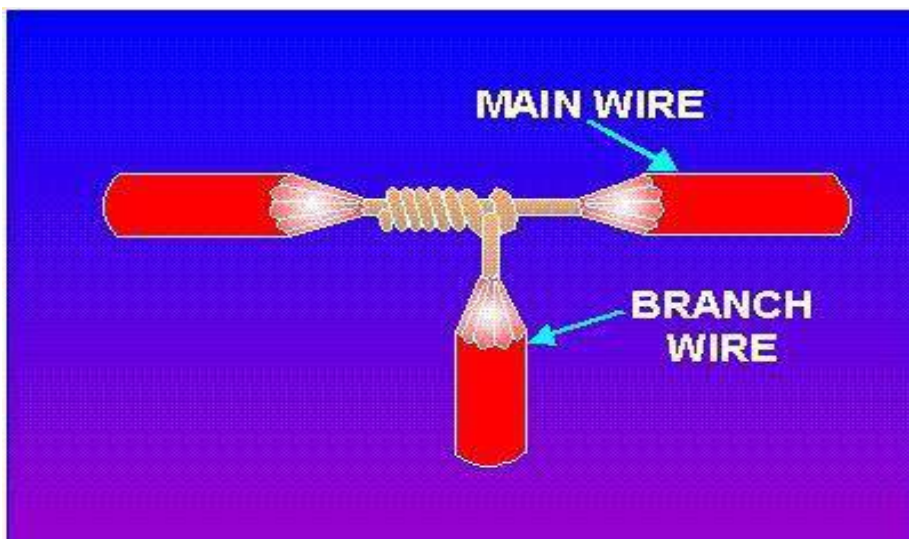
1. Strip the insulation off the ends of the cable to be joined
2. Twist the wires to create the rattail/ twisted effect



T joint

The T joint is used to for branch joints to connect a branch wire to a continuous wire.

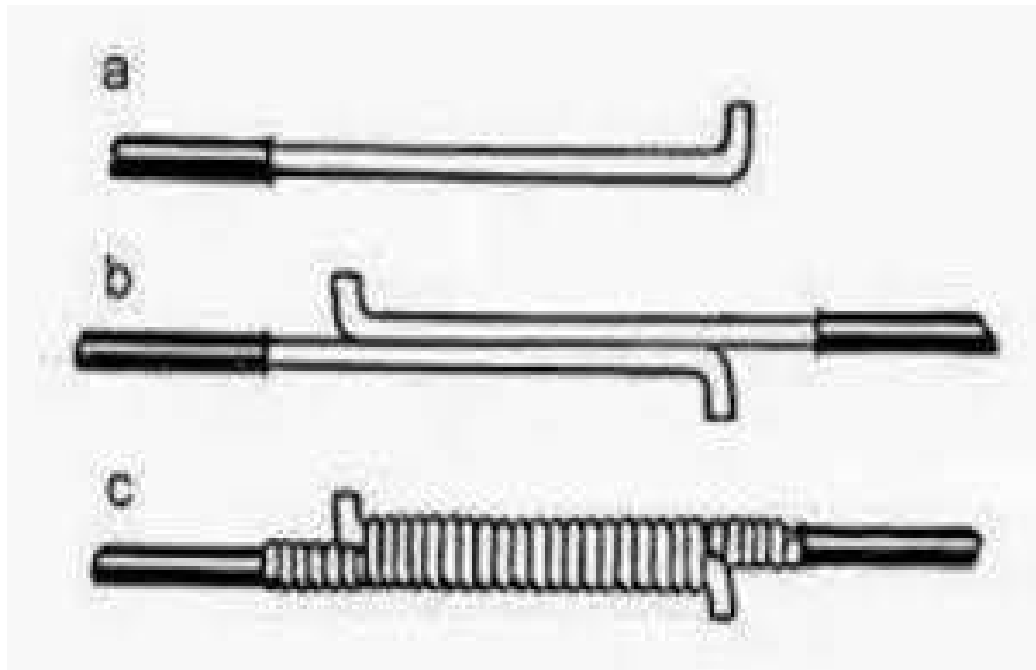
1. Remove about 1 inch of insulation from the main wire and about 3 inches from the branch wire.
2. Place the branch wire behind the main wire so that three-fourths of its bare wire extends above the main wire.
3. Bring the branch wire over the main wire, around itself, and finally over the main wire so that it forms a knot. Wrap the wire around the main conductor in short, tight turns and trim its end.



Britannia joint

The **Britannia joint** is a form of electrical **joint** used for bare overhead wires where great tensile strength is required.

1. The two wires are each tinned, and then each have a short shoulder bent in them, and are
2. then bound together with tinned wire before the whole is soldered.



Practical-3

Types of wiring

3.1 Casing-Capping Wiring

It is one of the oldest system of wiring and is still used in villages and remote areas. It can be of two types.

- (a) Wooden casing capping wiring.
- (b) PVC Casing Capping wiring.

PVC Casing Capping wiring: Increased cost of wood has brought PVC casing capping as a replacement to wooden casing capping system of wiring. PVC casing is similar to wooden casing having 2 to 3 grooves for laying of cables. It is fixed to wall or ceiling with PVC gutties and screws. Wires are laid in the grooves and is covered at the top with PVC capping.

Advantages

1. It is cheapest system of wiring.
2. Less chances of short circuit as phase and neutral wires run in separate groove.
3. Inspection and maintenance work can be done easily.
4. It is easy to install and rewire.
5. It can be used in wet conditions for a limited period.
6. It gives a better look than the wooden type.

Disadvantages

PVC becomes brittle after a gap of time and rewiring may be required.

3.2 Conduit Wiring

A conduit is a metallic pipe or PVC pipe used in electrical wiring system. A metallic conduit pipe is coated with black paint on the outer surface to save it from the effect of corrosion. Conduit is laid on the surface of wall or is embedded in the walls of building. Wires are then drawn with the help of 18 SWG steel wire through the conduit for the purpose of wiring. The conduit must be **mechanically and electrically** continuous and connected to earth at suitable points by use of earth wire. It is generally of following two types.

1. **Surface conduit wiring:** The conduit is used on the walls and then wire is drawn. Conduit is fixed to wall with the help of gutties, saddles, clamps and screws. Size of conduit depends upon the size and number of wires to be passed through the conduit. Accessories fitting used for conduit wiring are.

The types of wire used in conduit wiring is V.I.R or PVC.

- (i) Conduit couplers.
- (ii) Conduit bends.

- | | |
|---------------------------------|------------------------|
| (iii) Conduit Elbow. | (iv) Conduit bushings. |
| (v) Inspection bends and elbow. | (v) Junction Box |
| (vi) Inspection Box | (viii) Saddles. |
| (ix) Clips | (x) Conduit couplings. |

Advantages:

1. It provides complete protection against mechanical damage and fire.
2. It has a very long life span.
3. It is very reliable.

Disadvantages:

1. It is costliest wiring system.
2. Skilled labour is required hence, labour cost is more.
3. Location of fault and repair work is difficult.

Applications : Surface conduit wiring is mostly used in workshops, damp places, industries and fire hazardous places.

2. Concealed conduit wiring: In this conduit is laid inside the wall/ceiling while the construction work is in progress. Then the wall/ceiling is plastered, thus the conduit is not visible. Junction boxes, inspection box, inspection bends and elbows are available at the surface of walls. Wires are drawn through the conduit after the construction work is over and then connections are made.

Advantages:

1. It gives a very good look as no batten or pipe or wire is visible.
2. It is very safe against mechanical damage.
3. Atmospheric conditions have no effect on it
4. It has a very long Life.

Disadvantages:

1. Costliest system of wiring
2. It requires highly skilled labour due to which labour cost is high.
3. Location of fault is difficult.
4. Maintenance is not easy.

Application: Concealed conduit wiring is used in modern residential buildings, commercial complexes, cinema houses etc.

Wiring of main distribution board with four outgoing circuits for light and fan loads including main switch and fuses (only internal connection) Types of wiring and to make different light control circuits in the following types of wiring:

4.1 Casing capping wiring.

4.2 Conduit wiring (Surface and concealed)

Materials Required :

Tools Required

S. No.	Name	Quantity	Name	Quantity
1.	Energy meter	1 No.	1. Insulated plier 8"	1 No.
2.	Fuse	2 No.s	2. Screw Driver set	1 No.
3.	Switches 5A	10 No.s	3. Line Tester	1 No.
4.	Switches 15A	10 No.s	4. Hand Saw	1 No.
5.	Sockets 5A	10 No.s	5. Drill Machine 6mm	1 No.
6.	Three pin sockets 15A	10 No.s	6. Hammer 200 g	1 No.
7.	Earth wire	As required	7. Measuring tape	1 No.
8.	MCB	10 No.s	8. Cutter	1 No.
9.	PVC wire 1mm ²	2 Rolls		
10.	PVC wire 2.5 mm ²	2 Rolls		

Theory: A light & fan sub circuit can have a maximum load of 800 watts with the maximum number of points as 10. A power sub circuit can have a maximum load of 2000 watt. The maximum number of points in a power sub circuit can be 2. Power sub circuits contain 3 Pin 15 Amp. Socket outlet while light and fan sub circuits contain 3 Pin 5A socket outlet. The earth point of socket outlet must be connected to earth for the safety of operator/user.

Practical-4

Wiring of distribution board with four outgoing circuits

Procedure

1. Open the main switch. See the number of poles. It should have 2 poles for a single phase domestic supply,
2. Open the distribution box. See the number of sub circuits formed.
3. See the load connected in each sub circuit. See the number of points connected in a sub circuit. For a power sub-circuit, the max. number of points is two while in a light and fan sub circuit it can maximum 10 or 800 watt.
4. Verify that power sub-circuit is independent of light and fan sub-circuit.
5. See the earthing connection, body of main switch and distribution box must be earthed.
6. The earth pin of 3 pin socket outlet must be connected to earth.

Types of wiring: Electric current flows through conductors. Electrical wiring is done for safely carrying electrical energy at places of use.

The type of wiring to be done at a particular site (house, office, shop or industry) depends upon several factors. The various types of house wiring are as under.

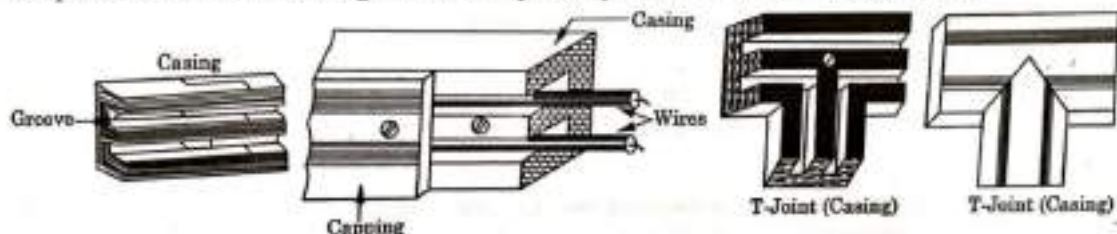
The various type of house wiring are as under:

1. Batten wiring or C.T.S. wiring.
2. Casing and capping wiring. It has two types:
 - (a) Wooden casing capping.
 - (b) P.V.C casing capping.
3. Cleat wiring.
4. Conduit wiring. It has also two types:
 - (a) Surface conduit wiring
 - (b) Concealed conduit wiring.

2. Casing and capping wiring: It has two type:

- (a) Wooden casing & capping wiring.
- (b) P.V.C. casing & capping wiring.

(a) Wooden casing and capping wiring: It is oldest system of wiring the casing and capping consists of teak wood and has two groves into witch the wires of opposite polarity are laid differently. The casing at the top is covered by capping witch is strip of wood of the same width as casing. The casing is placed 3.2 mm apart from the wall or ceiling by porcelain discs to protect the casing from dampness. The size of the casing to be used depends upon the number and size of cables.



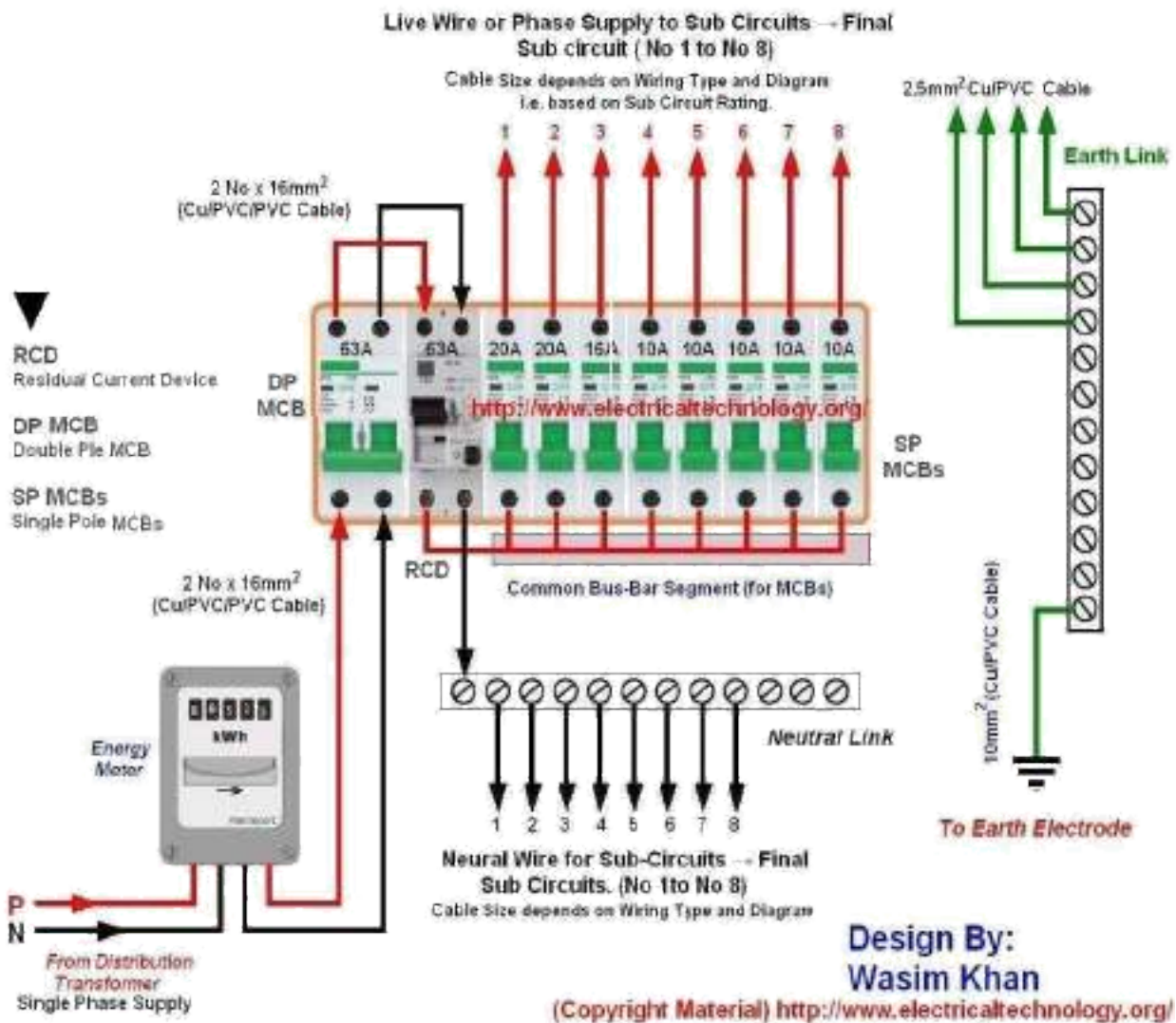
(b) **PVC casing capping wiring:** Increased cost of wood has brought PVC casing capping as a replacement to wooden casing capping system of wiring. PVC casing is similar to wooden casing having 2 to 3 grooves for laying of cables. It is fixed to wall or ceiling with PVC gutties and screws. Wires are laid in the grooves and is covered at the top with PVC capping.



Practical-5

Construction/Assembly of Distribution board and extension board

Wiring of the Distribution Board With RCD (Single Phase) Consumer Unit (From Energy Meter to the Main Distribution Board)



5.1 Construction /Assembly of Extension Board

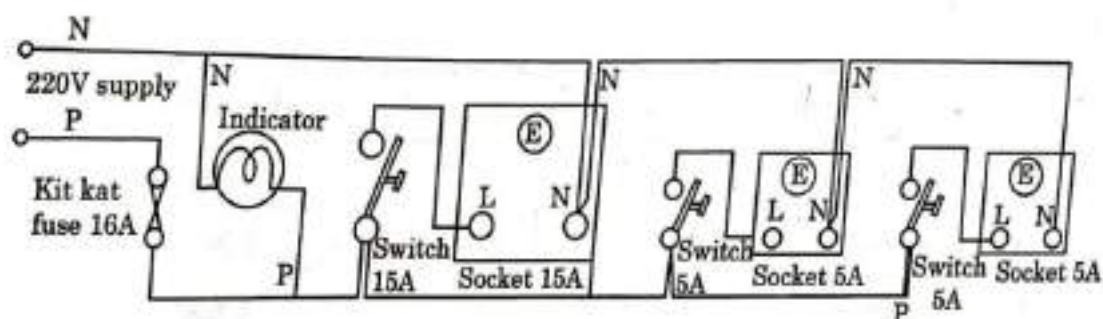
Tools and Apparatus Required

S. No.	Material	Tool	Qty
1.	Kitkat fuse 16 A	1. Screw Driver set	= 1 No.
2.	Indicator	2. Insulated plier 8"	= 1 No.
3.	Lamp holder	3. Cutter 6"	= 1 No.

S. No.	Material	Tool	Qty
4.	PVC wire	4. Line tester	= 1 No.
5.	Wooden Board 8" × 10"	5. Snipper	= 1 No.
6.	Bucklite sheet 8" × 10"	6. Hand drill M/C 6 mm	= 1 No.
7.	3 Pin socket 5 A	7. Drill bit set	= 1 No.
8.	3 pin socket 15 A	8. Hack saw	= 1 No.
9.	One way switch 5 A		= 2 Nos.
10.	3 pin socket 15 A		= 1 No.
11.	Insulation tape		= 1 roll

Procedure

1. Wire the extension Board.
2. Connect fuse in phase wire.
3. Always control the phase wire through fuse and switch not to be natural wire.
4. Connect the output of switches to 'L' marked terminals of each sockets.
5. Connect 'N' marked terminal to Neutral wire of supply.
6. Connect 'E' marked terminal to Earth wire.



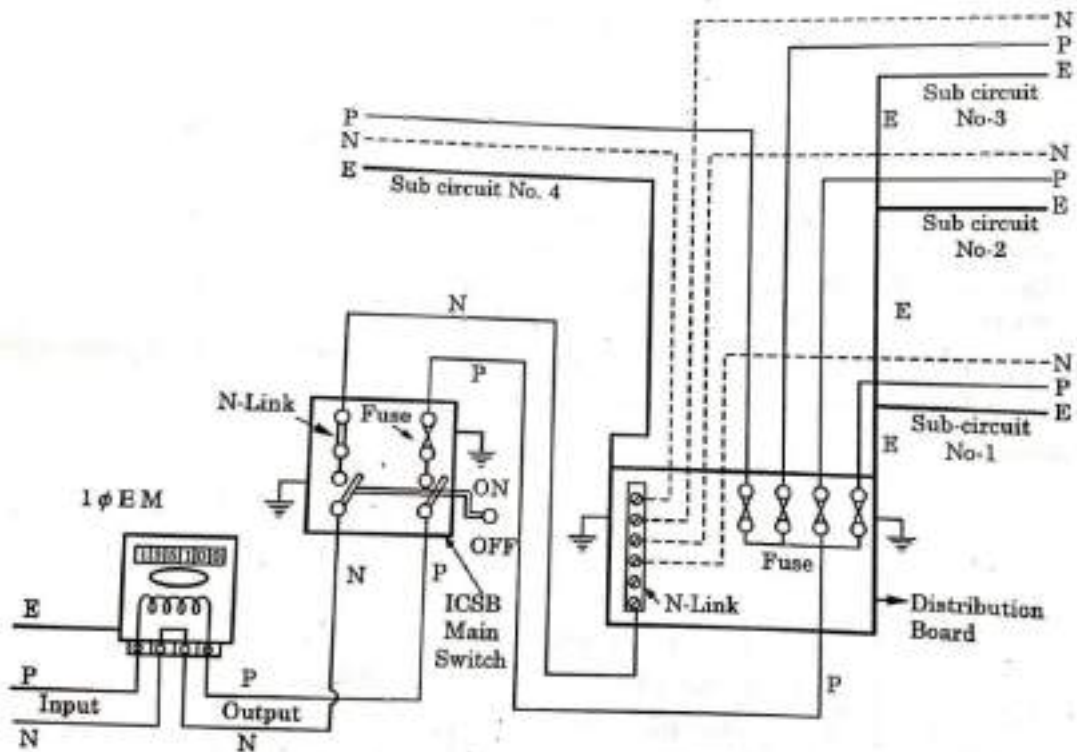
Wiring of main distribution board with four outgoing circuits for light and fan loads including main switch and fuses (only internal connections).

Apparatus

S. No	Name	Qty
1.	Energy meter 10-40A	1 No.
2.	Fuse	2 No.s
3.	Switches 15A	10 No.s
4.	Three pin switches 15A	05 No.s
5.	Switch 5A	10 No.s
6.	Three pin sockets 5A	05 No.s
7.	Earth wire	As required
8.	MCB	10 No.s
9.	PVC wire 1mm ²	2 Rolls
10.	PVC wire 2.5 mm ²	2 Rolls

Procedure

1. Open the main switch. See the number of poles. It should have 2 poles for a single phase domestic supply,
2. Open the distribution box. See the number of sub circuits formed.
3. See the load connected in each sub circuit. See the number of points connected in a sub circuit. For a power subcircuit, the max. number of points is 2, while in a light and fan sub circuit it is 10, or a maximum load of 800 watt.
4. Verify that power subcircuit is independent of light and fan subcircuit.
5. See the earthing connection, body of main switch and distribution box must be earthed.
6. The earth pin of 3 pin socket outlet must be connected to earth.
7. Insulation of wires should be sound.



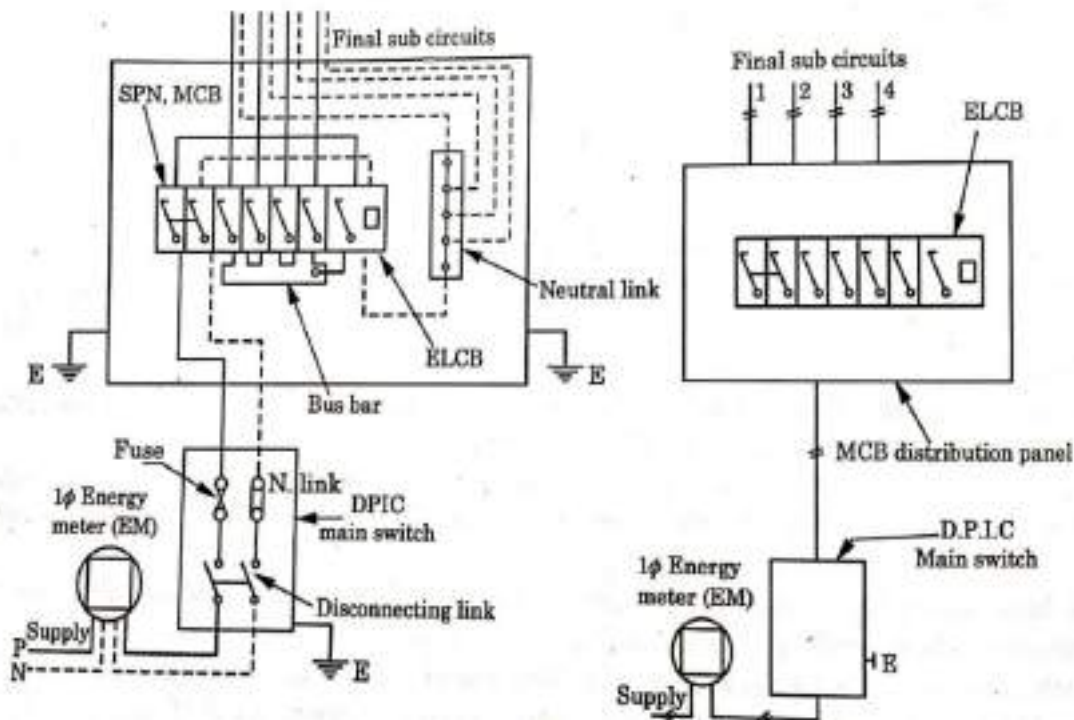
Construction/Assembly of distribution board using MCB, main switch and ELCB.

Tools and Apparatus Required:

S. No.	Name of item	Qty.
1.	Plier Insulted 8"	1 No
2.	Screw Drawer set	1 No set
3.	Cutter 6"	1 No
4.	Knife	1 No
5.	4-way Distribution Board	1 No
6.	D.P. I.C. (main switch)	1 No
7.	ELCB	1 No
8.	DPMCB	1 No
9.	Wire	As per requirement
10.	Wooden Board	1 No

Procedure

1. First connect DPMCB/SPN MCB on the wooden/metallic base with the help of gutties, plier and screw driver.
2. Next connect the ELCB, DPIC (main switch) on the Board.
3. Now connect the wires for interconnecting the SPN MCB, ELCB, DPIC and complete the circuit.
4. Connect the main fuse with the energy meter and check the continuity of the circuit as shown



Practical-6

Simple light and Alarm circuits

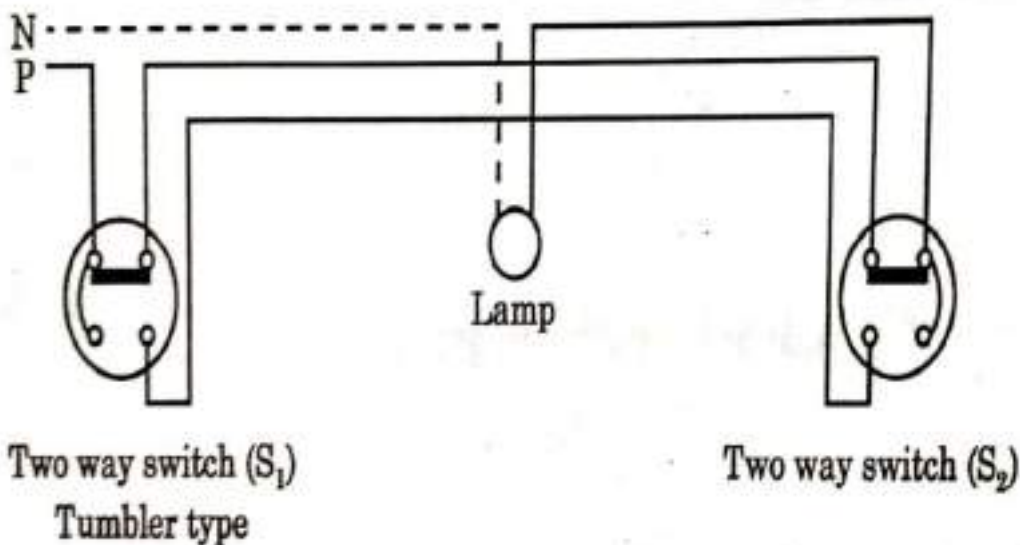
One lamp controlled by two switches (staircase circuit)

Procedure:

1. Connect the lamp and 2 Nos. two way switches as shown in fig. 6.2.
2. Move the contacts of switches 1 and 2 to different positions and observe the status of bulb

Procedure:

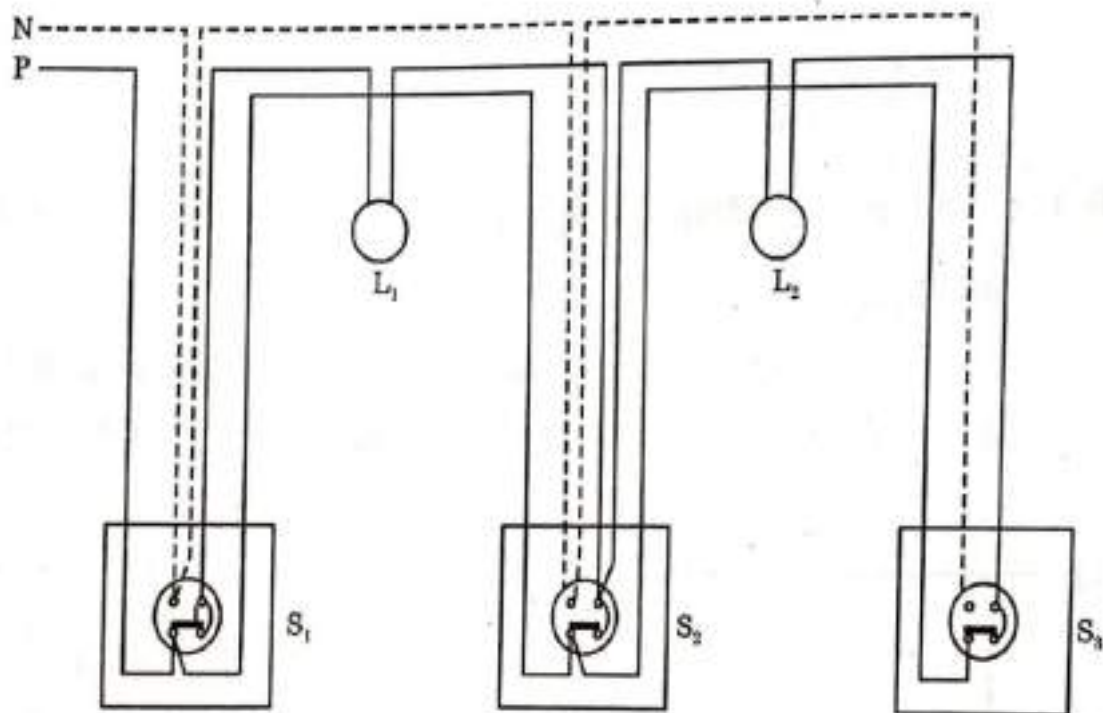
1. Connect the lamp and 2 Nos. two way switches as shown in fig. 6.2.
2. Move the contacts of switches 1 and 2 to different positions and observe the status of bulb.



Two lamps controlled by three switches (double staircase circuit)

Procedure:

1. Connect the two lamps and three nos. two way switches as shown in circuit of fig. 6.4.
2. Move the contacts of switches 1, 2 and 3 to different positions and observe the status of bulbs.



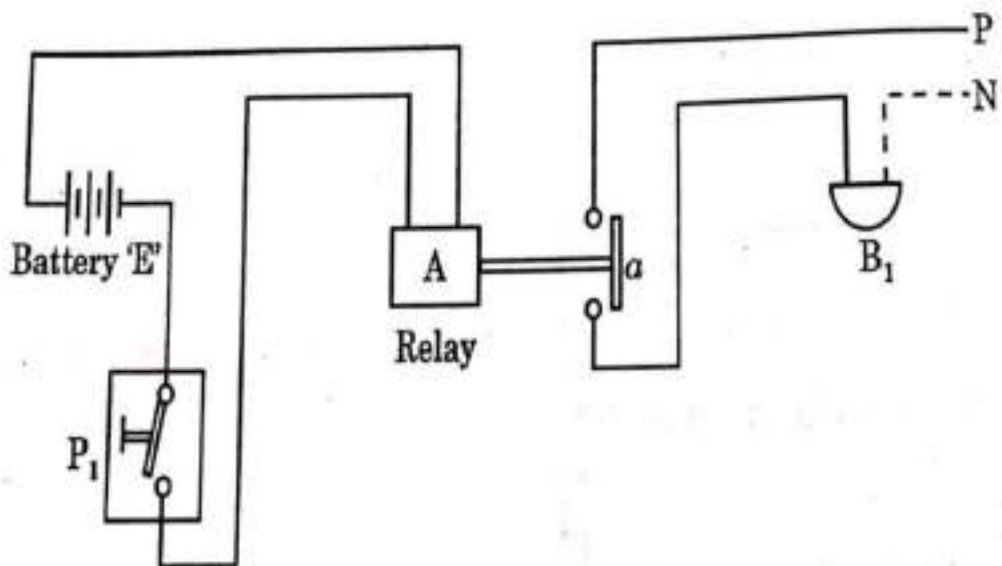
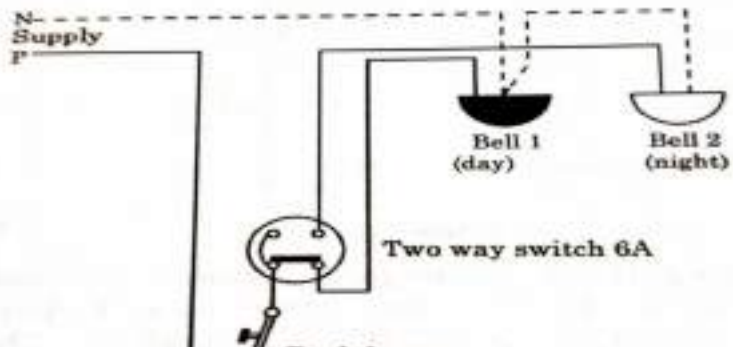
**Fig. 6.4(a): Wiring diagram (Double stair case wiring)
(Using tumbler type switch)**

3 Two ordinary bells (for day and night) used at a *distant residence*

Two ordinary bells (for day and night) used at a distant residence

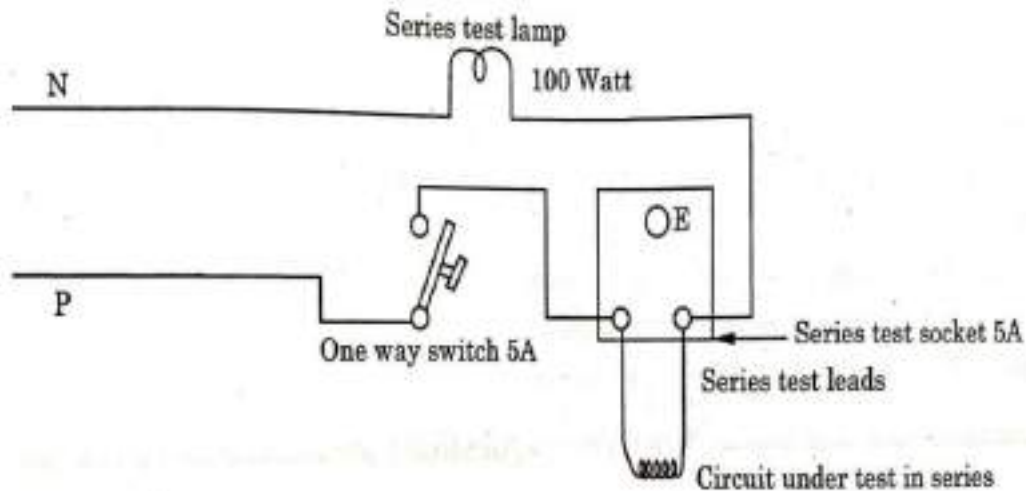
Procedure :

1. Connect the two nos. ordinary bells along with push button and one no. two way switch as shown in circuit of fig. 6.6 and 6.7.
2. Press the push button and observe which bell rings.
3. Press the push button and change the position of two way switch and observe which bell rings.



Practical-7

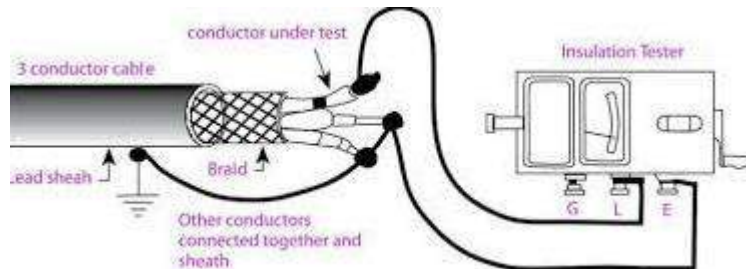
Wiring of a series test lamp board and to use it for finding out simple faults



Procedure:

- 1. If the supply is not available to the house wiring circuit**
 - (a) Check meter fuse. Replace if it is blown.
 - (b) Check main switch fuses.
 - (c) Check fuses in that particular circuit in the distribution box. Replace the fuses blown.
- 2. Check availability of supply at the input and output terminals of main switch** It is possible that main switch contact may not be proper or there may be carbon deposit at these terminals due to sparking.
If so, remove the carbon with a sand paper. Set right the moving contacts strips main switch.

Practical 8: USING MEGGER FOR DOMESTIC WIRE TESTING



1. Ensure that each circuit branching out of Main Switch board has a connected load of not more than 800 watts or 10 points
2. Test for Insulation resistance of conductor and earth to be as per IEC specifications
3. Electrical resistance from connection with Earth electrode should not be more than one ohm
4. Ensure metallic covering of iron clad switches, distribution boards are properly earthed
5. Test that that leakage current is less than $1/5,000$ of maximum supply current.

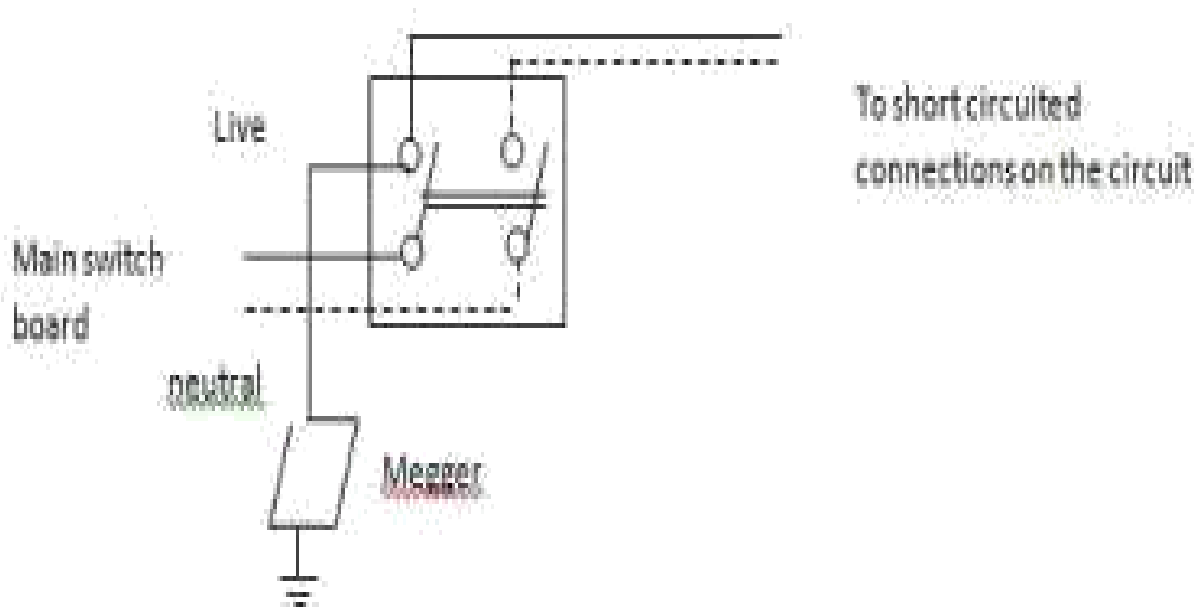
Key Tests to be performed for Wiring Installations

1. Insulation Resistance Test:

In this test, the insulation resistance of a wire is tested to ensure that there is no leakage current flowing through it. As per IE rules, the insulation resistance between wiring and earth should not exceed $1/5,000$ of the current flowing through it.

1. The test is performed using “Megger” instrument.
2. In this, main switch is put in OFF condition and all the lighting connections on the circuit are short circuited.

3. The Megger is connected between line and the earth.
4. Megger is then rotated to generate voltage and then the reading on the dial of Megger is noted.



If the result value is more than 1 then it should be considered as 1 mega-ohm. In no case this value should be less than 0.5 mega ohm. The insulation resistance should not be less than 50 Mega-ohm divided by no. of circuits. The insulation resistance per circuit is calculated as

$$50M$$

2. **Earth Continuity Test:**

This is second most important test for safety of installation.

All metal clad switches, metal parts, covers, conduits must be solidly connected to earth. In absence of this, there could be a severe damage to the whole electrical installation, appliances connected to it. In adverse events, the leakage current flowing through it may cause severe electrical shock to the person coming in physical contact with it.

1. In order to test this, the main switch should be in open position.
2. All other circuit contacts like bulbs and switches should be ON position.
3. The Earth continuity tester is then connected between the switch / conduit and an independent earth.
4. The tester will indicate the value of resistance. In all cases the value should not exceed more than 1 ohm. If the value appears higher than 1 ohm it indicates that the switch / conduit is not properly earthed.

Practical: 9 FLUORESCENT LAMP WIRING

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

Tools Required: 1. Screw driver 2. Hammer 3. Pliers 4. Line tester
 Components Required: 1. Tube light with fitting Joint clips 4. Switch
 2. 3. 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:

CIRCUIT DIAGRAM - TUBE LIGHT

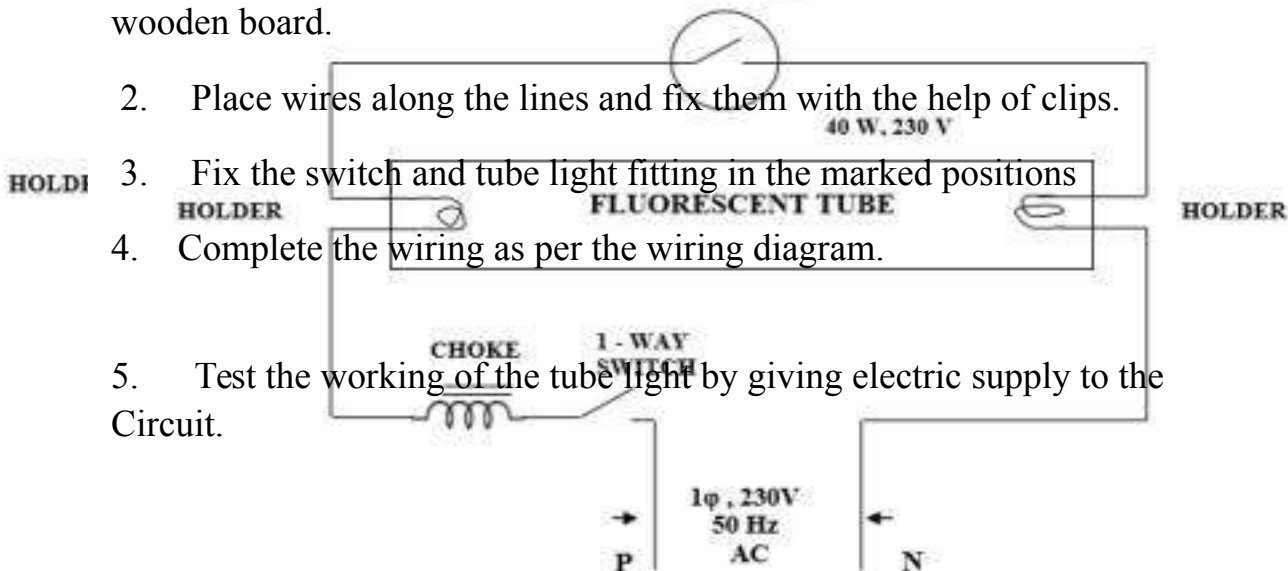
1. Mark the switch and tube light location points and draw lines for wiring on the wooden board.

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.



If the result value is more than 1 then it should be considered as 1 mega-ohm. In no case this

FLUORESCENT TUBE

1^Φ, 230V 50 Hz AC HOLDER

40 W, 230 V

FLUORESCENT TUBE

HOLDER

CHOKE 1 - WAY SWITCH

STARTER

Result: The wiring for the tube light is completed and tested

