HIGHER SECONDARY FIRST YEAR
VOCATIONAL EDUCATION

BASIC ELECTRICAL ENGINEERING PRACTICAL

Untouchability is Inhuman and a Crime

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Department of School Education
We are living in a modern world where all the systems are interconnected and interdependent with electrical sciences. By the year 2050, the demand of electrical energy is double or even become triple due to the advancement in modern technology. Now-a-days affordable practical knowledge is essential in the field of electrical for better understanding of electrical appliances.

This practical book has been written primarily for the students and is designed to serve the introductory part of the subject electrical engineering in school education under vocational stream for practical purpose. The basic concept of electrical science are explained with neat diagrams for better understanding to the students.

The Basic Electrical Engineering practical book has been written with the inspiration and interaction of scholars in electrical fields in India and abroad. The resource materials and ideas for making the book is obtained from experts in the field of electrical engineering in and around the country to meet the curriculum to international standard. The design of the book is based on bloom's taxonomy which is a learning tool for all students. This practical book obviously motivate the student for better understanding. The contents of this book are mainly confined to the content of syllabus fulfilling the objectives.

I along with team members originally undertook the task of writing the practical book for the vocational group students as basic subject in the field of electrical engineering due to the knowledge which have experienced in three decades. My experience in teaching, taught me two things about students; need of better understanding of concepts and relating the concepts to the life cycle. This intention forced me in making this book as effective one as a learning material for the vocational group students. As a result, the students will definitely follow along with the subject teacher in demonstrating an example in handling practical classes. I hope this book will definitely satisfy the primary needs of the student’s community to pursue secondary level courses.

Myself with our subject experts team have provided this practical book a more knowledgeable and readable on fulfilling the needs of students. Consequently, the teacher will feel more comfortable using the book, because it reflects the electrical engineering concepts in a pedagogy way. I would like to extend my sincere appreciation to the faculty from various academic institutions for the improvement of this practical book writing.

Finally, it is an immense pleasure to express the gratitude and sincere thanks to all of them who given this opportunity to take part in writing the book for vocational stream students.

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CLASS XI

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1

STUDY OF HAND TOOLS FOR WIRING

Do not wait for opportunity. Create it

12th
11th
10th
9th
8th
Aim

Usually, in the field of electricity, so many electric tools (both hand and machine tools) are now-a-days being utilised. A person becomes more efficient, when he knows the proper way of handling the tools. In domestic side, repairs, maintenance and electrical wiring work, various types of hand tools are used. In this topic, Line diagram is given to know about the study of hand tools for wiring purpose.

Cutting Plier

Uses

It is made up of forged steel and is used for cutting, twisting, pulling, holding and gripping small jobs in wiring assembly and repairing work. Non-insulated plier is also available. Insulated pliers are used for work on live lines.
They are specified with their overall dimensions of length in mm. Mostly, the pliers used for electrical work will be of insulated grip.

Long Nose Pliers

Uses

Long nose pliers are used for holding small objects in places where fingers cannot reach.
Round Nose Plier

Uses

Wire hooks and loops could be made using the round nose pliers.
Cutter

Uses

It is used for cutting copper or aluminium wires having smaller diameter.
Care and Maintenance of Pliers
1. Do not use pliers as hammers.
2. Do not use pliers to cut large size of copper or aluminium wires and hard steel wires of any size.
3. While using the pliers avoid damage to the insulation of hand grips.
4. Lubricate hinged portions.

Screw Driver

Uses
Screw drivers are used for tightening or loosing screws. The screw driver tip should snugly fit the grooves of the screw to have maximum efficiency and to avoid damage of the screw heads. The screw driver is used for electrical works, generally have plastic handles and the stem is covered with insulating sleeves. As the length of the screw driver is proportional to the turning force, for small work choose a suitable small sized screw driver.
Electrician Knife

Uses

It is used for removing the insulation of cables and cleaning the wire surface. One of the blade having sharp edge is used for skinning the cable and rough edged blade is used for cleaning the surface of wires.
Line Tester

Uses

It consists of a glass tube filled with neon gas and electrodes at the ends. To limit the current within 300 micro-amps at the maximum voltages, a high value resistance is connected in series with one of the electrode. It may have tip like probe or like screw driver at one end. The presence of supply is indicated by the glow of the lamp. When the tip is touched on the live supply and the brass contact in the other end of neon tester is touched by hand, then completes the circuit and the neon bulb will glow.
Ball Peen Hammer

Uses

The hammer is made up of special steel and the striking face is tempered and is used for nailing, straightening and bending work. The handle is made up of hard wood.
Rawl Jumper

Uses

A rawl plug tool has two parts, namely the tool bit and holder. The tool bit is made of tool steel the holder is made of mild steel. It is used for making holes in bricks, concrete wall and ceiling. Rawl plugs are inserted in them to fix accessories.

Pipe Jumper

Uses

A pipe jumper is used along with a hammer to make holes in wall which is required for wiring. The diameter of the pipe jumper depends upon the diameter of the pipe to be accommodated in wall, and the length depends upon the wall thickness.
Mallet

Uses

It is made up of hard wood or nylon. It is used for driving the firmer chisel for straightening and bending of thin metallic sheets. Also it is used in motor assembly work.
Try Square

Uses

It is used to check whether the object is plane, perpendicular or at right angle. Two straight blades set at right angle to each other constitute the try square. The steel blade is riveted to the stock. The stock is made up of cast iron. The stock should be set against the edge of the job.
Measuring Steel Tape

Uses

The measuring tape is made up of thin steel blade, bearing dimensions on it. It is used for measuring the dimension of the wiring installation and general measurements.
Hacksaw

Uses

It is made up of a sturdy nickel plated steel frame. The frame can be adjusted between 250mm to 300mm blades. It should be fixed on the frame with its teeth pointing away from the handle in order to the cutting in forward stroke. It is mainly wood saw (or) tenon saw.

Generally the length of a tenon saw is 250 to 300mm and has 8 to 12 teeth per 25.4mm and the blade with 10cm. It is used for cutting thin, wooden accessories like wooden batten, casing capping, boards and round blocks.
Pincers

Uses

It is used for extracting nails from the wood. The size is given by its length, e.g. 100mm, 150 mm and 200 mm.
Firmer Chisel

Uses

It has a wooden handle and a cast steel blade of 150mm length. Its size is measured according to the width of the blade, e.g: 6 mm, 12 mm, 18 mm or 25 mm. It is used for chipping, scrapping and grooving in wood.
Poker

Uses

It is a long sharp tool used for making pilot holes on wooden articles to fix screws.

Spanner - Double Ended

Uses

The size of a spanner is indicated so as to fit on the nuts. They are available in many sizes and sharps.
The sizes indicated in double-ended spanners are

10 – 11 mm
12 – 13 mm
14 – 15 mm
16 – 17 mm
18 – 19 mm
20 – 21 mm

Spanner sets are used for loosening and tightening of nuts and bolts. It is made of cast steel. They are available in many sizes and may have single or double ends.

**Ring Spanner**

**Uses**

The ring spanner is used in place where the space is restricted.
Centre Punch

Uses

The size of the centre punch is given by its length and diameter of body, e.g: 100×8 mm. The angle of tip of the centre punch is 90°. It is used for making and punching pilot holes on metals. It is made of steel and the ends are hardened and tempered.

Hand Drill

Uses

A hand drill machine is used for making holes in thin metal sheets or wooden articles.
Electric Drill

Uses

When power is available, power drilling machine is more convenient and an accurate tool for drilling holes on wooden and metal articles.
STAY AWAY FROM TRANSFORMERS
Dreams is not what you see in sleep is the thing which doesn't let you sleep

- A.P.J. Abdul Kalam
Aim
To study the basic components of house wiring, safety devices, house wiring rules as per ISI-specification and safety measures of electrical wiring.

Components of Basic Electrical Wiring
Besides safety precautions and regulations, the main thing want to familiarise the design of house wiring. It consists of three basic components:

➢ Service Entry
This refers to service wire (which brings power supply) from the main grid or pole to house and the Energy meter. The service entry is critical and there are a few things to keep in mind. First of all, make sure all service line are at least 10 feet above the ground, inaccessible from windows, and free of obstructions such as tree limbs. Besides that, make sure your service entry is properly installed so that no water can penetrate the access point or meter. Any changes or fault rectification in this area must be done by the service provider i.e, T.N.E.B.

➢ Panel Board
Panel board is the control centre for electrical wiring. It consists of Main switch and Distribution fuse board. Now-a-days new safety devices Double Pole MCB instead of Main Switch and Single Pole MCB instead of distribution fuse were used. While installing an Air conditioner, Heater, Washing machine or running wiring to a new addition, ensure electricity is switched off before starting the work, and where you install new breakers.

➢ Branch Circuits
Calculate total load of various electric points used in house, and the wiring should be carried out on distribution systems with branch circuits. Each branch circuit must have light circuits not exceeding 10 points or 800 watts, if power wiring circuit not more than 2 points and AC 1 point. This refers to isolate the areas of house from panel board. For instance, you cut power to your kitchen while the rest of the house is in operation.
Safety Devices

Fuse

Fuse and circuit breaker prevent overheating of wires and protect all electrical equipments. If the current through fuse is greater than its specified rating, it gets fused. This breaks the circuit and stops the current, making the equipment safe.

Safety points regarding fuse are:

- Always use the correct rating of fuse. For example, if the circuit is of 10 Amp capacity, the fuse rating must be 150% i.e. 15 amp.
- Always use the correct size of fuse, keep the old one to check.
- Never replace the fuse with bare wire. It will not be safe.
- Do not increase the fuse capacity for preventing or eliminating frequent fuse blow-ups. Instead it is essential to locate the causes and eliminate the same.
- Circuit Breakers are fuses that have buttons or switches for reset. Thus they do not normally need replacing.
Wiring of the Distribution Board with RCD (Single Phase Consumer Unit) 
(From Energy Meter to the Main Distribution Board)

Miniature Circuit Breakers (MCB)

Miniature Circuit Breakers are gaining increasing prominence in household, labs and distribution wiring in shops & commercial establishments. MCB is an electromagnetic device that embodies complete enclosure in a moulded insulating material. MCB works as
circuit breaker in case of overload/short circuit. It has an advantage since no replacement is required and it can be reset on elimination of fault and switched ON again. The main function of an MCB is to switch the circuit, i.e., to open the circuit (which has been connected to it) automatically when the current passing through MCB exceeds the value for which it is set. It can be manually switched ON and OFF as similar to normal switch if necessary. MCBs are of time delay tripping devices, to which the magnitude of over current controls the operating time. This means, these get operated whenever overload exist long enough to create a danger to the circuit being protected. Therefore, MCBs doesn't respond to transient loads and motor starting currents. Generally, these are designed to operate within 2.5 milli seconds during short circuit faults and 2 seconds to 2 minutes in case of overloads (depending on the level of current). MCBs characteristics are:

- Rated current up to 100 A
- Trip characteristics are not normally adjustable
- Thermal or Thermal-Magnetic operation

<table>
<thead>
<tr>
<th>MCB Type</th>
<th>Minimum Trip Current</th>
<th>Maximum Trip Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type B</td>
<td>3 Ir</td>
<td>5 Ir</td>
</tr>
<tr>
<td>Type C</td>
<td>5 Ir</td>
<td>10 Ir</td>
</tr>
<tr>
<td>Type D</td>
<td>10 Ir</td>
<td>20 Ir</td>
</tr>
</tbody>
</table>
**MCCBs**

Moulded Case Circuit Breakers are used for commercial purposes. Its characteristics are:

- Rated current up to 1000 A
- Trip current may be adjustable
- Thermal or Thermal-Magnetic operation

**ELCBs**

Earth Leakage Circuit Breaker works as a circuit breaker in case of only earth leakage.

- Phase (Line), Neutral and Earth wire are connected through ELCB
- ELCB is working based on earth leakage current

**RCD/RCCB**

Residual Current device (RCD)/Residual Current Circuit Breaker(RCCB) which works as a circuit breaker in case of an earth leakage, over load or short circuit. It is used for protection against electric shocks.

It's Characteristics:

- Phase (Line) and Neutral both wires are connected through RCD.
- It trips the circuit when an earth fault occurs.
- The amount of current flowing through the phase should return through neutral. Any mismatch between two currents flowing through phase and neutral is detected by RCD and trips the circuit within 30 milliseconds.
- RCDs are an extremely effective form of shock protection.
House Wiring Rules as Per ISI Specification

In construction of a house, the owner should focus on electric works, which need a lot of attention while laying wiring as well as quality of wiring, specification of electric appliances and cables/wires. Always plan to work exactly where the outlets, switches and fixtures are going to be placed. This also allows to check the appropriate tools and materials are in sufficient quality. Calculate the total load from various items that would be used in the house and select the proper conductor that is capable of withholding the total load and distribute accordingly.

Care should be taken while fitting pipes, junction boxes, fan hook boxes in RCC slab and walls. If any fault happens, it may cause any incident and may require dismantling of the defective portion. So take proper care to avoid dismantling which is very costly in comparison to get them fixed properly earlier. To avoid an electric shock, the following precautions must be kept in mind. Therefore the following rules laid down by the Indian Standard Institution should be followed. Few of them are listed below for your guidance.

- The wiring should be carried out on distribution systems with main and branch distribution boards.
- All conductors should run along walls and ceiling, so that they are easily accessible and capable of being thoroughly inspected. In any case, wiring should not be run above ceiling.
- Horizontal run of wiring should be at a height of 3 metre. Switch Boards should be fitted at a height of 1.5 metre.
- Fuse wire should be connected with phase only. Connect all switches with phase wire. Connect the neutral link in neutral wire.
- One circuit means, one connection from electrical meter or main fuse board. The number of points in light circuit should not exceed 10 (or) total load on circuit should not exceed 800 Watts.
- All conductors should be made of copper and should be stranded. They should have a cross section less than 0.002 square inches, nominal area (3/0.029 inches).
- For Power wiring circuit, the size of wire should be 1.5 mm square for copper and 2 mm square for aluminium.[One power circuit = (three 5 amp socket) or (two 15 amp socket) or (one 15 amp socket + two 5 amp socket) or (one Alternating current circuit)]
- Never use damaged insulation, for wiring. It avoid short circuit and overloading, with the use of MCB and save the electrical appliances.
- Burnt element, cut/broken wiring, loose/open connection should be avoided.
- Earthing means to connect electrical system to general mass of earth to ensure immediate discharge of electrical energy without danger. Provide earth connection to enhance voltage and protect human beings from sudden electric shock. Earth wire should be 14 SWG in case of copper and 4 mm square in case of Aluminium.
➢ All materials used in electrical fitting should be of approved quality of make and from a reputed manufacturer as per ISI specification.

➢ For low power operations 5 Ampere small size sockets, and for heavy power operations 15 ampere large size sockets should be used. Multi-plug adaptors are used for temporary usage only i.e., for a short period of time. No socket or extension box should be overloaded.

➢ Most of the imported equipments function in two different settings 110-120V and 220-240V. These equipments have switch for setting the input supply voltage. Hence, make sure that the switch in equipment is in 220-240V position.

➢ The wiring of a plug is colour coded to help guard against electrical accidents. The colour codes in India as per Indian Electricity Rules are: Phase (Line) is Red, Blue or Yellow, Neutral is Black and Earth (Ground) Green or Green with Yellow lines.

➢ If there are only two wires in the power cable, no earth connection is required. If there are three conductors then the equipment needs to be earthed properly.

➢ Always make sure that the earth wire is longer than the other two so that if the cable is accidently pulled out of the plug, the earth wire is the last wire to become disconnected.

Electrical Safety

Appliances have three safety devices:
• The fuse.
• The earth wire.
• The switch.

These devices are designed to stop you from being electrocuted and to prevent the appliance from being damaged.
Safe Work Practices

While operating the electrical circuits and handling the hand tools, the following safety measures should be taken.

1. **Avoid** contact with energized electrical circuits.
2. **Disconnect** the power source before servicing or repairing electrical equipment. Leave a note that you are working. Tape the circuit breaker in OFF position (or) Pull the fuse carrier, while working.
3. Use **Tester** to make sure of electrical connection is live or not. Even though fuse is pulled there may be supply from U.P.S or Auto Generator. So ensure it carefully.
4. Use **tools** and equipment only with insulated handles when working on electrical devices. Make sure that all the tools are provided before commencing the wiring. Example are Tester, Cutting plier, Screw driver, Hammer, Jumper, Electric Drill, Colour insulation tapes, Wire Stripper etc.,
5. Never use metallic pencils or rulers, or wear rings or metal watchbands when doing work with electrical equipment.
6. When it is necessary to handle equipment that is plugged in, be sure hands are dry and when possible wear non conductive **gloves & shoes** with rubber soles.
7. If it is safe to do so, work with only one hand, keeping the other hand at your side or in your pocket, away from all conductive material.

8. Equipment producing a “tingle” should be disconnected and reported promptly for repair.

9. Drain capacitors before working near them and keep the short circuit on the terminals during the work to avoid electrical shock.

10. When it is necessary to touch electrical equipment (for example, when checking for overheated motors), use the back of the hand. Thus, if accidental shock were to cause muscular contraction, you would not “freeze” to the conductor.

11. Do not rely on grounding to mask a defective circuit nor attempt to correct a fault by inserting another fuse or circuit breaker, particularly one of a larger capacity. Before replacing a fuse or circuit breaker, check the problem that caused earlier was rectified.

12. Insulate all electric contacts and conductors. Never splice wires together and conceal them within a wall without a junction box. An accessible junction box should always be used to join wires.

13. Never use an aluminium or steel ladder while working on any receptacle at height in your home. An electrical surge will ground and the whole electric current will pass through the body. Use only bamboo, wooden or a fibre glass ladder for electrification work.

14. Do not store highly flammable liquids near electric supply.

15. Minimize the use of electrical equipment in cold rooms or other areas where condensation is likely.

16. Keep the length of extension cords to restricted length.

17. Unplug cords by gripping the plug and, do not by pulling the cord.

18. Do not wear loosed clothing or ties near electrical equipment.

19. If a person was affected by an electric shock, immediately disconnect the power source of the circuit breaker or pull out the plug using a leather belt.

20. Never work on live equipment.

21. De-energize open experimental circuits and equipment to be left unattended.

22. Never use equipment with frayed cords, damaged insulation or broken plugs.

23. Be aware that interlocks on equipment disconnect the high voltage source when a cabinet door is open, but the power for control circuits may remain ON.

24. Try to cover the live wire with cap while working on circuit panels. The cap acts as an insulation and helps to prevent electric shock.
3

VERIFICATION OF OHM’S LAW

“Don’t wait
The time will
NEVER
be just
right”
Aim

To determine the resistance value of two given coils of wire by using Ohm’s Law.

Apparatus Required

<table>
<thead>
<tr>
<th>S No</th>
<th>Name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Battery -12V</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Plug Key</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Rheostat</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Resistances</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Voltmeter - 0-10V</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Ammeter - 0-1A</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Connecting Wires or Cord</td>
<td>As Required</td>
</tr>
</tbody>
</table>

Connection Diagram

Ohm’s Law

At constant temperature, the current flowing through the conductor is directly proportional to the voltage across it and inversely proportional to the resistance of the conductor.

\[ I = \frac{V}{R} \]

Where

\[ V = I \times R \]

\[ R = \frac{V}{I} \]

\[ \text{Where} \]

\[ V = \text{Voltage in volts} \]

\[ I = \text{Current in amps} \]

\[ R = \text{Resistance in ohms} \]
**Procedure**

- The first coil $R_1$ is connected as shown in the circuit diagram.
- After checking the connection, close the plug key.
- Adjust the rheostat.
- The corresponding voltmeter and ammeter readings are noted and are tabulated.
- By using the formula $R_1 = \frac{V}{I}$, the value of resistance is determined.

- Similarly, the second coil $R_2$ is connected as shown in the circuit diagram.
- After checking the connection, close the plug key.
- Adjust the rheostat.
- The corresponding voltmeter and ammeter readings are noted and are tabulated.
- By using the formula $R_2 = \frac{V}{I}$, the value of resistance is determined.

To Find $R_1$

<table>
<thead>
<tr>
<th>S No</th>
<th>Ammeter reading ‘I’ in ampere</th>
<th>Voltmeter reading in ‘V’ volts</th>
<th>Resistance $R_1 = \frac{V}{I}$ Ohms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mean $R_1 = \text{_______________}$
To Find $R_2$

<table>
<thead>
<tr>
<th>S No</th>
<th>Ammeter Reading 'I' in ampere</th>
<th>Voltmeter reading in 'V' volts</th>
<th>Resistance $R_2 = \frac{V}{I}$ Ohms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mean $R_2 = \underline{\phantom{\frac{\text{}}{\text{}}}}$

**Result**

The resistance of two coils of wire $R_1 = \underline{\phantom{\frac{\text{}}{\text{}}}}$ Ohm

$R_2 = \underline{\phantom{\frac{\text{}}{\text{}}}}$ Ohm
PREPARATION OF APPLIANCES TEST BOARD

"ALWAYS do your BEST. What YOU plant NOW, you will HARVEST Later."
Aim

To learn and to prepare an appliances test board and also know, how to test domestic appliances using it.

Tools Required

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Screw Driver</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Cutting Plier</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Tester</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Electrician Knife</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Poker</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Drilling Machine</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Ball Peen Hammer</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Hack Saw Frame</td>
<td>1</td>
</tr>
</tbody>
</table>

Materials Required

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wooden Board -12&quot; x 18&quot;</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Fuse Unit - 16A, 240V</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Ammeter - 0-5A</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Voltmeter - 0-300V</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Lamp - 200W</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Three Core Power Cord</td>
<td>5 metre</td>
</tr>
<tr>
<td>7</td>
<td>1/18 Copper Wire</td>
<td>3 metre</td>
</tr>
<tr>
<td>8</td>
<td>Indicating Lamp</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Lamp Holder</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>One Way Switch</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>Five Pin Socket</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>Three Pin Plug 16a, 240V</td>
<td>1</td>
</tr>
</tbody>
</table>

Connection Diagram

Test Board
Connection Procedure
1. Provide holes in the wooden board at the required places wherever necessary.
2. Fix the switches, socket, fuse indicator, ammeter and voltmeter properly.
3. Give connection to all accessories as per the connection diagram.
4. Connect the power cord properly.

DO YOU KNOW?

Testing Procedure
1. Connect the given appliances to the test lamp by series.
2. Lamp lighting and faults

<table>
<thead>
<tr>
<th>S No</th>
<th>Lamp Lighting</th>
<th>Fault</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Glows Dimly</td>
<td>No fault. Appliance “Good”.</td>
</tr>
<tr>
<td>2</td>
<td>Glows Brightly</td>
<td>Short circuit fault</td>
</tr>
<tr>
<td>3</td>
<td>If not Glow</td>
<td>Open circuit fault</td>
</tr>
</tbody>
</table>

3. After rectifying all the faults, connect the appliance parallel to the supply and find out the value of current and voltage
   1. Current = __________
   2. Voltage = __________

Result
I have known the method of preparing an appliances test board and also known the method of testing all the appliances by using test appliance board.
And also I have tested the value of current and voltage by ammeter and voltmeter respectively. The value of
   1. Current = __________
   2. Voltage = __________
ONE LAMP CONTROLLED BY A REGULATOR

All power is within you; you can do anything and everything.

- Swami Vivekananda
Aim

To learn about one lamp controlled by one regulator in various position.

Tools Required

<table>
<thead>
<tr>
<th>S No</th>
<th>Name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Screw Driver</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Cutting Plier</td>
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</tr>
<tr>
<td>3</td>
<td>Tester</td>
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</tr>
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<td>4</td>
<td>Electrician Knife</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Poker</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Drilling Machine</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Ball Peen Hammer</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Hacksaw Frame</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Measurement Tape</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Try Square</td>
<td>1</td>
</tr>
</tbody>
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Materials Required

<table>
<thead>
<tr>
<th>S No</th>
<th>Name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wooden Board - 3&quot; × 4&quot;</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3/4&quot; P.V.C Pipe</td>
<td>1 length</td>
</tr>
<tr>
<td>3</td>
<td>1/18 Copper Wire</td>
<td>8 meter</td>
</tr>
<tr>
<td>4</td>
<td>One Way Switch</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Regulator</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Lamp Holder</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Three Way Junction Box</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>3/4&quot; Clamp</td>
<td>12</td>
</tr>
<tr>
<td>9</td>
<td>3/4&quot; Screws</td>
<td>24</td>
</tr>
<tr>
<td>10</td>
<td>1 ½” Screws</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>Insulation Tape</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>60W Lamp</td>
<td>1</td>
</tr>
</tbody>
</table>

Layout Diagram
Connection Diagram

Procedure

- Study layout diagram and the cable route, distance location of fitting and other accessories.
- Draw the wiring diagram as per the line diagram.
- List out the materials required for this wiring.
- Confirm how to frame PVC pipe.
- Fix the PVC pipe by using clamps, junction box and switch boxes using wooden screws.
Run the cable in the PVC pipe as per the wiring diagram.
Connect the terminals of switches and lamp holder as per the circuit diagram.
Connect the leads of pendent holder by using wire.
Fix the lamp in pendent holder.
Give supply and check the circuit.

**Result**

I have known the method of one lamp controlled by one regulator. After giving supply to the circuit through one way switch, turn the regulator in clock wise direction and find out the brightness of the lamp.
WIRING CONNECTION OF FLUORESCENT LAMP

"PRICE is what YOU pay. Value is what YOU get."
Aim

To know and do the wiring connection method of Fluorescent Lamp.

Tools Required

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Screw Driver</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Electrician Knife</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Cutting Plier</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Poker</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Tester</td>
<td>1</td>
</tr>
</tbody>
</table>

Materials Required

<table>
<thead>
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<th>S.No</th>
<th>Name</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Fluorescent Lamp</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Led Tube Light</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Choke</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Starter</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Electronic Choke</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Single Strand Conductor</td>
<td>15 meter</td>
</tr>
<tr>
<td>7</td>
<td>Insulation Tape</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Sleeves</td>
<td>10 cm</td>
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<tr>
<td>9</td>
<td>Tube Light Holder</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Starter Holder</td>
<td>1</td>
</tr>
</tbody>
</table>

Connection of tube light with choke and starter

Procedure

Phase supply is given to the pin 1 of the first terminal through switch and choke (all are connected in series)

Neutral is connected to pin 1 of the second terminal

Pin 2 of the both the terminals are connected to starter.

These connections are shown in the connection diagram
Connection of Tube Light with Electronic Choke

Procedure
Phase supply is given to the input side (L) of the choke through switch. Neutral is given to the input side (N) of the choke directly.

From choke four wire connections are taken and they are connected to both the terminals as shown in the diagram.

Connection Diagram of LED Tube Light

Procedure
As shown in the diagram, phase and neutral supply is given to the LED tube light

Result
Verified and known the method of doing wiring connection of tube light with various chokes.

Do You Know?
Fluorescent Bulbs Contain Mercury!
Everybody is able to make plans, but few people can implement them

~ Thiruvalluvar ~
Aim
To learn and know about the method of doing of Stair-case wiring.

Tools Required

<table>
<thead>
<tr>
<th>S No</th>
<th>Name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Screw Driver</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Cutting Plier</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Tester</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Electrician Knife</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Poker</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Drilling Machine</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Ball Peen Hammer</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Hack Saw Frame</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Measurement Tape</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Try Square</td>
<td>1</td>
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</table>

Materials Required

<table>
<thead>
<tr>
<th>S No</th>
<th>Name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wooden Board - 3&quot; × 4&quot;</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3/4&quot; P.V.C Pipe</td>
<td>1 length</td>
</tr>
<tr>
<td>3</td>
<td>1/18 Copper Wire</td>
<td>10 meter</td>
</tr>
<tr>
<td>4</td>
<td>L Bend</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Two Way Switch</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Lamp Holder</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Three Way Junction Box</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>3/4&quot; Clamp</td>
<td>18</td>
</tr>
<tr>
<td>9</td>
<td>3/4&quot; Screws</td>
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<td>10</td>
<td>1 ½&quot; Screws</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>Insulation Tape</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>60W Lamp</td>
<td>1</td>
</tr>
</tbody>
</table>
Layout Diagram

Connection Diagram
Procedure

- Study the layout diagram and the cable route, distance location of fitting of all accessories.
- Draw the wiring connection as per the line diagram.
- List out the materials required for this wiring.
- Confirm how to fix PVC pipe.
- Fix the PVC pipe by using clamps, junction box and switch boxes using wooden screws.
- Run the cable in the PVC pipe as per the wiring diagram.
- Connect the terminals of switches and lamp holder as per the circuit diagram.
- Connect the leads of pendent holder by using wire.
- Fix the lamp in pendent holder.
- Give supply and check the circuit.

Result

I have known the method of doing stair-case wiring. If both switches are in ‘UP’ or ‘DOWN’ position, the lamp glows. Otherwise the lamp does not glow.
“IF YOU CAN BELIEVE, YOU CAN ACHIEVE”
Aim
To learn and know about the method of doing Go-down wiring.

Tools Required

<table>
<thead>
<tr>
<th>S No</th>
<th>Name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Screw Driver</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Cutting Plier</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Tester</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Electrician Knife</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Poker</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Drilling Machine</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Ball Peen Hammer</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Hack Saw Frame</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Measurement Tape</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Try Square</td>
<td>1</td>
</tr>
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</table>

Materials Required

<table>
<thead>
<tr>
<th>S No</th>
<th>Name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wooden Board - 3&quot; × 4&quot;</td>
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<tr>
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<td>3/4&quot; P.V.C Pipe</td>
<td>2 length</td>
</tr>
<tr>
<td>3</td>
<td>1/18 Copper Wire</td>
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<tr>
<td>4</td>
<td>One Way Switch</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Two Way Switch</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Lamp Holder</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Three Way Junction Box</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
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</tr>
<tr>
<td>9</td>
<td>¾&quot; Screws</td>
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<td>10</td>
<td>1 ½&quot; Screws</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td>Insulation Tape</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>60W Lamp</td>
<td>3</td>
</tr>
</tbody>
</table>

Layout Diagram
Connection Diagram

![Connection Diagram Image]

**Procedure**

- Study layout diagram and the cable route, distance location of fitting of all accessories.
- Draw the wiring diagram as per the line diagram.
- List out the materials required for this wiring.
- Confirm how to fix PVC pipe.
- Fix the PVC pipe by using clamps, junction box and switch boxes by using wooden screws.
- Run the cable in to the PVC pipe as per the wiring diagram.
- Connect the terminals of switches and lamp holder as per the circuit diagram.
- Connect the leads of pendent holder by using wire.
- Fix the lamp in pendent holder.
- Give supply and check the circuit.

**Result**

I have known the method of doing the godown wiring. If we switch ON the first switch, first lamp only glows. And if we switch ON the second switch, second lamp only glows. And if we switch ON the third switch, third lamp only glows.
ELECTRIC BELL

Imagination is more important than knowledge.

Albert Einstein
Aim
To know and learn about an electric bell controlled by one way bell switch and its working.

Tools Required

<table>
<thead>
<tr>
<th>S No</th>
<th>Name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Screw Driver</td>
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</tr>
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<td>2</td>
<td>Cutting Plier</td>
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</tr>
<tr>
<td>3</td>
<td>Tester</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Electrician Knife</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Poker</td>
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<tr>
<td>6</td>
<td>Drilling Machine</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Ball Peen Hammer</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Hacksaw Frame</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Measurement Tape</td>
<td>1</td>
</tr>
</tbody>
</table>

Materials Required

<table>
<thead>
<tr>
<th>S No</th>
<th>Name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wooden Board - 3&quot; x 4&quot;</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3/4&quot; P.V.C Pipe</td>
<td>1 length</td>
</tr>
<tr>
<td>3</td>
<td>1/18 Copper Wire</td>
<td>8 meter</td>
</tr>
<tr>
<td>4</td>
<td>One Way Bell Switch</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Electric Bell</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>One Way Junction Box</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Three Way Junction Box</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>3/4&quot; Clamp</td>
<td>12</td>
</tr>
<tr>
<td>9</td>
<td>3/4&quot; Screws</td>
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</tr>
<tr>
<td>10</td>
<td>1 ½&quot; Screws</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>Insulation Tape</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Ceiling Rose</td>
<td>1</td>
</tr>
</tbody>
</table>

Layout Diagram
Procedure

- Study the layout diagram, the cable route, distance location of fitting of all other accessories.
- Draw the wiring diagram as per the line diagram.
- List out the materials required for this wiring.
- Confirm how to fix PVC pipe.
- Fix the PVC pipe by using clamps, junction box and switch boxes using wooden screws.
- Run the cable in the PVC pipe as per the wiring diagram.
- Connect the terminals of switches and ceiling rose by using wire as per the circuit diagram.
- Fix the electric bell in ceiling rose.
- Give supply and check the circuit.

Working of an Electric Bell

The image below shows the internal mechanism of an electric bell.
The step by step process of the working of the electric bell is described below:

- If the switch is pressed ON and the current will flows through the circuit.
- The electromagnet is powered and generates a magnetic field, that attracts the iron strip towards it.
- The striker of the bell strikes the gong (bell)
- When the striking arm strikes the gong, the contact is broken and current stops flowing through the circuit.
- This causes the electromagnet to lose its magnetic field.
- The connected spring arm returns the striker to its original rest position.
- The contact is restored and current flows through the circuit (provided the main switch is still pressed).
- The process is repeated.

**Result**

I have known the method of preparing an electric bell controlled by one way bell switch and its working. After giving supply to the circuit, the electric bell will ring.
10 TESTING OF RESISTOR, DIODE, TRANSISTOR AND CAPACITOR

SUCCESSFUL PEOPLE NEVER WORRY ABOUT WHAT OTHERS ARE DOING
Aim
To study and test the conductivity of the components of Resistor, Diode, Transistor and Capacitor.

Apparatus Required

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Description</th>
<th>Quantity</th>
<th>Typical Value</th>
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<tr>
<td>1</td>
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<td>2</td>
<td>Diodes</td>
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<td>1N4007, 1N4002</td>
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<tr>
<td>3</td>
<td>Capacitor</td>
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<td>1mFD, 2mFD</td>
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<td>Transistors-NPN</td>
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<td>BC107, BC108</td>
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<td>5</td>
<td>Transistors-PNP</td>
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<td></td>
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</table>

Testing of Resistor

Objective
To learn the resistor code and identify the value of given resistors.

Consider the following diagram for the better understanding of finding the resistor values. The first band indicates the first digit, second band is for the second digit and the third band indicates the multiplier. The numerical value corresponding to the colour bands are shown below. If the first colour band is brown and the second band is black then the first two digits are 10. If the multiplier colour is red (value in 2) then two numbers of zeros added with first two digit.

Tolerance value of Gold = ±5%

Tolerance value of Silver = ±10%
<table>
<thead>
<tr>
<th>Colour</th>
<th>1st Digit</th>
<th>2nd Digit</th>
<th>Multiplier</th>
<th>Code</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>brown</td>
<td>1</td>
<td>0</td>
<td>00</td>
<td>1000</td>
<td>1kΩ</td>
</tr>
</tbody>
</table>

Likewise, the other types of resistors as four band, five band and sixbands. The toler ance is fixed from these bands.(fig)

**Testing of Diode**

**Objective**

To test the diode for its forward (conduction) and reverse mode (non-conduction) of operation.

**Description**

It is well known that the diodes are unidirectional devices which allow current in one direction. These are expected to offer very low resistance for the flow of current under forward biased condition and a very high resistance under reverse biased condition. In other words, one can undertake diode testing by measuring the resistance across its terminals by using an equipment like multimeter.

A diode is forward-biased when the positive (red) test lead is on the anode and the negative (black) test lead is on the cathode.

A diode is reverse-biased when the positive (red) test lead is on the cathode and the negative (black) test lead is on the anode.
Step 1. Select the switch of the multimeter in resistance mode

Step2. Connect the positive terminal of the diode to Anode and the negative terminal to the cathode.

Step3. Check the reading of the multimeter.

Under this condition the resistance of the diode is very less that means good conduction is expected.
Step 4. Connect the positive terminal of the diode to cathode and the negative terminal to the Anode.

Under this condition the resistance of the diode is very high which means open circuit is expected.

1N4001 diode

Testing of Transistor
Objective

Transistors:
The bi-polar junction transistor (BJT) transistor has three terminals. They are

1. Emitter (E)
2. Base (B)
3. Collector (C)

To identify the above three terminals, keep the flat surface of transistor facing towards the face of you and mark 1.2 and 3 from left side onwards.

The schematic diagram of BJT is shown below.
**Steps to Identify the NPN Type Transistor**

1. Keep the Multimeter in the Diode mode.
2. Keep the positive probe to the center pin (Base) of the transistor.
3. Touch the negative probe to the pin-1 (Emitter). You will see some voltage in the multimeter.
4. Similarly, touch the negative probe to the pin-3 (Collector) with respect to the pin-2. You will see some voltage in the multimeter.
5. It will ensure that it is a NPN transistor. The logic behind this is, in NPN transistor Emitter (E) - N type material - Equivalent to cathode of the diode Base (B) - P type material - Equivalent to anode of the diode Collector (C) - N type material - Equivalent to cathode of the diode
6. If the multimeter positive probe is connected to anode and negative probe is to cathode, then it will show voltage. If the connections are interchanged it will not show any value.

**Steps to Identify the PNP Type Transistor**

1. Keep the Multimeter in the Diode mode.
2. Keep the positive probe to the pin-1 (Emitter) of the transistor.
3. Touch the negative probe to the center pin (Base). You will see some voltage in the multimeter.
4. Similarly touch the negative probe to the center pin (Base) with respect to the pin-3 (Collector). You will see some voltage in the multimeter.
5. It will ensure that it is a PNP transistor. The logic behind this is, in PNP transistor Emitter (E) - P type material - Equivalent to anode of the diode Base (B) - N type material - Equivalent to cathode of the diode Collector (C) - P type material - Equivalent to anode of the diode
6. If the multimeter positive probe is connected to anode and negative probe is connected to cathode, then it will show voltage. If the connections are interchanged it will not show any value.
Testing of Capacitor

Objective: To test the condition of a capacitor.

Test & Check a Capacitor By a Digital Multimeter

1. Make sure the capacitor is discharged.
2. Set the meter on Ohm range (Set it at least 1000 Ohm = 1k).
3. Connect the meter leads to the capacitor terminals.
4. Digital meter will show some numbers for a second. Note the reading.
5. And then immediately it will return to the OL (Open Line). Every attempt of Step 2 will show the same result as was in step 4 and Step 5. It means that Capacitor is in Good Condition.
6. If there is Change, then Capacitor is dead.

Conclusion

Thus the passive elements of electrical engineering is tested for its values.

Result

In this practical, I have known the method of testing the value of Resistor, Diode, Transistor and Capacitor.
<table>
<thead>
<tr>
<th>Sl. no</th>
<th>Symbols</th>
<th>Component Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>DC Supply</td>
<td>Direct Supply</td>
</tr>
<tr>
<td>2</td>
<td>~</td>
<td>AC Supply</td>
<td>Alternating Supply</td>
</tr>
<tr>
<td>3</td>
<td>1 φ (or) 1~</td>
<td>Single Phase Supply</td>
<td>Single Phase Power</td>
</tr>
<tr>
<td>4</td>
<td>3 φ (or) 3~</td>
<td>Three Phase Supply</td>
<td>Three Phase Power</td>
</tr>
<tr>
<td>5</td>
<td><img src="image" alt="Fuse symbol" /></td>
<td>Fuse</td>
<td>The fuse disconnects when current above threshold. Used to protect circuit from high currents</td>
</tr>
<tr>
<td>6</td>
<td><img src="image" alt="Earth/Ground symbol" /></td>
<td>Earth/Ground</td>
<td>Used for zero potential reference and electrical shock protection</td>
</tr>
<tr>
<td>7</td>
<td><img src="image" alt="Lamp/Bulb symbol" /></td>
<td>Lamp/Bulb</td>
<td>Generates light when current flows through</td>
</tr>
<tr>
<td>8</td>
<td><img src="image" alt="Connected Wires symbol" /></td>
<td>Connected Wires</td>
<td>Connected wires crossing</td>
</tr>
<tr>
<td>9</td>
<td><img src="image" alt="Not Connected Wires symbol" /></td>
<td>Not Connected Wires</td>
<td>Wires are not connected</td>
</tr>
<tr>
<td>10</td>
<td><img src="image" alt="Spst Switch symbol" /></td>
<td>Spst Switch</td>
<td>Disconnects current when open</td>
</tr>
<tr>
<td>11</td>
<td><img src="image" alt="Resistor symbol" /></td>
<td>Resistor</td>
<td>Resistor reduces the current flow</td>
</tr>
<tr>
<td>12</td>
<td><img src="image" alt="Adjustable Resistor/Rheostat symbol" /></td>
<td>Adjustable Resistor/Rheostat</td>
<td>Adjustable resistor - has 2 terminals</td>
</tr>
<tr>
<td>13</td>
<td><img src="image" alt="Trimmer Resistor symbol" /></td>
<td>Trimmer Resistor</td>
<td>Pre-set Resistor</td>
</tr>
<tr>
<td>14</td>
<td><img src="image" alt="Capacitor symbol" /></td>
<td>Capacitor</td>
<td>Capacitor is used to store electric charge. It acts as short circuit with AC and open circuit with DC</td>
</tr>
</tbody>
</table>
15. Variable Capacitor: Adjustable capacitance
16. Inductor: Coil / Solenoid that generates magnetic field
17. Variable Inductor: Inductor value can be varied
18. Battery Cell: Generates constant voltage
19. Generator: Electrical voltage is generated by mechanical rotation of the generator
20. Motor: Electric motor
22. Ammeter: Measures electric current. Has near zero resistance. Connected serially
23. Wattmeter: Measures electric power
24. Ohm Meter: Measures resistance
25. Transformer: Change AC voltage from high to low or low to high
26. Star Connection: Method of connecting 3ϕ winding in star connection
27. Delta Connection: -do- Delta
28. Electric Bell: Rings when activated
29. Buzzer: Produces buzzing sound
30 Loudspeaker | Converts electrical signal to sound waves
31 AC Motor | Operator in AC only
32 AC Generator | To produce alternating current
33 Universal Motor | Operates in both AC & DC
34 Push Button (N.O) | Momentary switch - normally open
35 Single Phase Alternator | Produces single phase AC current
36 Fault | Identify fault in circuit
37 Over Head Line | High tension supply line
38 Diode | Diode allows current flow in one direction only - left (anode) to right (cathode)
39 Zener Diode | Allows current flow in one direction, but also can flow in the reverse direction when above breakdown voltage
40 NPN Bi-Polar Transistor | Allows current flow when high potential at base (middle)
41 PNP Bi-Polar Transistor | Allows current flow when low potential at base (middle)
42 Antenna/Aerial | Transmits & receives radio waves
<table>
<thead>
<tr>
<th>No.</th>
<th>Symbol</th>
<th>Description</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td><img src="lighting_switch.png" alt="Lighting Switch" /></td>
<td>Main Switch Lighting</td>
<td>To control the lighting circuit</td>
</tr>
<tr>
<td>44</td>
<td><img src="power_switch.png" alt="Power Switch" /></td>
<td>Main Switch Power</td>
<td>To control the power circuit</td>
</tr>
<tr>
<td>45</td>
<td><img src="change_over_switch.png" alt="Change Over Switch" /></td>
<td>Change Over Switch</td>
<td>Changing supply from one line to another line</td>
</tr>
<tr>
<td>46</td>
<td><img src="choke.png" alt="Choke" /></td>
<td>Choke</td>
<td>Increase voltage for illumination of tube light</td>
</tr>
<tr>
<td>47</td>
<td><img src="siren.png" alt="Siren" /></td>
<td>Siren</td>
<td>Produces sound</td>
</tr>
<tr>
<td>48</td>
<td><img src="5%E3%83%94%E3%83%B3%E3%82%BD%E3%82%B1%E3%83%83%E3%83%88.png" alt="5-Pin Socket" /></td>
<td>5-Pin Socket</td>
<td>Used for 2-Pin and 3-Pin plug</td>
</tr>
<tr>
<td>49</td>
<td><img src="ceiling_fan.png" alt="Ceiling Fan" /></td>
<td>Ceiling Fan</td>
<td>Air to Hall/room</td>
</tr>
<tr>
<td>50</td>
<td><img src="thermostat.png" alt="Thermostat" /></td>
<td>Thermostat</td>
<td>Set constant heat in heating appliances</td>
</tr>
</tbody>
</table>
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