

ST. ANNE'S

COLLEGE OF ENGINEERING AND TECHNOLOGY

(An ISO 9001:2015 certified Institution)

Anguchettypalayam, Panruti – 607 106



GE3271 - ENGINEERING PRACTICES LABORATORY

(ELECTRICAL & ELECTRONICS)

OBSERVATION NOTE

(FOR IV B.E ELECTRONICS AND COMMUNICATION ENGINEERING STUDENTS)

NAME : _____

REGISTER NO : _____

YEAR/SEMESTER : I Year / II Semester

AS PER ANNA UNIVERSITY (CHENNAI) SYLLABUS

2021 REGULATION

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION
ENGINEERING**

PREPARED BY: Mr. S. BALABASKER, ASP/ECE

ABOUT OBSERVATION NOTE & PREPARATION OF RECORD

- ❖ This Observation contains the basic diagrams of the circuits enlisted in the syllabus of GE3271 - ENGINEERING PRACTICES LABORATORY course, along with the design the design of various components of the circuit and controller.
- ❖ Aim of the experiment is also given at the beginning of each experiment. Once the student is able to design the circuit as per the circuit diagram, he/she is supposed to go through the instructions carefully and do the experiments step by step.
- ❖ They should note down the readings (observations) and tabulate them as specified.
- ❖ It is also expected that the students prepare the theory relevant to the experiment referring to prescribed reference book/journals in advance, and carry out the experiment after understanding thoroughly the concept and procedure of the experiment.
- ❖ They should get their observations verified and signed by the staff within two days and prepare & submit the record of the experiment while they come for the laboratory in subsequent week.
- ❖ The record should contain experiment No., Date ,Aim, Apparatus required, Theory, Procedure and result on one side(i.e., Right hand side, where rulings are provided) and Circuit diagram, Design, Model Graphs, Tabulations and Calculations on the other side (i.e., Left hand side, where no rulings is provided)
- ❖ All the diagrams and table lines should be drawn in pencil
- ❖ The students are directed to discuss & clarify their doubts with the staff members as and when required. They are also directed to follow strictly the guidelines specified.

GE3271 - ENGINEERING PRACTICES LABORATORY

SYLLABUS

LIST OF EXPERIMENTS

GROUP – A (CIVIL & ELECTRICAL)

PART-II ELECTRICAL ENGINEERING PRACTICES

- a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
- b) Staircase wiring
- c) Fluorescent Lamp wiring with introduction to CFL and LED types.
- d) Energy meter wiring and related calculations/ calibration
- e) Study of Iron Box wiring and assembly
- f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
- g) Study of emergency lamp wiring/Water heater

GROUP – B (MECHANICAL AND ELECTRONICS)

PART IV ELECTRONIC ENGINEERING PRACTICES

SOLDERING WORK:

- a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

- a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

- a) Study an elements of smart phone.
- b) Assembly and dismantle of LED TV.
- c) Assembly and dismantle of computer/ laptop

LIST OF EXPERIMENTS

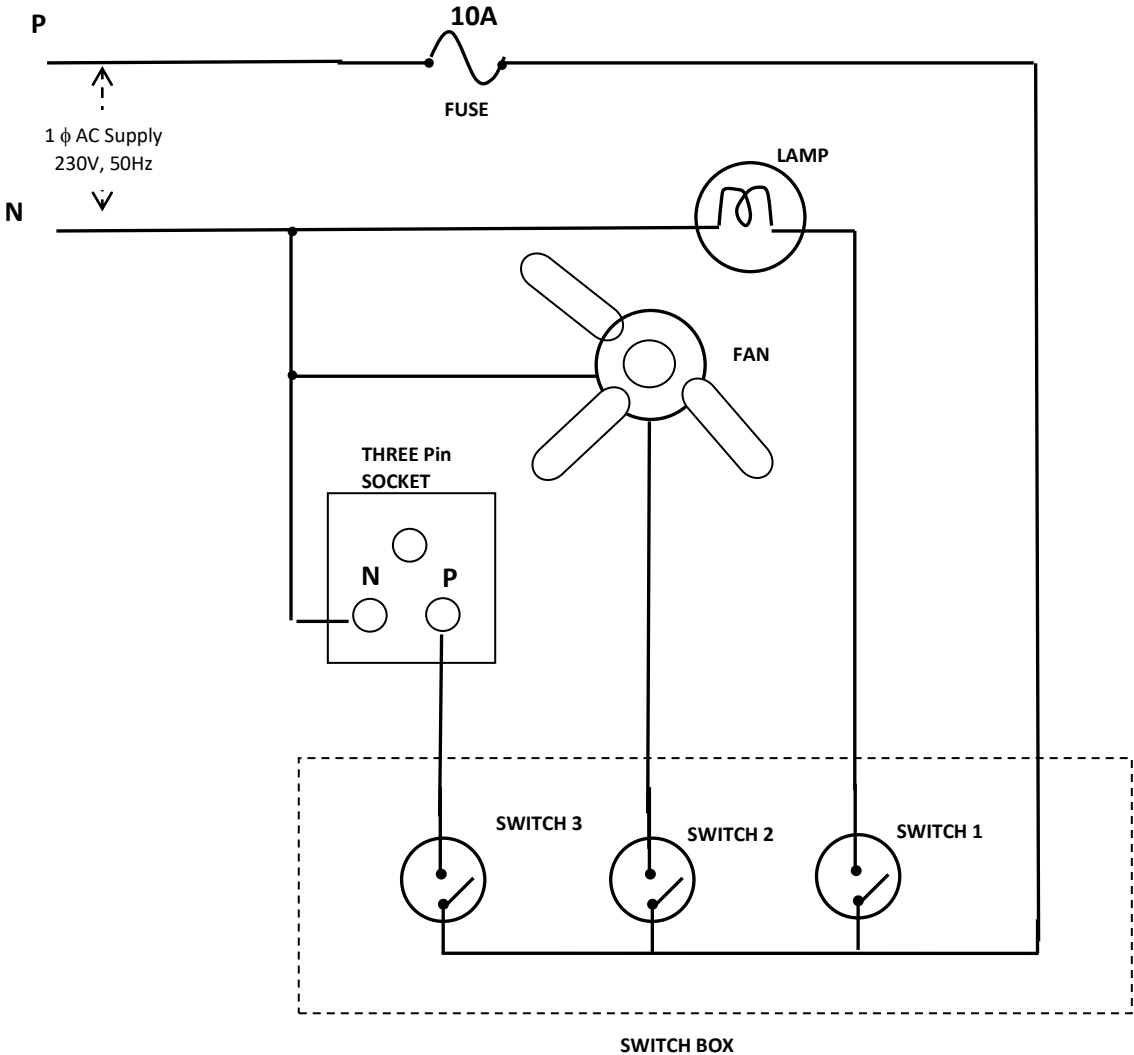
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LIST OF EXPERIMENTS

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GROUP – A (PART II)
ELECTRICAL ENGINEERING PRACTICE

CONNECTION DIAGRAM:



Ex. No: 1 BASIC SWITCH BOARD WIRING WITH LAMP, FAN AND THREE PIN SOCKET

Date :

AIM

To set up a model switch board wiring using switches, fuses, three pin socket , fan and lamps

APPARATUS REQUIRED:

Sl. No	Description	Range / Size	Quantity
1.	One way Switch	230V / 5A	3
2.	Lamp	230V / 60W	1
3.	PVC box	6" x 4"	1
4.	PVC pipe	$\frac{3}{4}$ "	As req.
5.	Copper wire	$\frac{1}{18}$	As req.
6.	Lamp Holder	230V / 5A	1
7.	PVC bends, clamps and screws	$\frac{3}{4}$ "	As req.
8.	PVC Junction box	1 way	1
9.	Fuse Unit	230V / 10A	1
10.	Fan	-	1
11.	Three Pin Socket	-	1

PRECAUTIONS

1. Ensure that power is switched off, before the connections are being made.
2. Live wire should always be controlled with switch.
3. Don't use neon tester as screw driver.
4. Joints in wire are made with proper insulation.

PROCEDURE

1. Layout of the given circuit diagram was drawn on the circuit board.
2. Given electrical accessories like switch, fuse, indicator and energy meter were fixed with the help of screws.
3. Given electrical accessories were connected by using copper wire.
4. Connections were checked before giving supply.
5. Performance of the given model house wiring was tested.

RESULT

Thus the set-up of model house wiring using switch, fuse, lamp, fan and three pin socket was successfully connected and was tested.

Ex. No: 1(ii) INTRODUCTION TO SWITCHES, FUSES, INDICATORS AND LAMPS

Date :

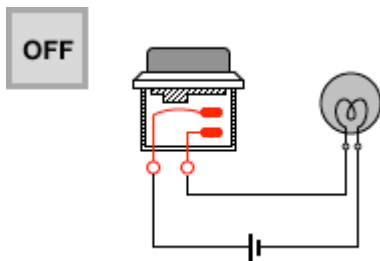
AIM

To study the basics of Switches, Fuses, Indicators and Lamps

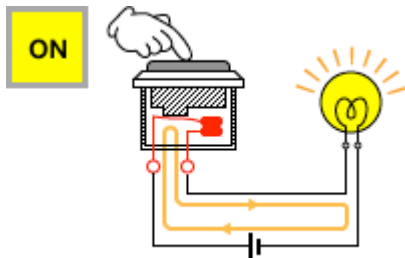
1. SWITCHES:

A switch responds to an external force to mechanically change an electric signal. Switches are used to turn electric circuits ON and OFF and to switch electric circuits.

1. Circuit ON/OFF Operation

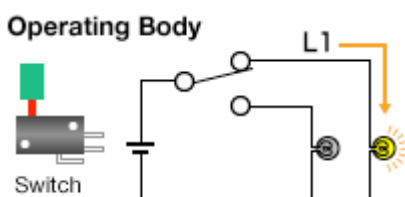


The contacts are separated while the switch is not pressed, so the circuit is not connected and the lamp is not lit.

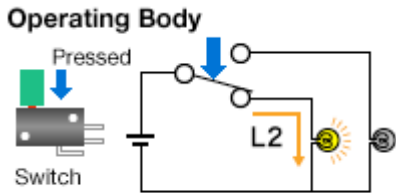


When the switch is pressed, the contacts come into contact, closing the circuit and lighting the lamp.

2. Circuit Switching Operation



While the switch is not operated, the lamp on circuit L1 is lit.

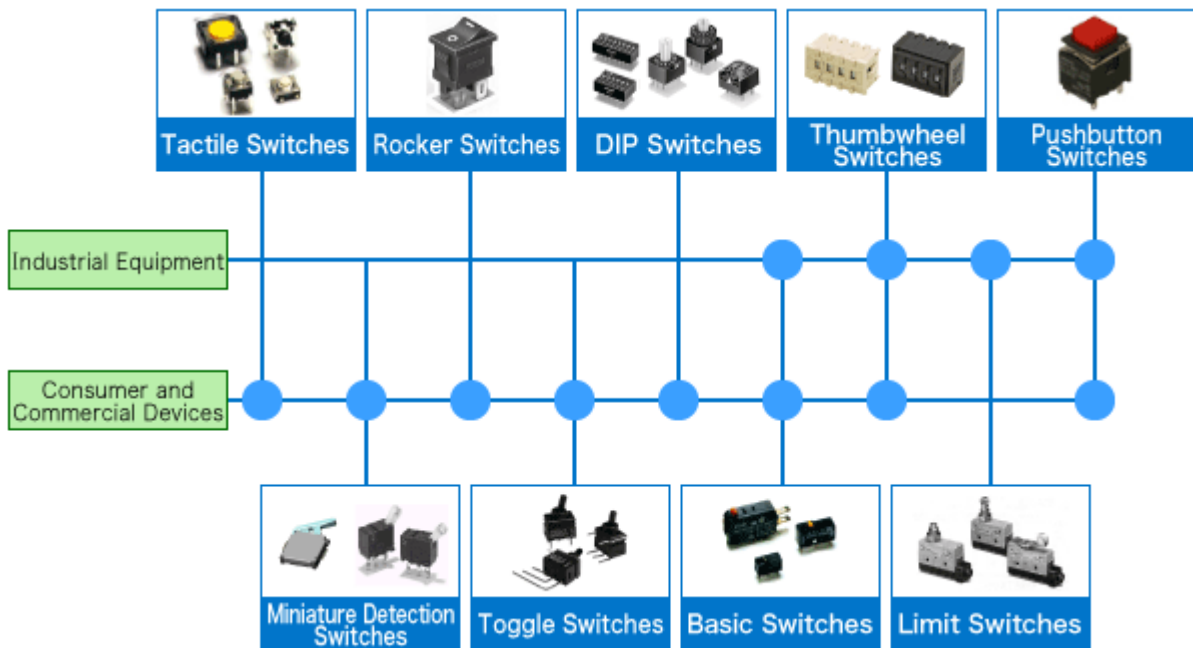


When the switch is pressed, the circuit is switched so that the lamp on circuit L2 is lit.

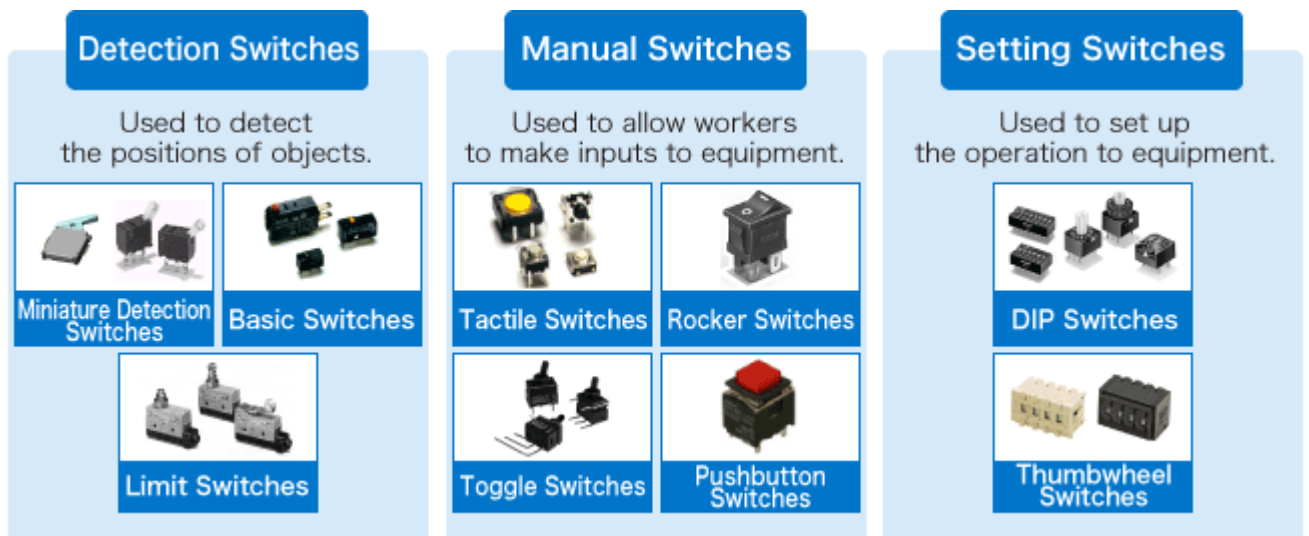
Switch Types & Classifications

1. Types of Switches

There are many different types of switches. Based on their size, robustness, environmental resistance and other characteristics, they are divided into switches for industrial equipment and switches for consumer and commercial devices.



2. Switch Classifications



2. FUSE:

An electrical fuse is a safety device that operates to provide protection against the overflow of current in an electrical circuit. An important component of an electrical fuse is a metal wire or strip that melts when excess current flows through it. It helps to protect the device by stopping or interrupting the current. In this article, let us know in detail about the Working Principle of electrical fuse along with its functions and types.



Principle of Electrical Fuse

The primary use of an electric fuse is to protect electrical equipment from excessive current and to prevent short circuits or mismatched loads. Electrical fuses play the role of miniature circuit breakers. Apart from protecting equipment, they are also used as safety measures to

Function of Fuse

In the field of electrical engineering, a fuse is a device that provides overcurrent protection to the functional electrical circuit. Here, we have listed a few major functions of the fuse.

- Acts as a barrier between the electric circuit and the human body
- Prevents device failure due to faulty circuit operation
- Fuse prevents short-circuits
- Prevents overload and blackouts
- Prevents damage that is caused due to mismatched loads
- The markings on the fuse carry information such as the Ampere rating, voltage rating, and interruption rating.

Types of Fuses

Different types of fuses are available in the market, and they are classified on the basis of different aspects. But mainly, fuses can be divided into two categories based on the input supply as follows:

- AC fuses
- DC fuses

3. INDICATORS:

The purpose of indicator is to provide a human readable indication of an instrument signal. Sometimes process transmitters are not equipped with readouts for whatever variable they measure: they just transmit a standard instrument signal (4 to 20 mA, etc.) to another device.



In some cases we may need extra local display for showing the process value to the operators, examples like an level transmitter installed on a big tank & level value will be shown to operator at the bottom of the tank using indicators or loop powered devices. An indicator gives a human operator a convenient way of seeing what the output of the transmitter is without having to connect test equipment. Moreover, indicators may be located far from their respective transmitters, providing readouts in locations more convenient than the location of the transmitter itself.

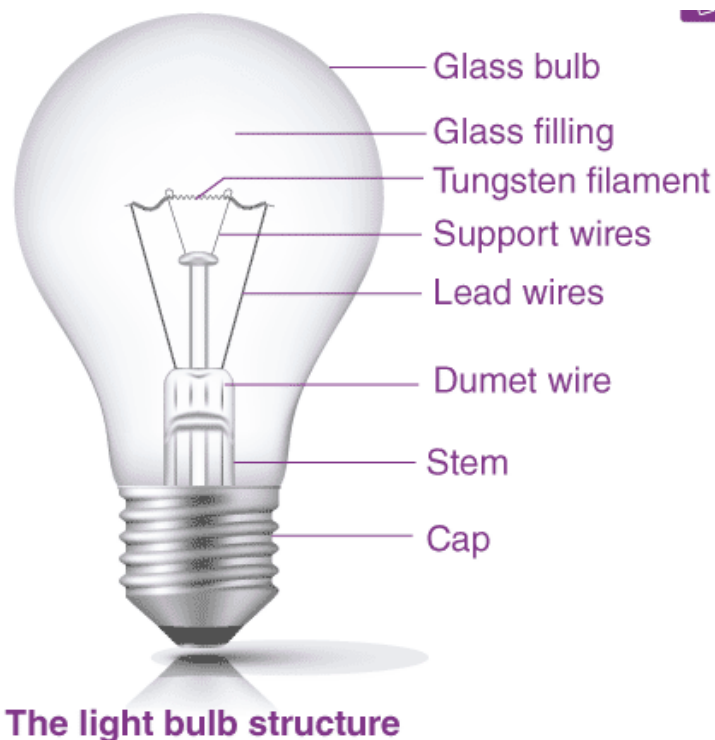
4. LAMPS(Electronic Bulb):

The electronic bulb is the simplest electrical lamp, that was invented for illumination more than a century ago. It was the small and simplest light that brightened the dark space. The electronic bulb is also known as the light bulb.

The electronic bulb is also known as an incandescent lamp, incandescent light globe or incandescent light bulb. Bulb comes in different sizes, light output and operates with a voltage range from 1.5 Volts to about 300 Volts. Now let us study the parts and structure of the bulb in detail.

Structure of the Electronic Bulb

An electronic bulb is a small and simple light source that uses a wire filament to glow on the application of electricity. The structure of incandescent light bulbs is as shown in the figure below.



The light bulb consists of three key parts

- The filament
- The glass bulb
- The base of the light bulb

The filament which is a coiled thin wire is made of tungsten. Tungsten is chosen as filament since it has a high melting point, which avoids the melting of the filament at high temperatures.

The filament is enclosed in a globe-shaped glass mount and is connected with copper and lead wires which are connected to the base of the lamp. The wires and the filament are enclosed in a glass bulb, which is filled with an inert gas like argon. Since argon is an inactive gas, it protects the filament from burning as well as increasing the lifetime of the filament. Thin glass is used to manufacture the bulb, this glass prevents the air from reaching the filament to protect it from burning.

When electric power is passed through the bulb, it reaches the filament through copper and lead wires. The base holds the bulb in an upright position and connects to the electric circuit.

Copper and lead wires let the electricity pass from the base to the tungsten filament. It causes the filament to emit the light and glow.

There are two types of bulb base:

- Spiral base
- Two side nails base

The picture of spiral base bulb is as shown below:



Spiral base bulb features a piece of lead that directly connects the lamp to the electric circuit.

The picture of two side nails base bulb is as shown below:



It has nails in the base and contains two pieces of lead that connect the lamp to the electric circuit.

Uses of Electronic Bulb

- It is used in portable lighting such as table lamps
- It is used in vehicle lights and car headlights.
- It is used in household and commercial lighting
- It is used in decorative and advertising lighting

Advantages

- Bulbs offer longer life than any other light source.
- The working time ranges from 8000 to 15000 hours.
- It is affordable and economical.
- It is easy to install.
- It comes in various sizes and shapes.
- Produces relatively high output.

Disadvantages

- It is energy inefficient.

- A short lamp lifetime is about 1000 hours typically.
- It produces warm light.
- Requires higher operating cost.
- Since it is made of glass, it is fragile and should be handled with care.
- Bulb generates low lumen per watt.

Safety and Precautions

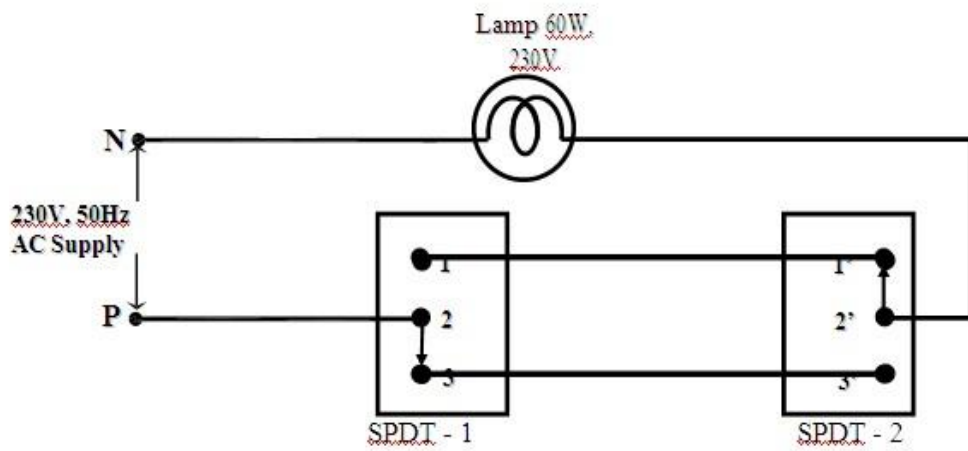
Here are some of the safety measures to be followed while handling bulb:

- Electronic bulbs must be handled carefully since they can break very easily.
- The breakable parts of the bulb are extremely sharp and can puncture the skin if touched.
- Since the bulb consists of chemicals like argon and mercury, handling should be done carefully. Mercury is toxic to the human body.
- When the bulb breaks, the mercury inside escapes as vapor or fine droplets and can settle on the objects nearby. Inhaling mercury is hazardous.
- Proper disposal of the bulbs should be ensured.

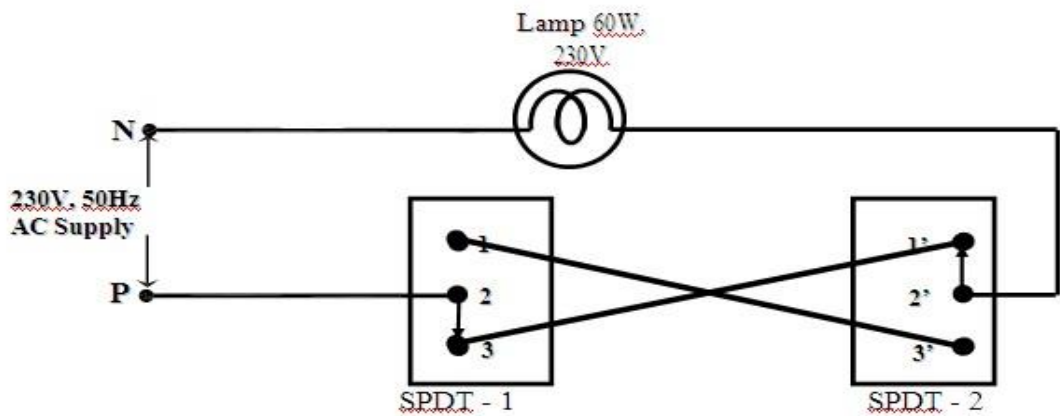
RESULT

Thus the basics of Switches, Fuses, Indicators and Lamps were studied

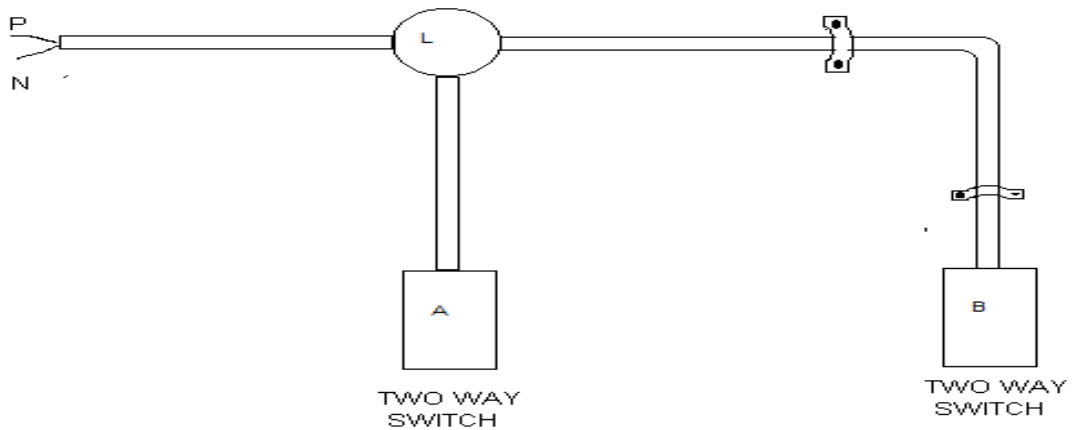
CIRCUIT DIAGRAM (STRAIGHT CONNECTION):



CIRCUIT DIAGRAM (CROSS CONNECTION):



LAYOUT DIAGRAM:



Ex. No.: 2

STAIRCASE WIRING

Date :

AIM

To set up a staircase wiring, to control a lamp.

APPARATUS REQUIRED

Sl. No	Description	Range / Size	Quantity
1.	Two way Switch	230V / 5A	2
2.	Lamp	230V / 60W	1
3.	PVC box	4" x 4"	2
4.	PVC pipe	$\frac{3}{4}$ "	As req.
5.	Copper wire	$\frac{1}{18}$	As req.
6.	Lamp holder	230V / 5A	1
7.	PVC bends, clamps and screws	$\frac{3}{4}$ "	As req.
8.	PVC junction box	3 way	1

TRUTH TABLE

STRAIGHT CONNECTION			
SL.NO.	SPDT 1	SPDT 2	LAMP CONDITION
1			
2			
3			
4			

CROSS CONNECTION			
SL.NO.	SPDT 1	SPDT 2	LAMP CONDITION
1			
2			
3			
4			

PRECAUTIONS

1. Live wire should always be controlled with switch.
2. Don't use neon tester as screw driver.
3. Joints in wire are made with proper insulation.

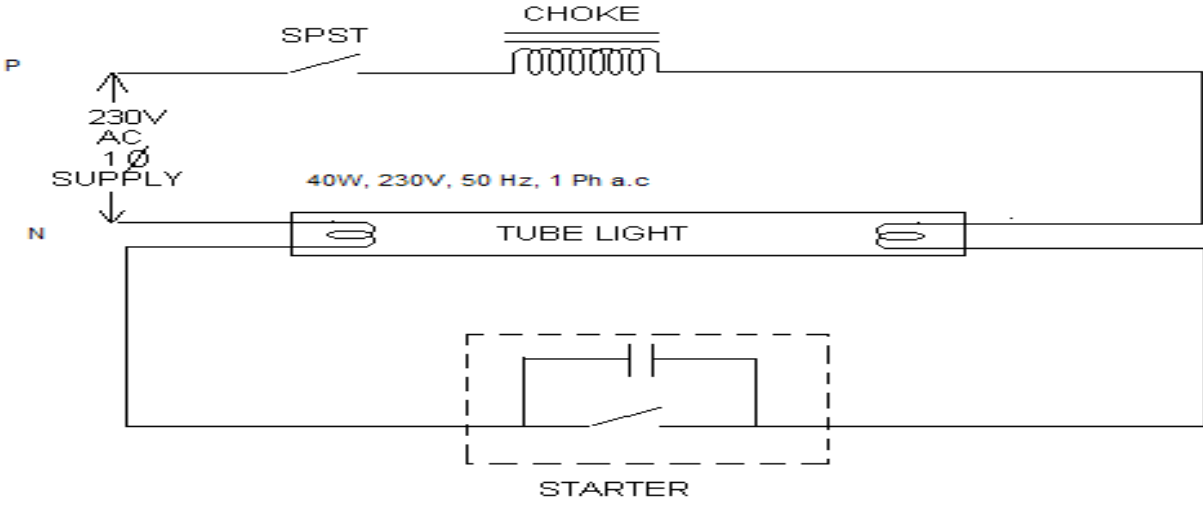
PROCEDURE

1. Layout of the given circuit diagram was drawn on the circuit board.
2. By using drilling machine, necessary materials were fixed in the layout board.
3. One end of the lamp holder was connected to neutral point and another point was connected at the centre of the two-way switch B.
4. The centre of the switch A was connected to the phase line.
5. The point 1 of switch A was connected to point 3 of A was connected to 1 of B.
6. The given lamp was fixed on the lamp holders.
7. Controlling the switches, the circuit was checked and the results were tabulated.

RESULT

Thus the setup of staircase wiring was constructed, tested and the results were tabulated

CONNECTION DIAGRAM FOR FLOURESCENT LAMP



Ex. No.: 3 FLOURESCENT LAMP WIRING WITH INTRODUCTION TO CFL AND LED TYPES

Date :

AIM

To set up a fluorescent lamp, LED wiring, controlled by a switch.

APPARATUS REQUIRED

Sl. No.	Description	Range / Size	Quantity
1.	One way Switch	230V / 5A	1
2.	Fluorescent Lamp	230V / 60W	1
3.	LED light	220V/12W	1
3.	Choke	-	1
4.	Tube base	4 feet	1
5.	Copper wire	$\frac{1}{18}$	As req.
6.	Starter	Glow type	1
7.	Screws	$\frac{1}{2}$ "	As req.
8.	Tube side holder	-	2
9.	Starter holder	-	1

PRECAUTIONS

1. Live wire should always be controlled with switch.
2. Don't use neon tester as screw driver.
3. Joints in wire are made with proper insulation.

PROCEDURE

1. Layout of the given circuit diagram was drawn on the circuit board.
2. Fluorescent tube accessories like starter holder, holder for tube and choke were fitted in the tube base with the help of screws.
3. Finally the tube was fixed in the tube holder.
4. Supply was given to the circuit and the glow of lamp was identified after fine adjustment of the lamp.
5. For connecting LED type light, connect directly with supply line.

Introduction to Compact Fluorescent Lamp (CFL) Bulbs:

- CFL Bulbs are commonly known for their energy efficiency that consumes less electricity and ultimately reduces overall spending on electricity, than the traditional incandescent bulbs. So these bulbs are curled up.



Fig. CFL lamp.

- These are available in two types in the lighting market:
 - Screw-in
 - Plug-in
- Compact Fluorescent Lamp, has two main parts, i.e. gas-filled tube and ballast, which is either magnetic or electronic.
- CFLs with magnetic ballast, usually flicker at the time of start.
- Normally, they are available in spiral or helical design. They are made up of glass tube, which contains gases including mercury and argon.
- Fluorescent Material is used to smear the glass tube from within.
- As soon as the switch is on, current flows from the ballast, electrons are produced that electrifies the gases present in the tube that releases ultraviolet radiation.
- As a result of which the coating inside the tube is induced, that emits light.
- Hence, the process takes a certain amount of time which is why CFL bulbs take time to lighten up completely.
- When compared to an incandescent bulb, the amount of light produced by a 15W CFL bulb is equal to the 60 incandescent bulbs, which is nearly 60 lumens per watt. Also, these bulbs can be recycled, as they contain mercury, instead of throwing after usage.

Introduction to LED:

- A light-emitting diode (LED) is basically a semiconductor device that transmits light when an electric current is given into it.
- Light is displayed when the particles that take the current (known as electrons and holes) mix with the semiconductor material.

Different Types of LED

1. Through-Hole LEDs: (Types of LED)

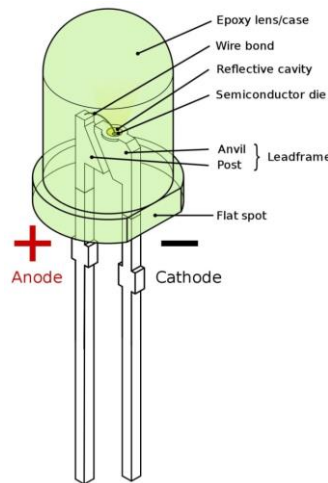
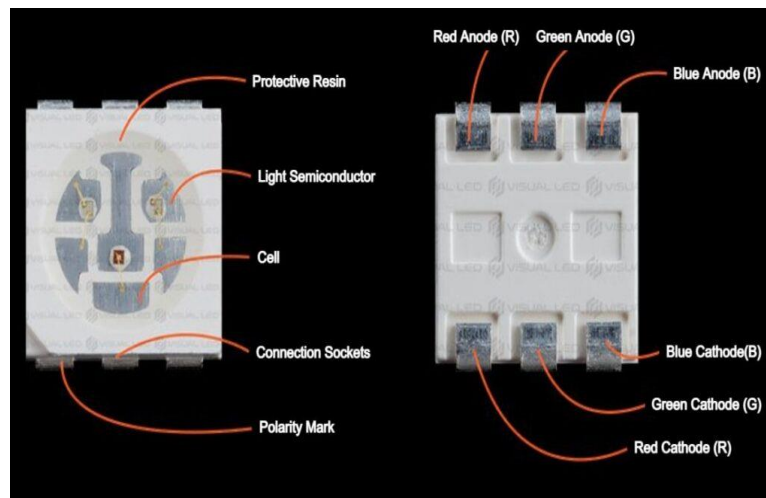


Fig.: Through Hole LED

- These types of LEDs are found in different shapes and sizes and the most common LEDs are 3mm, 5mm and 8mm LEDs.
- These LEDs are available in different colors like Red, Blue, Yellow, Green, White, etc.

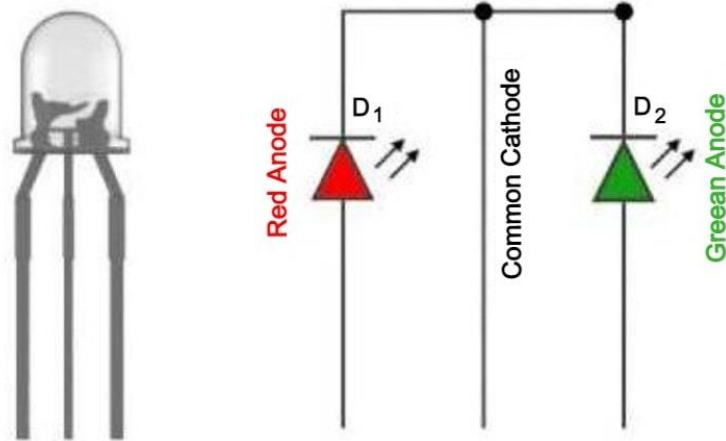
2. Surface Mount LEDs: (Types of LED)



SMD

- Surface Mount or SMD LEDs are the special types of LEDs that can be simply mounted on the surfaces like PCB and general-purpose boards.

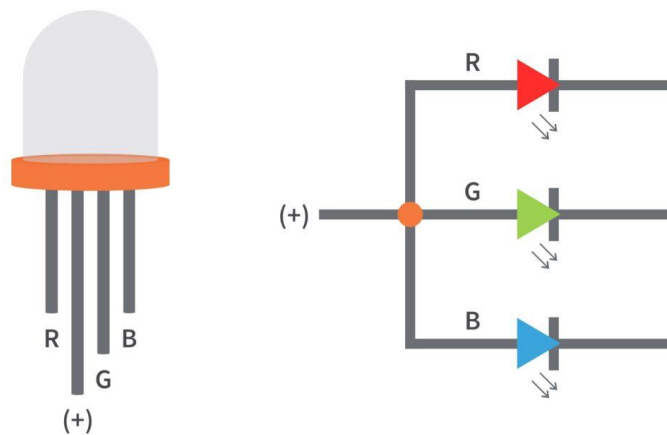
3. Bi-Color LEDs: (Types of LED)



Bi Color LED

- The next type of LEDs are Bi-color LEDs. As the name implies, they can transmit two colors.
- Bi-color LEDs have three leads, in which there are two anodes and one is a common cathode. Depending on the order of the leads, the color will be formed.

4. RGB LED: (Types of LED)



- RGB LEDs are the most beloved and most stylish LEDs among hobbyists.
- Even computer builds are very popular for performing RGB LEDs in computer cases, motherboards, RAMs, etc. RGB LED includes three LEDs on a single chip and by a method called PWM (Pulse Width Modulation), we can control the output of the RGB LED to produce a wide range of colors.

5. High-Power LEDs: (Types of LED)

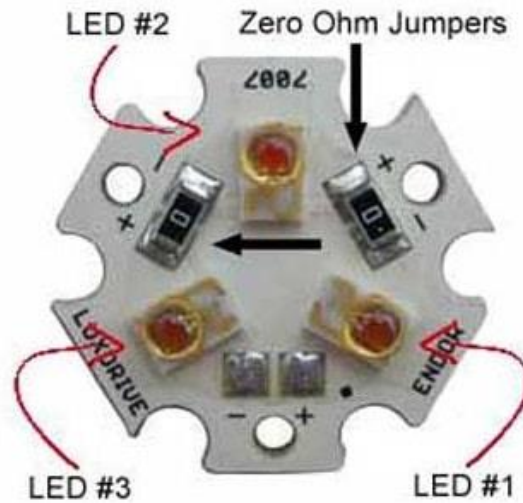


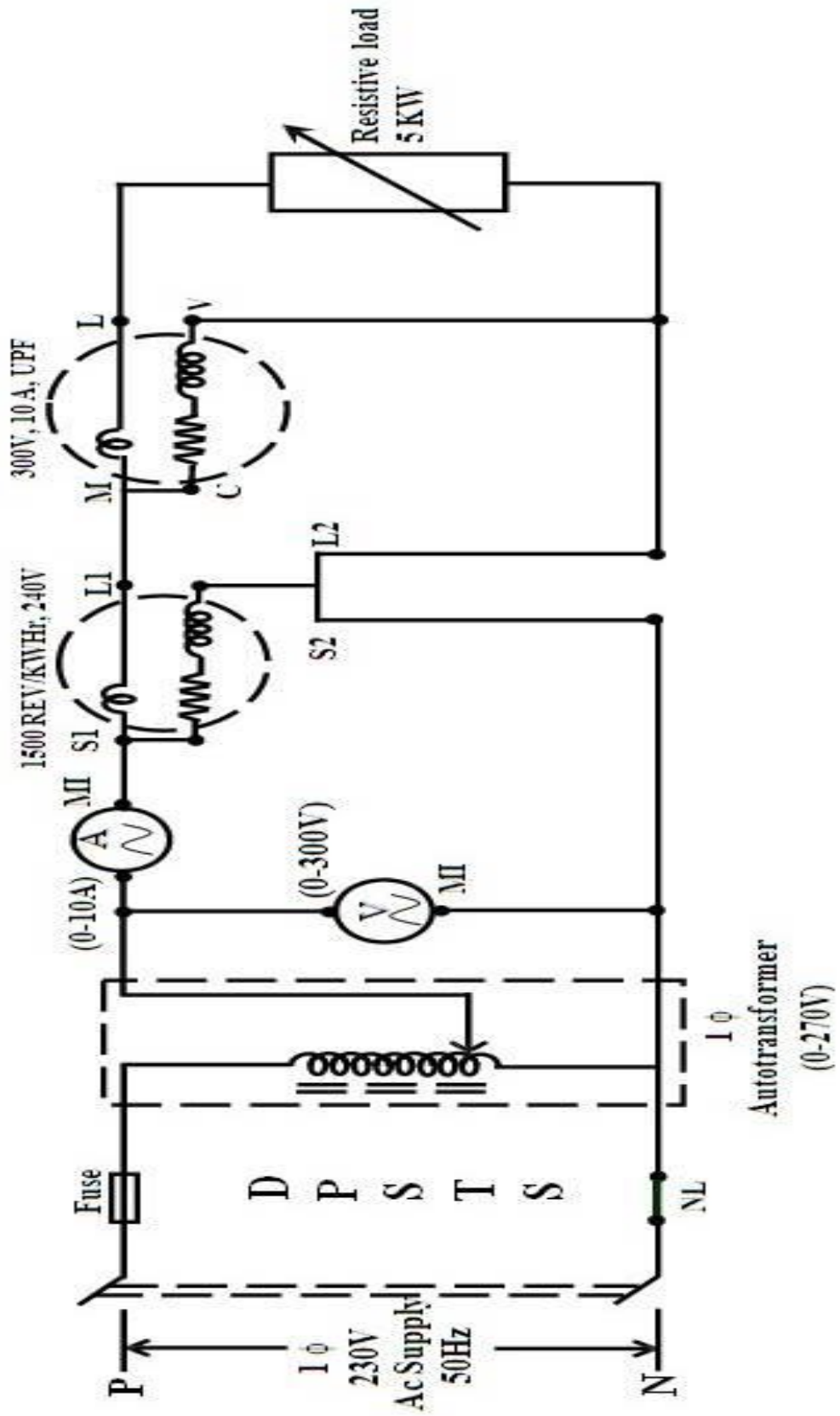
Fig. High Power LED

- The LEDs having a power rating of more than or 1 Watt is called a High Power LED. This is because conventional LEDs have a power dissipation of few mill watts.
- High Power LEDs are very radiant and are often used in Flashlights, Automobile Headlamps, Spotlights, etc.
- Since the power dissipation of High – power LEDs is large, a decent cooling and method of heat sinks are required. Also, the input power needed for these LEDs will be usually very high

RESULT:

Thus the set-up of fluorescent lamp, LED light wiring was completed and tested successfully.

CIRCUIT DIAGRAM



**Ex. No.: 4 ENERGY METER WIRING AND RELATED CALCULATIONS/
CALIBRATION**

DATE :

AIM

To measure the energy consumed by an electrical load using single phase energy meter.

APPARATUS REQUIRED

Sl. No	Description	Range / Type	Quantity
1	Single phase Energy meter	1500 rev / kWh, 240V, 50Hz	1 No
2	Wattmeter	300V, 10A, UPF	1No.
3	Voltmeter	(0-300)V, MI	1No.
4	Ammeter	(0-10)A, MI	1No.
5	Load	Resistive, 5kW	1No.
6	Wires	1 / 18 SWG	As per requirement

PRECAUTIONS

1. Ensure that power is switched off, before the connections are being made.
2. Live wire should always be controlled with switch.
3. Don't use neon tester as screw driver.
4. Joints in wire are made with proper insulation.
5. When starting an auto transformer, it should be in minimum position.

FORMULA USED

$$\text{Theoretical Energy Consumption(True Energy)} = \frac{V \times I \times t}{1000 \times 3600} \text{ in kWh}$$

$$\text{Practical Energy Consumption(Measured Energy)} = \frac{\text{No. of Revolutions}}{\text{Meter Constant}} \text{ in kWh}$$

Where,

V – Voltage in volt

I – Current in ampere

t – Time in seconds

TABULATION :

Energy Meter Constant = _____

Multiplication Factor = _____

Sl. No	Supply Voltage V	Load Current I (A)	Wattmeter Reading P (W)		Time t (sec)	True Energy (kWh)	Measured Energy (kWh)
			OBS	ACT			

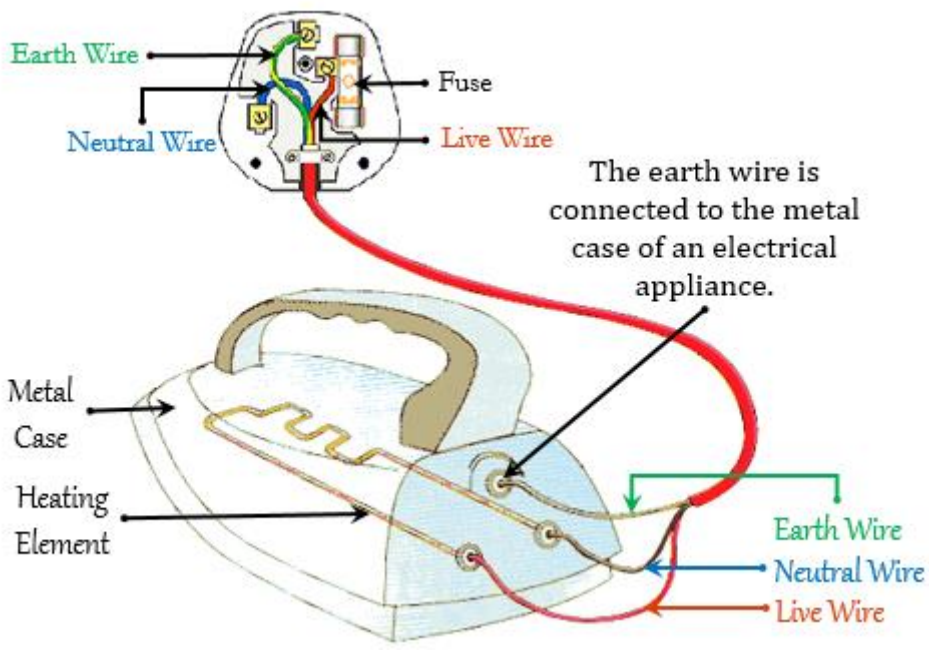
PROCEDURE

1. Connection was made as per the circuit diagram.
2. Proper connection was checked before giving the supply.
3. After that, load was gradually increased by using tapping switches and corresponding voltmeter, ammeter and energy meter disc revolutions were noted.
4. After successful completion of the experiment, the applied load was gradually reduced.
5. Finally, power supply switch was switched off and the circuit was disconnected.

RESULT

Thus the measurement of energy using single phase energy meter for different load conditions was calculated successfully.

WIRING DIAGRAM OF IRON BOX



Ex. No.: 5 STUDY OF IRON BOX WIRING AND ASSEMBLY

Date :

AIM:

To study of Iron Box wiring and assembly with its working principle.

REQUIREMENTS:

1. Iron box
2. Tools

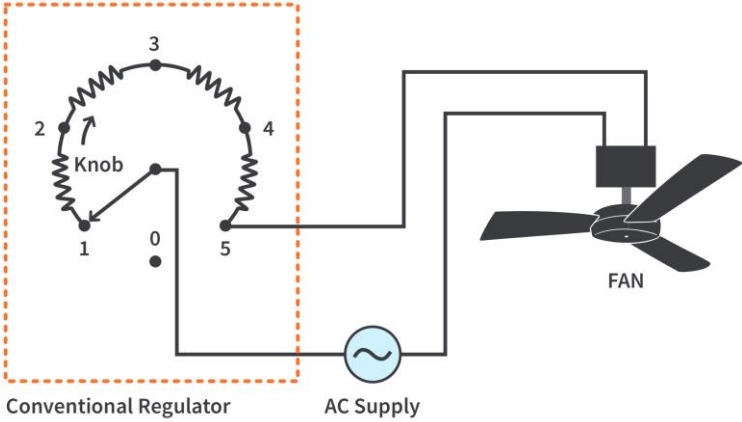
THEORY:

- The colours of three wires in a cable connected to the plug of an electric iron are:
 - Live wire - red
 - Neutral wire - black
 - Earth wire - green
- The electric wiring in houses, shops, or factories has three wires: live, neutral and earth. The first two carry electric current from the power station and the third is earthed by connecting it to the earth through a metal wire called 'Earth Wire'.
- To avoid confusion between these three wires, we follow different colour code to insulate these wires. This colour coding of wires helps us to connect the switches, plugs and other electrical components through the appropriate wire in the home wiring circuit.
- The red wire is the live wire, the black wire is neutral and the earth wire is given green insulation.

RESULT:

The iron box wiring and assembly has been studied.

CIRCUIT DIAGRAM



Ex. No. 6 (i) STUDY OF FAN REGULATOR (RESISTOR TYPE)

Date:

AIM:

To study the electronic type using Resistor type fan regulator.

REQUIREMENTS:

1. AC Power supply
2. Fan
3. Resistor by regulator
4. Electronic type regulator

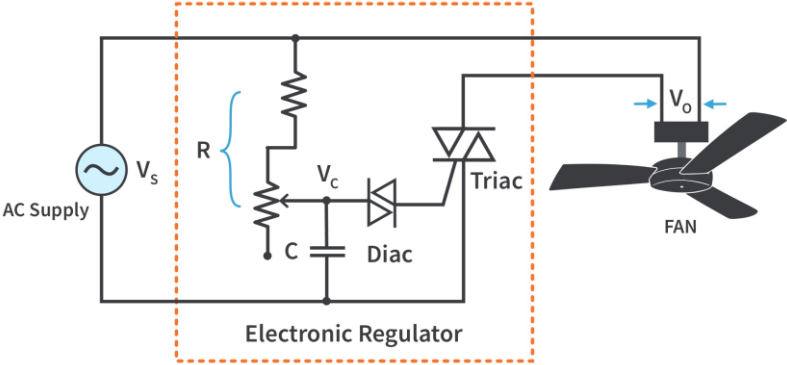
THEORY:

- A fan is probably one of the most used household electrical appliances in the world but they are also used extensively for thermal management.
- Before we dive into what regulates and controls fans, we shall first look at the fan itself and understand how its speed is controlled.
- Regulators are devices that are used to control the speed of the fan. Today, electronic regulators are used everywhere and it's hard to find conventional regulators being used. Let's see why.
- The conventional type, also called the resistor type regulator is a basic potential divider circuit as shown below.
- As we go on changing the position of the knob from 1 to 5, the series resistance keeps on decreasing and hence the voltage applied to the fan increases and so does the speed.
- But in this type of regulator, the energy we save in running the fan at slower speeds is lost in heating up the resistors.
- This damages the regulator over a period of time and hence they aren't reliable.
- Also, they are bulky.

RESULT:

Thus the resistor type regulator of fan has been studied.

CIRCUIT DIAGRAM



**Ex. No. 6 (ii) STUDY OF FAN REGULATOR (ELECTRONIC TYPE) USING
DIAC/TRIAC**

Date:

AIM:

To study the electronic type using Diac/Triac type fan regulator.

REQUIREMENTS:

1. AC Power supply
2. Fan
3. Resistor by regulator
4. Electronic type regulator

THEORY:

Today, we use smaller electronic regulators which consist of power semiconductor devices - mainly the TRIAC and the DIAC.

COMPONENTS:

TRIAC:



- A TRIAC is a three terminal semi-controlled power semiconductor device which conducts current in both the directions when triggered. The trigger pulse is given to the gate terminal (G) of the device.

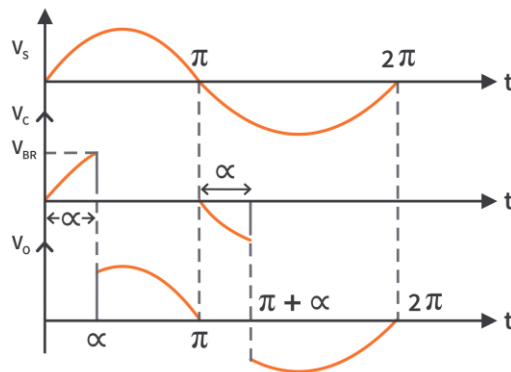
DIAC



- A DIAC is a two terminal uncontrolled power semiconductor device which conducts current in both the directions when the voltage across the device crosses a certain threshold level called the breakdown voltage (V_{BR}).

Operation of the Electronic Voltage Regulator Circuit

- Consider the positive half cycle of the supply.
- As the TRIAC is not yet triggered, it remains off condition and the voltage across the fan is zero.
- And hence the current flows through the resistor capacitor branch and charges the capacitor.
- Once the capacitor is sufficiently charged enough such that the voltage across the DIAC crosses its breakdown voltage level (V_{BR}), it conducts triggering the TRIAC and turning it on and now, the supply voltage appears across the fan.
- The same thing happens even in the negative half cycle.
- As the voltage doesn't appear across the fan for the complete cycle, the RMS value of the voltage across the fan decreases and hence its speed reduces.



- The RMS voltage across the fan depends on α , which is the time taken by the capacitor to charge up to the voltage V_{BR} .
- This depends on the time constant ($R \cdot C$) of the resistor capacitor branch.
- As we decrease the value of the resistance R , the time constant decreases which results in the decrease in α which in turn increases the RMS value of the voltage across the fan and hence increasing the speed and vice versa.
- Therefore, by varying the resistance R , we can control the speed of the fan using the electronic regulator.
- In the case of electronic regulators, the loss of energy as heat through resistors is much less as only a very small current flows through them.
- Also, they are small and compact and have a quicker response time, making them more widely used.

RESULT:

Thus the electronic type using Diac/Triac type fan regulator has been studied.

Ex. No. 7 (i): STUDY OF WATER HEATER WIRING

Date :

AIM:

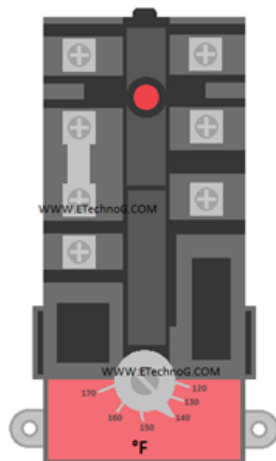
To Study of Water heater

REQUIREMENTS:

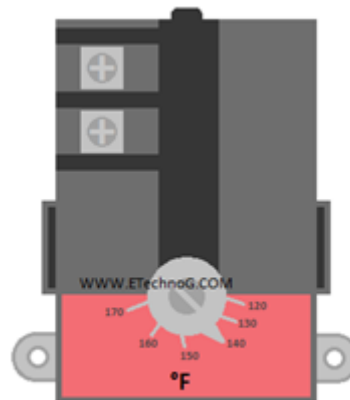
1. AC Power supply
2. Water heater

THEORY:

- An electric heater is an instrument that converts electrical energy into heat energy.
- The connection diagrams show the connections used in geysers.
- Electric heaters come with very useful during the winter seasons for water heating, room heating, and many other applications.
- Heaters are wired with the objective of proper heating, safety, automatically, on, off, etc.
- It will helps to find out the internal fault in a water heater system and is easy to repair.
- There are two types of water heater systems mostly used –
 1. Single Element Water Heater and
 2. Double Element Water Heater.
- Single Element water heaters are those which use a single heating element for heating.
- The double-element water heaters are those which use two heating elements for heating.
- Most of the water heaters come with a thermostat connection.
- A thermostat is a device that allows to turn on or turn off the heating element automatically.
- Also, we can set the temperature according to our requirements.
- So, here we will see the thermostat connection also.



Upper Thermostat



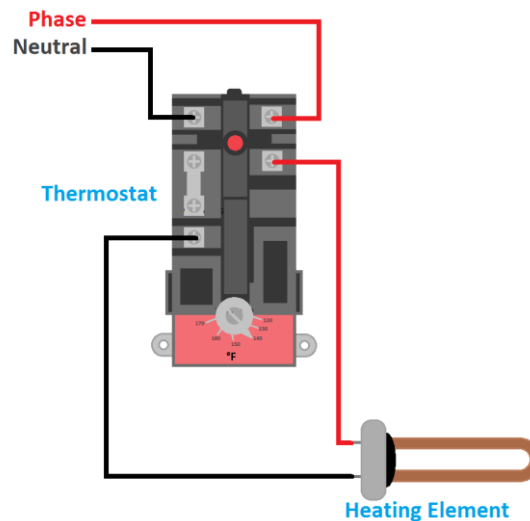
Lower Thermostat

There are two types of thermostats used in a double-element water heater system - Upper Thermostat and Lower Thermostat.

- The upper thermostat has a total of five terminals for its connection and the lower thermostat has a total of two terminals for its connection.
- The terminal diagram of the upper and lower thermostat are shown in the diagram.

SINGLE ELEMENT WATER HEATER WIRING DIAGRAM AND CONNECTION

The figure shows the connection diagram of the single-element water heater.



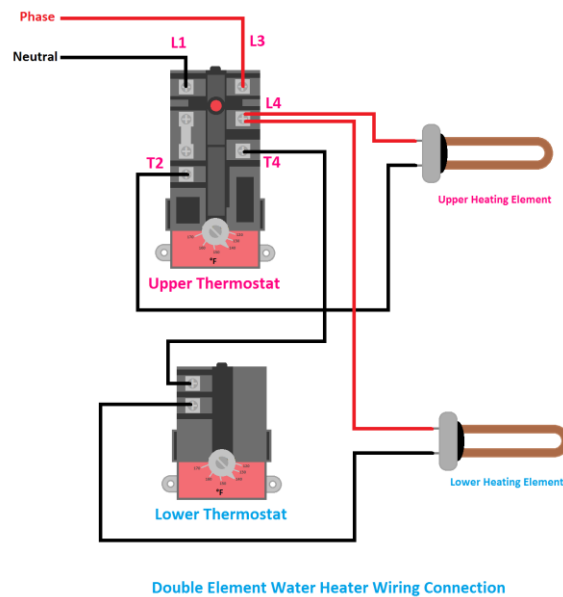
PROCEDURE TO WIRE A WATER HEATER

1. Connect the upper right side terminal to the phase terminal of the power supply.
2. Connect the upper left side terminal to the neutral terminal of the power supply.
3. Connect the lower right side terminal to the phase terminal of the heating element.
4. Connect the lower left side terminal of the thermostat to the neutral terminal of the heating element.

- Remember that a single element water heater can be operated at 120V or 230V AC Supply.
- Also, note that the thermostat used in a single element water heater system is different from the thermostat used in a double element water heater system.

DOUBLE ELEMENT WATER HEATER CONNECTION DIAGRAM WITH THERMOSTAT

The figure shows the connection diagram of the double element water heater system with thermostat.



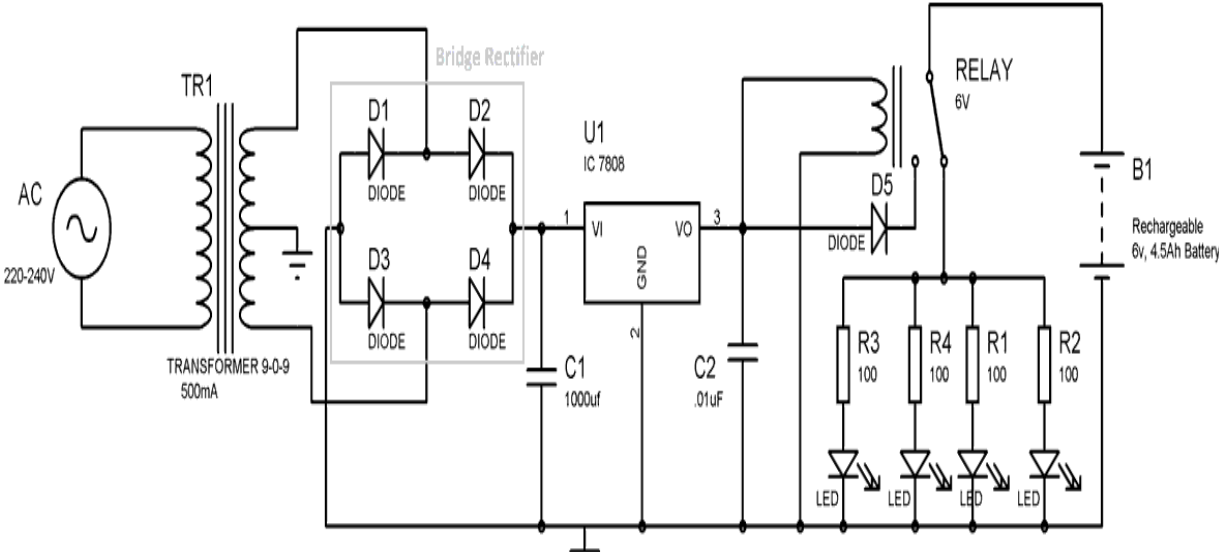
Connection Procedure

1. Connect the upper right side terminal of the upper thermostat to the phase terminal of the power supply.
2. Connect the upper left side terminal of the upper thermostat to the neutral terminal of the power supply.
3. Connect the upper right middle terminal of the upper thermostat to the phase terminal of the upper heating element.
4. Connect the lower left side terminal of the upper thermostat to the neutral terminal of the upper heating element.
5. Connect the phase terminal of the lower heating element to the upper right middle terminal of the upper thermostat.
6. Connect the neutral of the lower heating element to the lower right side terminal of the upper thermostat through the lower thermostat as shown in the above figure.

RESULT:

Thus the water heater has been studied.

CIRCUIT DIAGRAM



Ex. No. 7 (ii): STUDY OF EMERGENCY LAMP WIRING

Date:

AIM:

To study of emergency lamp wiring with its working principle.

REQUIREMENTS:

1. Transformer- 9-0-9 500mA
2. Bridge rectifier
3. Diode- 1N4007
4. IC 7808 voltage regulator
5. Capacitor 1000uF, 0.01uF
6. Relay- 6v
7. Resistors- 100 ohm
8. LEDs- Ultra bright white LED
9. Rechargeable 6v, 4.5Ah Battery

THEORY:

Emergency light is an integral part of household electronics nowadays. We all know Emergency light is used during the power failure to light up the home. As it is used during the power failure, it should last long, hence generally bright white LEDs are used in emergency light, because they produce more light and consume less power. Emergency light is very useful and popular project in DIY section. So today we are going to build a simple and cost effective emergency light.

In this emergency light circuit, when the Power goes OFF, the emergency light activates automatically. We have used four bright white LEDs, more LEDs can be added to produce more light considering that total current consumption should not exceed the supply current. Ultra bright white LED consumes 3v and 20mA current.

CIRCUIT EXPLANATION:

We can divide this LED emergency light circuit into two parts; first part is used to drop down the 220v AC voltage into 8v regulated DC, with the help of Transformer and bridge rectifier. And second part consists of Relay and rechargeable battery, which is used to lighten the LEDs during power failure.

n the first part of the circuit we have used Transformer 9-0-9 500mA, to step down the 220 voltage into 9v. Bridge rectifier is the combination of 4 diodes which is used to remove the negative half component of AC. This process is called the Rectification. Further, 1000uF capacitor has been used for Filtration, means removing the ripples in resulted wave. And voltage regulator 7808 has been used to Regulate the DC wave, to provide the uninterrupted and smooth 8v DC supply.

The second part of the emergency light circuit consist the main functionality, that is to automatically switch ON the emergency light (Array of white LEDs) on Power Failure. We have used Relay here to automate this. A 6v, 4.5Ah rechargeable battery is connected to the Array of LEDs, through a Relay. Normally when there is no power failure, the coil of Relay remains energised and lever is attracted towards the NO (normally open) terminal and NC (normally connected) terminal remains open. In this situation LEDs are disconnected from the rechargeable battery and remains OFF, also battery is getting charge through the power supply from the transformer. A diode D5 is used to prevent the battery from flowing back.

Now when the power fails, relay coil become de-energized and lever gets connected to NC terminal, which connects the LEDs to the rechargeable battery, and LEDs array goes ON. This is how this emergency light works. Now when the power is restored back, relay gets activated and lever again connects to NO terminal which in turn disconnects the LEDs from the battery and connects battery to the transformer for charging.

Generally 6v, 4.5Ah rechargeable battery comes with Deep discharge recovery and overcharge protection mechanism, but we can use zener diode of 6.8v to protect the battery from overcharging. We can also use other rechargeable batteries like Nickel-cadmium battery (NiCad), Nickel–metal hydride battery, cell phone batteries etc. Further we can also use PNP transistor BD140 in place of Relay. PNP transistor can be used here as a switch, like it will be OFF when continuously voltage is applied to base of it, in case when power is there and it will be ON, in case of power failure which connects the LEDs to the rechargeable battery, and activates the LED emergency light.

This emergency light can also be made using LDR (light dependent resistor), in which light will automatically switch ON according to darkness, means it remains switch OFF in presence of light and switch ON in absence of light.

Applications of Emergency Light

The applications of these lights include the following. Emergency lights are used where the light turns on automatically when the power supply gets off. These are used as emergency lamps in buildings, homes, workplaces, study rooms in order to keep away from unexpected power failures. These lights are used in several industries

RESULT:

The emergency light circuit is studied and observed the operating principles along with its applications.

GROUP – B (PART IV)
ELECTRONICS ENGINEERING PRACTICE

INTRODUCTION TO RESISTORS

Resistors are the most common components in electronic circuits. Its main function is to reduce the high current to the desired value and also to provide desired voltage in the circuit. The resistors are manufactured to have a specific value in ohm. The physical size of resistor determines how much power can be dissipated in the form of heat. However there is co-relation between resistor physical sizes and its resistance value. They are manufactured in variety of standard values and power settings.

There are two types of resistors:

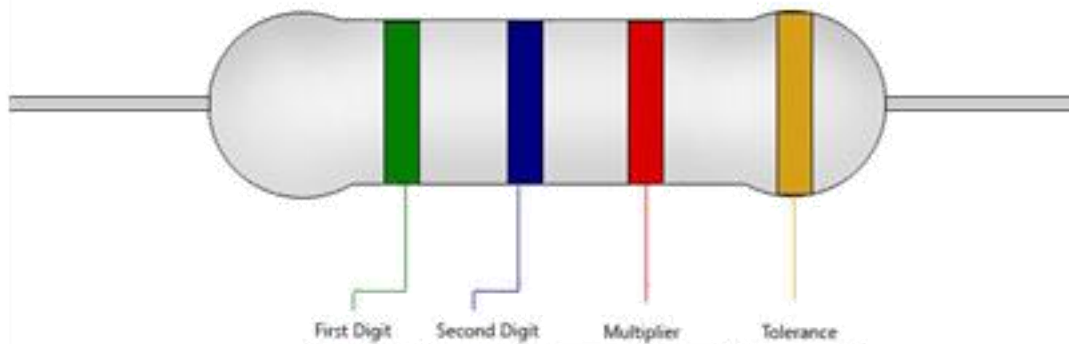
- Fixed resistor
- Variable resistor

Fixed resistor has a resistance value that does not change where as a variable resistor having variable resistance range with 4 lines or color code. They indicate the resistance value in ohms out on a larger resistor; the resistance value is printed on the body of the resistor. The important feature of resistor is that its effect is same for both AC and DC circuits.

TYPES OF RESISTORS

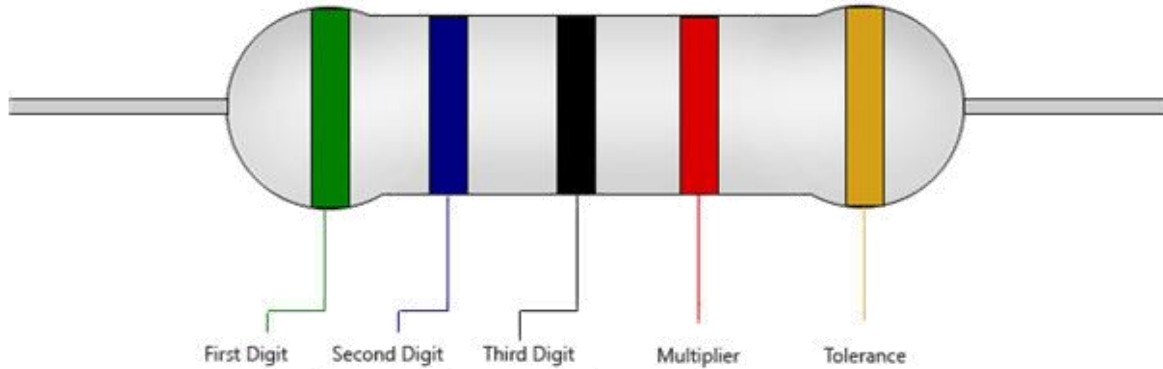
- Wire wand resistors
- Carbon Composition resistors
- Film resistors
- Surface mount resistors
- Fusible resistors

4 Band Resistor



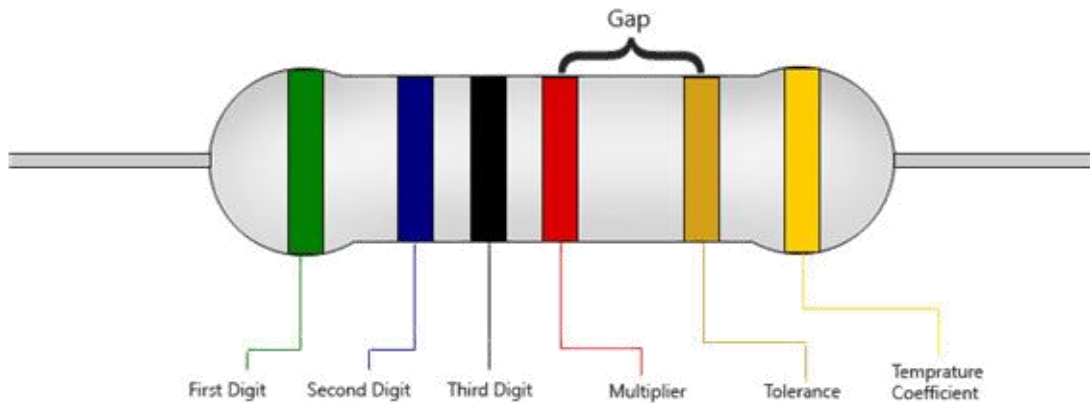
	First Digit	Second Digit	Multiplier	Tolerance
Black	Nil	0	1	Nil
Brown	1	1	10	±1%
Red	2	2	100	±2%
Orange	3	3	1000	±3%
Yellow	4	4	10000	±4%
Green	5	5	100000	±0.5%
Blue	6	6	1M	±0.25%
Violet	7	7	10M	±0.10%
Grey	8	8	100M	±0.05%
White	9	9	1G	Nil
Gold	Nil	Nil	+10	±5%
Silver	Nil	Nil	+100	±10%

5 Band Resistor



	First Digit	Second Digit	Third Digit	Multiplier	Tolerance
Black	Nil	0	0	1	Nil
Brown	1	1	1	10	±1%
Red	2	2	2	100	±2%
Orange	3	3	3	1000	±3%
Yellow	4	4	4	10000	±4%
Green	5	5	5	100000	±0.5%
Blue	6	6	6	1M	±0.25%
Violet	7	7	7	10M	±0.10%
Grey	8	8	8	100M	±0.05%
White	9	9	9	1G	Nil
Gold	Nil	Nil	Nil	÷10	±5%
Silver	Nil	Nil	Nil	÷100	±10%

6 Band Resistor



Black	Nil	0	0	1	Nil	Nil
Brown	1	1	1	10	±1%	100
Red	2	2	2	100	±2%	50
Orange	3	3	3	1000	±3%	15
Yellow	4	4	4	10000	±4%	25
Green	5	5	5	100000	±0.5%	Nil
Blue	6	6	6	1M	±0.25%	10
Violet	7	7	7	10M	±0.10%	5
Grey	8	8	8	100M	±0.05%	Nil
White	9	9	9	1G	Nil	Nil
Gold	Nil	Nil	Nil	÷10	±5%	Nil
Silver	Nil	Nil	Nil	÷100	±10%	Nil

FIND THE COLOR OF THE RESISTOR:

Provided Resistor Value	Resistor Values (Ω)	Color Code			
995 Ω					
3.39K Ω					
1K Ω					
15 K Ω					
330 Ω					

FIND THE VALUE OF THE RESISTOR:

Provided Color Code			Value (Excluding Tolerance)			Theoretical Value	Multimeter Value
Red	Red	Orange					
Brown	Green	Red					
Red	Red	Red					
Orange	Orange	Orange					

OHM'S LAW:

Ohm's law states the relationship between electric current and potential difference. The current that flows through most conductors is directly proportional to the voltage applied to it. Georg Simon Ohm, a German physicist was the first to verify Ohm's law experimentally.

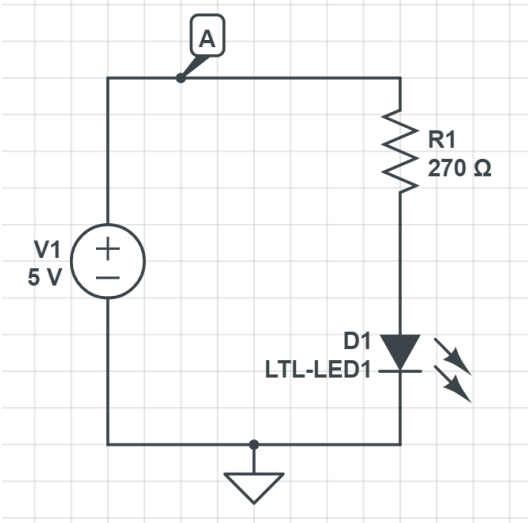
$$V=IR$$

V- Voltage in Volts(V)

I- Current in Amps(A)

R- Resistance in Ohms(Ω)

CIRCUIT DIAGRAM:



TABULATION:

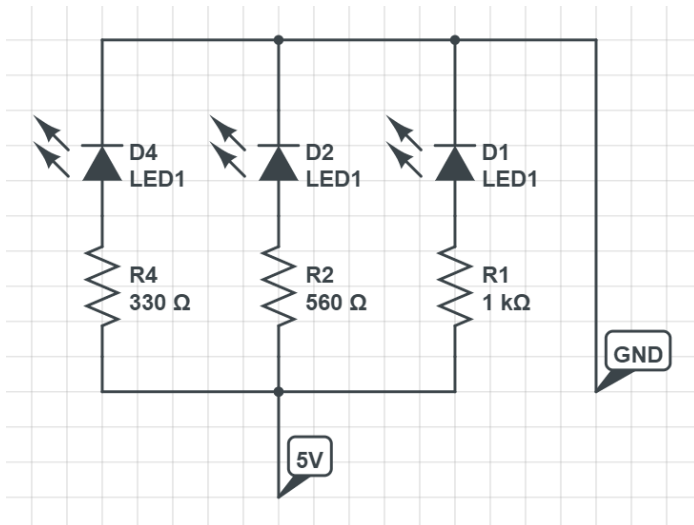
Resistor	Voltage	Current
270Ω	5V	

RESULT:

Thus the basics of resistor color code and ohms law is studied and verified..

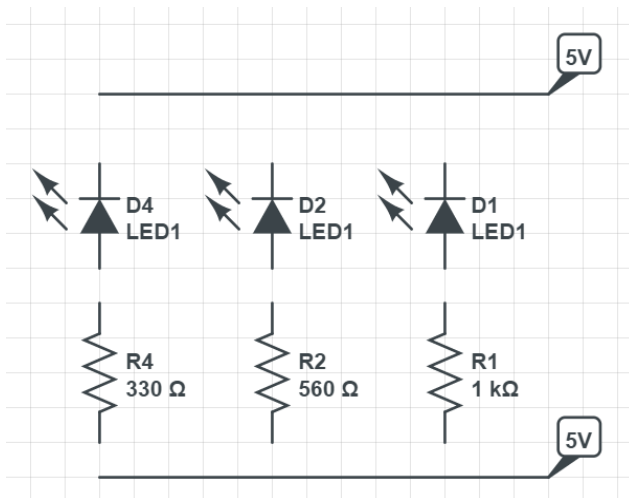
SOLDERING:

CIRCUIT DAIGRAM:



DESOLDERING:

CIRCUIT DAIGRAM:



Ex. No.: 9 SOLDERING WORK**(a) SOLDERING SIMPLE ELECTRONIC CIRCUITS AND CHECKING CONTINUITY****Date:****AIM**

To practice soldering and de-soldering for the electronic circuit by assembling and disassembling in the Printed Circuit Board (PCB) and check for its Continuity.

APPARATUS REQUIRED

S.NO	NAME OF THE APPARATUS	RANGE	QUANTITY
1.	PCB Board	-	1
2.	Soldering iron	60/40 grade	1
3.	Solder	-	As Required
4.	Soldering Flux	-	As Required
5.	Capacitor	100 μ f	As Required
6.	Resistor	1k Ω	As Required
7.	Multimeter	-	1

THEORY:

- ✓ Soldering is the process of joining electrical parts together to form an electric connection, using a molten mixture of lead and tin (solder), with a soldering iron.

Soldering Iron:

- ✓ It supplies sufficient heat to melt solder by heat transfer, when the iron tip is applied to a connection to be soldered.
- ✓ The soldering iron temperature is selected according to the work to be performed.

Soldering Iron Stand:

- ✓ The stand is the safe place to put the iron when we are not holding it.
- ✓ The stand includes a sponge which can be dampened for cleaning the tip of the iron.

Solder:

- ✓ It is alloy of low melting metals like tin, lead, cadmium, silver etc.
- ✓ The most commonly used alloy combination is 63% tin and 37% lead.

Soldering Flux:

- ✓ It is a resin, applied on the work piece to be soldered, preventing contact with the atmosphere.
- ✓ It maintains a clean surface and dissolves oxides thereby enabling good soldering.
- ✓ Aluminium chloride or zinc chloride are commonly used as flux.
- ✓ The flux also assists in the transfer of heat from the soldering iron tip to the joint area.

PROCEDURE:**SOLDERING:**

1. Study the electronic circuit.
2. Clean the given PCB board.
3. Clean the tip of the soldering iron before heating and also the resistor, capacitor which are to be soldered.
4. Heat the soldering iron and apply solder to the tip as soon as it is hot to melt on it.
5. Bend the resistor leads to fit into the holes on the board.
6. Insert the resistor, as per the circuit shown in the figure and bend the leads.
7. Apply the hot tips to the joints and apply the solder.
8. Remove the soldering tip and hold the resistor tightly until the solder has cooled and set.
9. Trim excess component lead with side cutter.
10. Repeat the above steps to fix the other resistor and capacitor.

DE-SOLDERING:

1. Place the tip of the soldering iron on the joints until the solder is melt.
2. Using de-soldering wick remove the molten state.
3. On the component side using tweezers remove the de-soldered components.

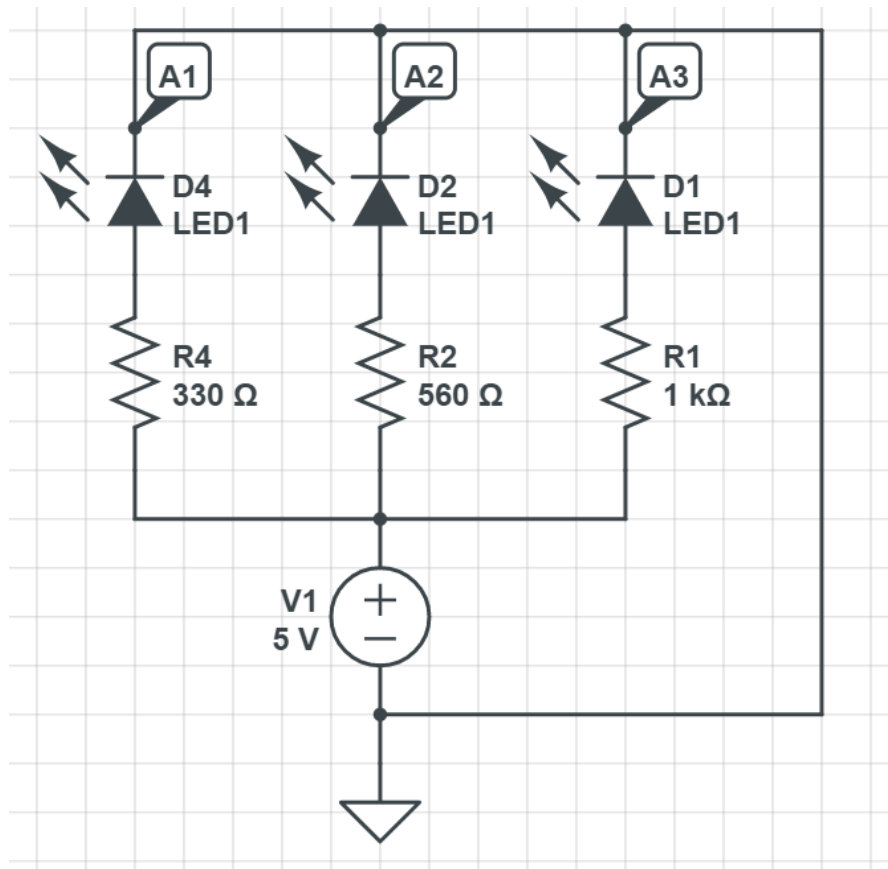
CONTINUITY CHECK:

1. Set the Multimeter in continuity check mode or resistor mode.
2. Place the two leads (common, +ve lead) in the two points to be checked.
3. If the resistance value is displayed as zero, there exists continuity.
4. Otherwise two points are not internally connected. (When set in continuity check mode, a beep sound is heard, if continuity exists between the two points)

RESULT:

Thus the soldering and de-soldering for the electronic circuit by assembling and disassembling in the Printed Circuit Board (PCB) is practiced and continuity check was also done.

CIRCUIT DIAGRAM:



Ex. No: 10 ELECTRONIC ASSEMBLY AND TESTING WORK:
ASSEMBLING AND TESTING ELECTRONIC COMPONENTS ON A SMALL PCB.

AIM:

To practice assembling and testing electronic components on a small PCB.

COMPONENTS REQUIRED:

S.NO	COMPONENTS NAME	VALUE	QUANTITY
1.	Power Supply	5V/1A	1
2	Digital multimeter (DMM)-	-	1
3	Resistors	330, 560, 1K	Each 1 no
4	Connecting wires	-	1
5	Soldering kit	-	1
6	Printed Circuit Board		

PROCEDURE:

1) Assembling the circuit

- a) Assemble the circuit by placing the LEDs and resistors in the PCBs per the assembly diagram shown in the figure.
- b) Bend the resistors lead to the appropriate size before inserting them into the board
- c) Solder the resistor on bottom side of PCB board using soldering iron.

2) Testing the circuit

- a) Connect the 5V DC source from power supply.
- b) Connect the multimeter at A1, A2 and A3 nodes and measure its current.

3) TROUBLESHOOTING:

- a) Set the digital multimeter in the continuity mode. Unplug the device or switch off the circuit before attempting a continuity test. Check the continuity between all five nodes.
- b) When the resistor value differs from the circuit, the output value also differs.

Measure the current and note the values in the table below.

Voltage (V)	Resistor (R)	Theoretical Current (A)	Practical Current (A)
5V	330Ω		
5V	560 Ω		
5V	1K Ω		

RESULT:

Thus, the practice of assembling and testing electronic components on a small PCB has been successfully done.

Ex. No.: 11 ELECTRONIC EQUIPMENT STUDY:

STUDY AN ELEMENTS OF SMART PHONE.

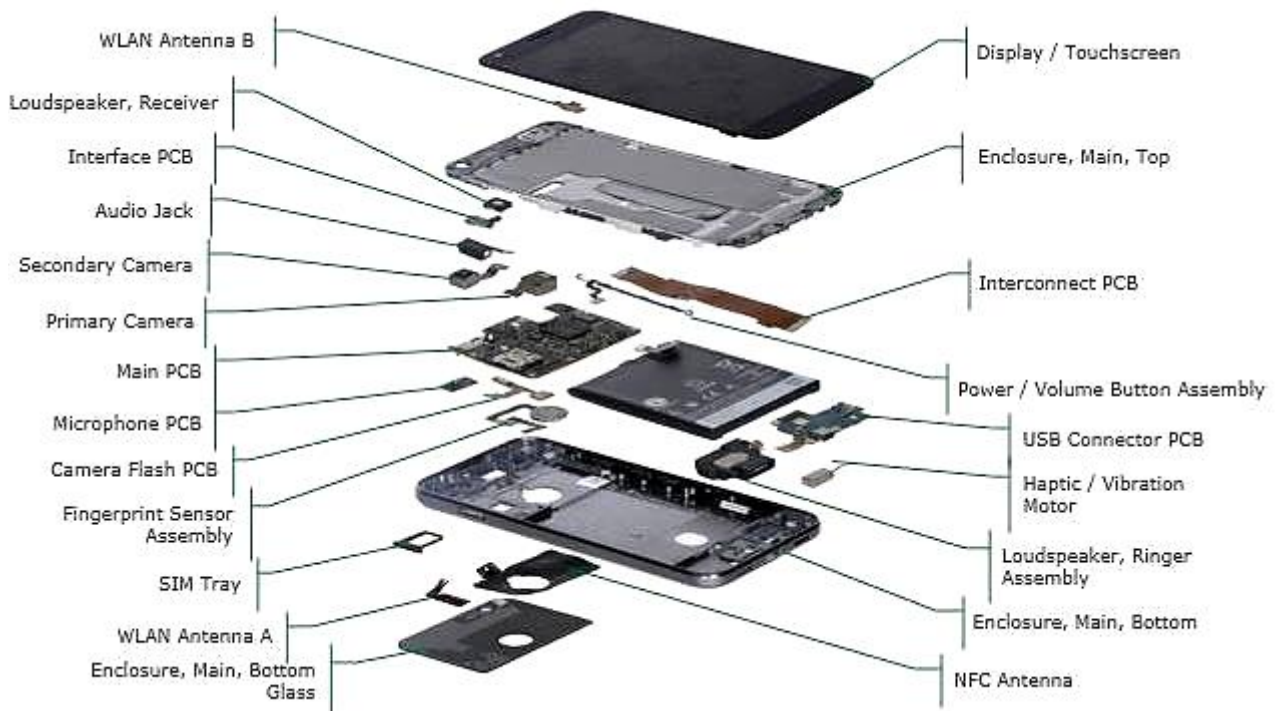
AIM:

To study the elements of a smart phone.

REQUIREMENTS:

1. Any smart Phone
2. Screwdriver Tool Kit

DIAGRAM:



➤ **Touch screen:**

- The digitizer pasted to the front glass together is called as a "Touch Screen".

➤ **Display:**

- The Display or The LCD (Bottom Layer) - The bottom layer which produces the image. The display is the visual component underneath the glass that displays the image on the screen.

➤ **Mobile enclosure (Top and Bottom):**

- Mobile enclosure with easy to hold rounded design. Frame is made from extruded aluminum material, while the panel is ABS plastic.

➤ **PCB Interconnect:**

- Male PCB Connectors are often referred to as Pin Headers, as they are simply rows of pins.
- Female PCB Connectors can be called Sockets, Receptacles, or sometimes even Header Receptacles.
- **Power / Volume button assembly:**
 - Power button:** It's usually a single button located along the top or right edge of the phone. Press and hold the power button to switch ON or OFF the smart phone.
 - Volume button assembly:** Volume buttons are used to Slide the following volume levels
 - Media volume: Music, videos, games, other media
 - Call volume: Volume of the other person during a call
 - Ring volume: Phone calls, notifications
 - Alarm volume
- **USB connector PCB:**
 - Android smartphones have used the USB Micro-B connector for both data transfer and charging
- **Haptic / Vibration Motor:**
 - Haptics allow non-responsive surfaces like touchscreens to emulate the feeling of using real objects like buttons and dials. Haptic technology can involve vibrations, motors, and even ultrasound beams to simulate the feeling of touch.
- **Loud speaker, Ringer assembly:**
 - The loudspeaker is a small sound driver fitted within a mobile phone, or other communication device, which is used to produce sound. The loudspeakers on mobile phones are used to produce sound alerts for events such as incoming calls, incoming messages and alarms.
- **WLAN Antenna A:**
 - WiFi Antenna (WLAN antenna) is iate signal in air at specified frequency 2.4GHz or 5.8GHz through WiFi antenna/ WLAN antennas and allow other WLAN devices like NB or smartphone to get signal at same frequency range.
- **SIM tray:**
 - A small holder for a phone's SIM card.
- **Fingerprint sensor assembly:**
 - Fingerprint sensors are for added safety and security, and to easily identify users.
 - The two most common fingerprint sensors in use today are optical sensors and capacitive sensors.
- **Camera Flash PCB:**
 - The PCB (Printed Circuit Board) used to connect flash for mobile phone.

- **Microphone:**
 - The microphone at the bottom of your phone. Speak into the mic directly to be heard by others or to speak to your phone.
- **Primary camera: (Main Camera)**
 - It refers to the rear-facing camera system. The lens or lenses reside on the rear of the phone or within a backward facing pop-up camera module.
- **Secondary camera:**
 - This is the Selfie Camera - refers to the front-facing camera system. The lens or lenses reside on the front of the phone or within a forward facing pop-up camera housing.
- **Audio jack:**
 - A phone connector, also known as phone jack, audio jack, headphone jack or jack plug, is a family of electrical connectors typically used for analog audio signals.
- **Loud speaker:**
 - The loudspeaker is a small sound driver fitted within a mobile phone, or other communication device, which is used to produce sound. Traditionally, loudspeakers on mobile phones are used to produce sound alerts for events such as incoming calls, incoming messages and alarms.

RESULT:

Thus the elements of a smart phone were studied.

Ex. No.: 11 ELECTRONIC EQUIPMENT STUDY:

ASSEMBLY AND DISMANTLE OF LED TV.

AIM:

To assemble and dismantle the LED TV.

REQUIREMENTS:

3. LED TV
4. Screwdriver Tool Kit

Warning: This monitor contains electrostatically sensitive devices. Use caution when handling these components.

CAUTIONS:

1. Disconnect the monitor from the power source before disassembly.
2. Follow these directions carefully; never use metal instruments to pry apart the cabinet.

PROCEDURE:

Step 1: Inside the TV - Back View

- Removing some screws (Phillips) off the back panel allows it to be removed.

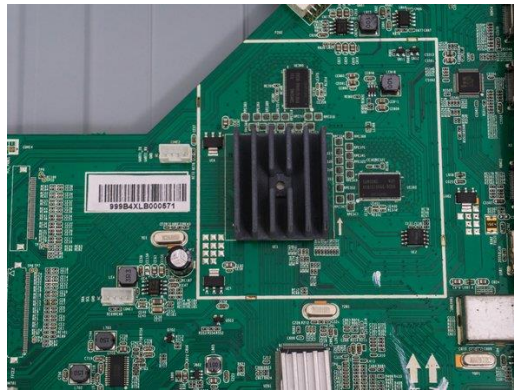


Step 2: Inside Board 1

- This is the power supply. The output voltages include 24V (Backlight), 12V (Control + Panel).



Step 3: Inside Board 2



- This is the main digital board of the TV. It controls all of the TV's functions.
- An interesting note: The service menu (Press Input then 3138 on the remote) has a factory reset option inside it, DO NOT ever use that. It will cause the display to malfunction, and you will have to trigger it again blindly to restore video output.
- The main IC is a MStar chip. The heatsink is poorly adhered to the IC with double sided thermal tape, which may lead to early thermal failure of the IC (seems to be common issue on Newegg forums, digital board failed).
- I glued the heatsink using some thermal RTV adhesive I got from eBay.
- The board has some I2C or Serial UART port on it, maybe it can be used? The USB can supply 5V.
- One cable supplies display data to the panel.

Step 4: Internal Board 3



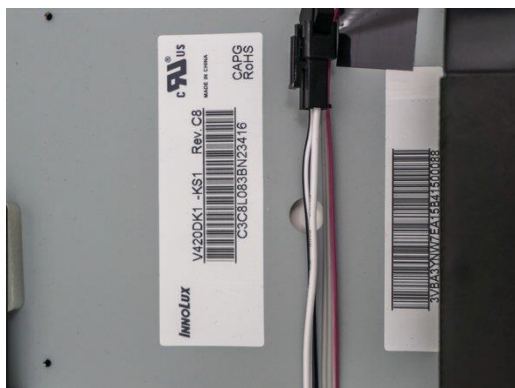
- This is the display TCON (Timing Controller) board. It is considered to be part of the Innolux panel.
- This IC becomes very, very hot during operation and the provided cooling seems to be insufficient. In order to make it possibly last longer, added some fans to this area and powered them off of the 12V from the mainboard.

Step 5: Internal Board 4



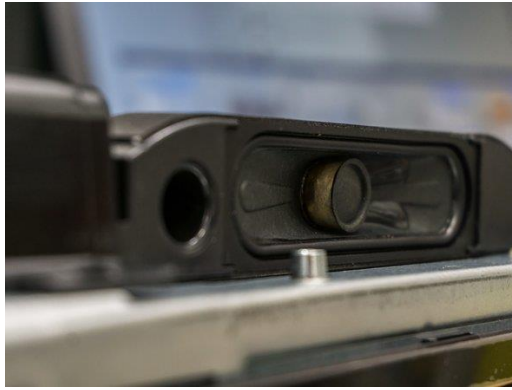
- This is the LED backlight's controller. The backlight seems to run on a fairly high voltage and the backlight cable is thus quite thin (right angle cable in the first image.) It is covered by plastic cover.
- The controller appears to be built using a bunch of MOSFETs and inductors as a boost/buck/current limiting DC-DC converter. The board is well-cooled with a lot of heavy copper fill areas, in my experience it does not need extra cooling to be okay
- Straight ribbon cable goes to TCON to allow backlight contrast dynamic dimming and control on/off/brightness.

Step 6: LCD Panel



- Model number of Innolux 3840*2160 panel. It can support 60p/60Hz if you replace the driver board with one from Alibaba I think, according to its datasheet.

Step 7: Speakers and Audio



- The speakers in the TV aren't really good so I won't elaborate too much. I have a calibrated EQ profile for them but I lost it, maybe will make another if there is demand.
- Port is tuned for ~300Hz
- PEQ (Parametric EQ) is built into the Service Menu of firmware.

Step 8: Debezeling modification



- The display can be debezeled by removing all screws from back, and then sliding the brackets to the side gently to release. Top side needs some prying to release. Border is 9mm after mod.

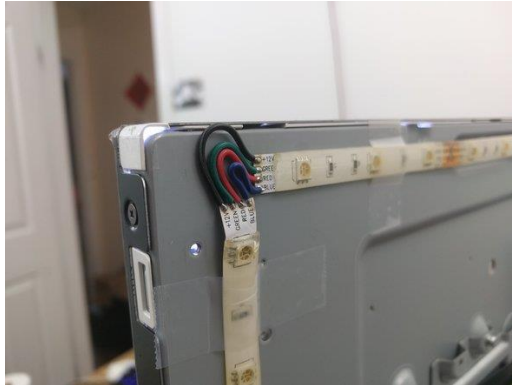
Step 9: Cooling fan and LED mods 1



- Added two 120mm computer fans and some LEDs to the back of the display
- Fans held by 3d printed brackets.
- Fans powered by unpopulated 'Panel VCC' pins on mainboard so they come on when TV is on. LM2596 buck converter used to reduce voltage for silent operation.

- LEDs powered similarly.
- If the board GND hard to solder to, you can just use extra screw to mount that wire to Chassis GND.

Step 10: LED mods 2



- 12Vcc and soldering the controller
- The controller IR remote and TV remote interfere with each other.

Step 11: Final Result



RESULT:

Thus the assembly and dismantle of LED TV has been done.

Ex. No.: 14 ELECTRONIC EQUIPMENT STUDY:
ASSEMBLY AND DISMANTLE OF COMPUTER / LAPTOP.

AIM:

To assemble and dismantle of computer.

REQUIREMENTS:

1. Personal computer
2. Laptop
3. Screwdriver Tool Kit

THEORY:

- Computer assembly is a process in which all the internal components required for the computer system are fitted so as to make the computer functional.
- There is a proper sequence of attachment of each and every component into the computer system. To establish proper connectivity, one has to use the tools.
- Proper handling of tools is also required by the technician.
- It is required that students learn the steps of installation of each component.
- The main component involves installing CPU, motherboard, drives, video, graphics card, sound card, modem and adapter, and connectors, and system panel connector.

COMPUTER ASSEMBLY:

- Computer assembly is a systematic process. First, arrange the computer parts. The sequence for assembly and working of the computer listed below is as:
 - Open the case.
 - Install the power supply.
 - Attach the components to the motherboard.
 - Install the motherboard.
 - Install internal drives.
 - Connect all internal cables.
 - Install motherboard power connections
 - Connect external cables to the computer.
 - Boot the computer for the first time.

MATERIAL REQUIRED

- Computer case, with power supply installed
- Motherboard
- CPU
- Heat sink/fan assembly
- Thermal compound
- RAM module(s)
- Motherboard standoffs and screws
- Anti-static wrist strap and anti-static mat
- Tool kit

PROCEDURE OF ASSEMBLING PC:

Step 1: Open the case



Fig. 1: Unscrew cabinet



Fig. 2: Pull cabinet side cover

- The first step in assembling a computer is to open the computer case (see Figure 1). There are different methods for opening cases.
- The computer comes with various types of cabinets. The method for opening the case is different based on the manufacturer.



Fig. 3: Unscrew bolts

- To open the case, first remove the screws of the left side cover and slide the side cover (see Figure 3).

Step 2 : Install the power supply

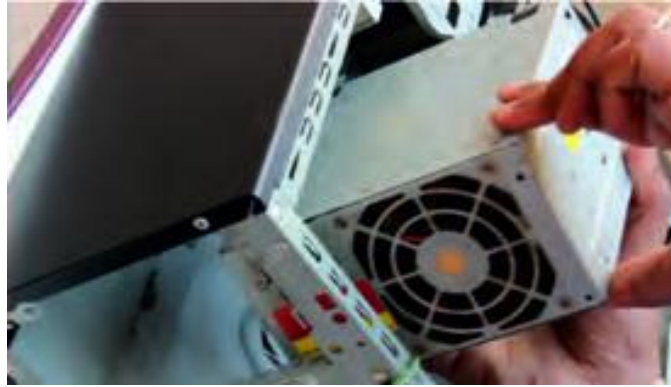


Fig. 4: Install power supply

- When installing a power supply, make sure that all of the screws are used and that they are properly tightened.



Fig. 5: Installing CPU on the motherboard

Step 3: Attach the components to motherboard

- To prepare the motherboard, you first need to install the CPU, then the heat sink on the CPU and CPU fan.

CPU

- The CPU and motherboard are sensitive to electrostatic discharge. So place them on a grounded anti-static mat and wear an anti-static wrist strap while handling the CPU.
- When handling a CPU, do not touch the CPU contacts at any point. The CPU is secured to the socket on the motherboard with a locking assembly.

Heat sink and fan assembly

- Heat sink and fan assembly is a two-part cooling device.
- The heat sink draws heat away from the CPU.
- The fan moves the heat away from the heat sink.
- Connect the assembly power cable to the CPU fan connector on the motherboard.



Fig. 7: Screw the heat sink



Fig. 8: Screw the heat sink fan assembly

Installation of RAM

- It is better to install the RAM first on the motherboard and then fix the motherboard in the case. To install RAM, first ensure its compatibility with the motherboard.
- Press down the side locks of the memory slot (see Figure 9). Align the notches on the RAM module to the keys in the slot and press down on both ends of RAM module until the side lock gets locked.



Fig. 9: Memory slot

Step 4: Install motherboard



Fig. 10: Lay the motherboard over the standoffs



Fig. 11: Tighten all the motherboard screws

- Plastic and metal standoffs are used to mount the motherboard and to prevent it from touching the metal portions of the case.
- To install the motherboard, connect the 4-pin ATX power connector from the power supply to the motherboard.

Step 5: Install internal drives

Hard drive



Fig. 12: Insert hard disk

- The hard drive is the device which stores all the data.
- Secure the HDD to the case using proper screws (see Figure 13).



Fig. 13: Tighten screws of HDD

Optical drive



Fig. 14: Insert optical drive

- Insert the optical drive into the drive bay so that the optical drive screw holes align with the screw holes in the case (see Figure 14).

- Secure the optical drive to the case using the proper screws (see Figure 15).
- Connect the power cable coming from the SMPS to the power socket of optical drive.
- Connect SATA data cable from optical drive socket to the motherboard socket.

Step 6: Connect all internal cables

- Power cables are used to distribute electricity from the power supply to the motherboard and other components.
- Data cables transmit data between the motherboard and storage devices, such as hard drives.

Step 7: Install motherboard power connections

- Just like other components, motherboards require power to operate.
- Align the 4-pin and 20-pin ATX power connector with the socket on the motherboard.

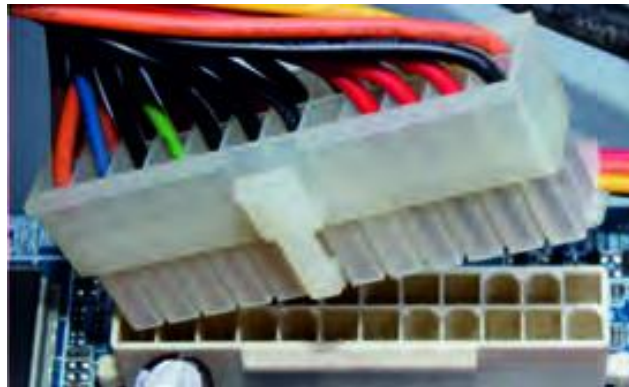


Fig. 18: Plug-in 20-pin ATX power connector to motherboard

SATA power connectors



Fig. 20: Plug-in 15-pin connector to HDD

- SATA power connectors use a 15-pin connector (see Figure 20).
- Serial advanced technology attachment (SATA) power connectors are used to connect to hard disk drives, optical drives, or any devices that have a SATA power socket.

Step 8: Connect external cables to the computer

- Setting up the computer system involves the complete process of establishing the proper connectivity of various parts of the computer system — input and output devices, connectivity of computer with the surge power supply.
- Reattach the side panels to the case.
- The process of connecting the external cables given below:

Locate the monitor cable



Fig. 21: Display cable and ports

- Locate the two power cable and one VGA cable or monitor cable (see Figure 21).
- The VGA cable is used to connect to monitor and another point on to the back side of the cabinet.
- If you are having trouble finding these, refer to the instruction manual of or the computer.

Connecting monitor

- Make sure the VGA cable plug aligns with the port, then connect it.

Connecting mouse

- If it uses a USB connector, plug it into any of the USB ports on the back of the computer.
- If it uses a PS/2 connector, plug it into the green mouse port on the back of the computer.
- In case of wireless mouse or keyboard, connect a Bluetooth dongle (USB adapter) in one of the USB ports of the computer.

Connecting headphones or speakers, and microphone



Fig. 26: Connecting speakers or headphones, and microphone

- Connect the external speakers or headphones, to computer's audio port (either on the front or back of the computer case).

UPS (uninterruptible power supply)



Fig. 28: UPS

- While working on computer, its power supply should not be interrupted.
- UPS is like a power bank which gives power to the computer system.
- So make sure to plug power cable of monitor and cabinet into the UPS power output socket.
- Ensure the connection is proper.

Step 9: Starting the computer



Fig. 31: Starting window of Windows 10



Fig. 32: Starting window of Windows 7



Fig. 33: Starting window of Ubuntu

COMPUTER DISASSEMBLY

- Disassembly is the process of breaking down a device into separate parts.

Procedure

The disassembly procedure of computer is demonstrated as below.

Step 1: Unplugging

- Unplug the power cord and all the peripherals attached to the computer, such as the keyboard, mouse, monitor, headphones, and any external drives.

Step 2: Open the case



Fig. 38: Unscrew cabinet



Fig. 39: Pull cabinet side cover

- Pull the latch to release the side panel. Then lift the side cover out from the chassis.

Step 3: Disconnect all the connectors

- Disconnect all the connectors connected to the motherboard include SATA power cables and data cable of HDD.



Fig. 40: Unplug 15-pin connector from HDD

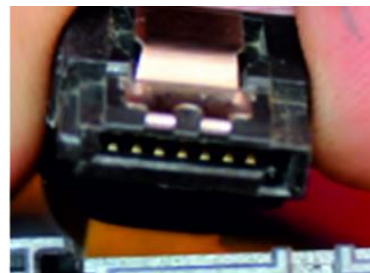


Fig. 41: Unplug 7-pin connector from HDD

Step 4: Remove the fan



Fig. 42: Unscrew fan



Fig. 43: Remove the system fan



Fig. 44: Unscrew heat sink

- To remove the CPU fan from the heat sink, first, disconnect its connector from the motherboard. Then remove the four screws securing it (see Figure 44).

Step 5: Remove the power supply

- The power supply is connected to the motherboard by a 20-pin connector and 4-pin connector.
- Firstly, disconnect hard disk drive and the optical drive connectors from the motherboard (see Figure 47).



Fig. 48: Unplug power cable



Fig. 49: Remove the screws



Fig. 50: Unscrew the SMPS and remove it from cabinet

- Disconnect the power cable of the hard disk and optical drive which connects to the SMPS (see Figure 48).

Step 6: Removing HDD and optical drive

- Remove the SATA cable connecting to the HDD and motherboard.



Fig. 51: Unscrewing of HDD



Fig. 52: Remove HDD

Step 7: Remove RAM (random access memory) modules

- RAM allows for the transfer of information to and from the CPU.
- Computer runs fast with more RAM. Most computers have four RAM slots, and two RAM chips.
- It will cause the module to pop up for easy removal.

Step 8: Remove expansion cards



Fig. 54: Expansion card

- The modern motherboards are integrated with the audio, video and network cards.
- However, if your computer has the expansion card as shown in Figure 54, insert into the expansions slot to increase the functionality.
- Carefully take out the card from the slot.

Step 9: Remove motherboard

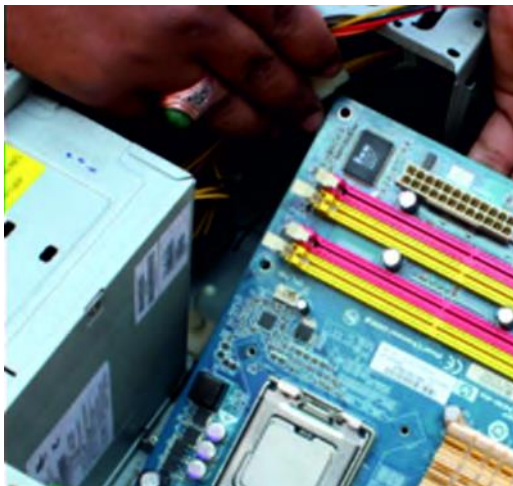


Fig. 55: Removing the motherboard

- Every part of the computer is attached to the motherboard. The CPU, RAM, and expansion cards are directly attached to the motherboard.
- To remove the motherboard, disconnect all the cables from the motherboard.

Step 10: Reassemble the components

- Identify every component and take its photograph.

- After identification of each component, put all the components back in their place and ensure that all cables and wires are connected at the right place to avoid further troubleshooting.
- Close the case and put the screws back in their place.
- Lastly, connect every external device such as the keyboard, mouse, monitor, etc., and turn on the computer to see everything is working fine after assembled.

Result:

Thus, the assembly and dismantle of personal computer were studied.

Ex. No.: ELECTRONIC EQUIPMENT STUDY:

ASSEMBLY AND DISMANTLE OF LAPTOP.

Aim:

To study the assembly and dismantle of laptop.

Requirements:

1. Laptop
2. Laptop repair tool kit (Precision Screwdriver Set)
3. Anti-static wrist strap
4. Magnifying glass

THEORY:

Assembling of Laptop:

Procedure

Step 1: Keep track of screws

Place these in small envelopes and write the component name on the envelope.

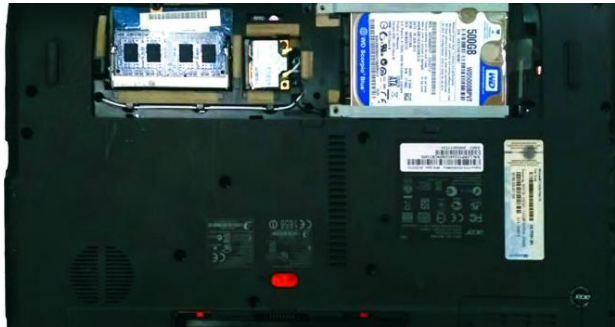
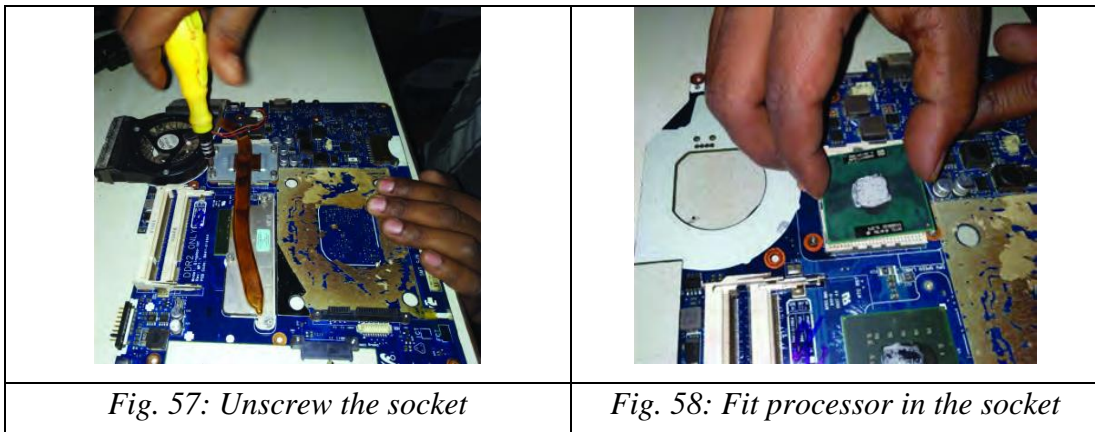


Fig. 56: Back panel of a laptop

Step 2: Installation of processor

First component to be installed is the processor. Take extreme care not to touch the pins in the socket during the process (see Figure 57 and 58).



Step 3: Pop in the video card

- Hold the card at about a 30-degree angle as you insert its edge connector into the video-card slot near the center of the motherboard.

- Press the card in and downward, and then use the two small black screws to secure it in place.

Step 4: Set up the drive

- The motherboard SATA connectors are along the front, right edge, and under the lip of the laptop's shell.
- Drop the drive into place and then carefully use your thumb to push the drive into the SATA connectors.

Step 5: Add memory

- To install memory, locate the memory slots on the motherboard.
- Align the notches on the memory module with the ridge in the slot.
- Firmly push the module until the clips on the side of the slot snap into place.

Step 6: Final assembly

- Now that all the hardware components are installed.
- To prepare for power up, pop in the notebook's battery pack, connect the power brick and plug it into a wall outlet.

DISASSEMBLY OF LAPTOP:

Procedure

Step 1: Removal of battery



Fig. 59: Remove battery and optical drive

- Start the disassembly process by removing the battery (see Figure 59).
- Remove all the screws in the panel.

Step 2: Separation of palm rest



Fig. 60: Separate palm rest from bottom case

- Using a plastic case opener, separate the palm rest from the bottom case as shown in Figure 60.

Step 3: Removal of bottom case

- Turn the notebook upside down and remove the bottom case.

Step 4: Disconnecting the hard drive cable from the motherboard

- Remove the three screws fixing the hard drive bracket to the case.
- Disconnect the hard drive cable from the motherboard.



Fig. 61: Remove screws from the hard drive and disconnect it



Fig. 62: Open the connector and release hard drive cable

Step 5: Remove the hard drive

- Remove the hard drive assembly from the notebook.
- If you are going to replace it with another hard drive or SSD, you will have to transfer the mounting bracket and the SATA cable.



Fig. 63: Remove hard drive assembly



Fig. 64: Disconnect SATA cable

Step 6: Removal of RAM



Fig. 65: Remove RAM memory modules

- A notebook PC motherboard has two memory slots.
- Remove both RAM modules if necessary.

Step 7: Disconnection of cable

- Remove the one screw fixing the USB LED status board.
- Disconnect the cable from the motherboard.

Step 8: Removal of USB LED status board



Fig. 66: Remove USB LED status board

- Remove the USB LED status board.

Step 9: Removal of screw fixing the optical CD/ DVD drive connector board



Fig. 67: Remove optical CD DVD drive connector board

- Remove the one screw fixing the optical CD/DVD drive connector board. Disconnect the cable from the motherboard.

Step 10: Removal of the cooling fan

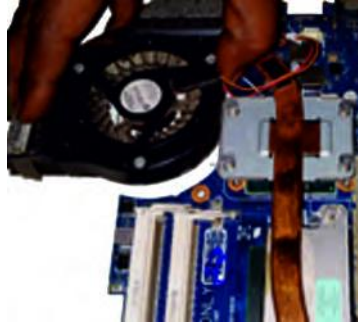


Fig. 68: Remove cooling fan

- Remove the two screws fastening the cooling fan to the case.
- Unplug the fan cable from the motherboard and remove the cooling fan (see Figure 68).

Step 11: Removal of DC power jack

- In PC, the DC power jack is mounted under the hinge. Remove it.
- Disconnect the Wi-Fi antenna cable from the wireless card. Disconnect the DC power jack harness from the motherboard.
- Open up the hinge and remove the DC power jack.



Fig. 71: DC power jack mounted under display hinge



Fig. 72: Disconnect Wi-Fi Module

Step 15: Removal of screw securing the board

- The power button board is also mounted under the same hinge.
- Remove the one screw securing the board and unplug the cable from the motherboard.

Step 12: Removal of motherboard

- Separate the motherboard from the top case and remove it.



Fig. 73: Disconnect cables from motherboard and remove screws



Fig. 74: Remove the motherboard from notebook case



Fig. 75: Keyboard permanently attached to top case

Laptop LCD Screen Removal

Procedure

- It is possible to disassemble the LCD screen of a laptop independently. Previous steps are not required for disassembling the display, you only need to disconnect the battery before you start.

Step 1: Separate the display bezel from the back cover. You will have to wiggle the bezel to unfasten it from the cover. Start on the top and move to the sides for the display assembly.

Step 2: On the bottom, the bezel is attached to the LCD screen with adhesive tape. Carefully separate it from the screen.

Step 3: Remove the bezel completely.

Step 4: Remove the four screws securing the LCD screen to the side brackets (see Figure 77).



Fig. 76: Notebook PC LCD screen removal



Fig. 77: Remove the four screws securing LCD screen

Step 5: Separate LCD screen from the back cover and place it the front side down on the keyboard.



Fig. 78: Remove screen bezel

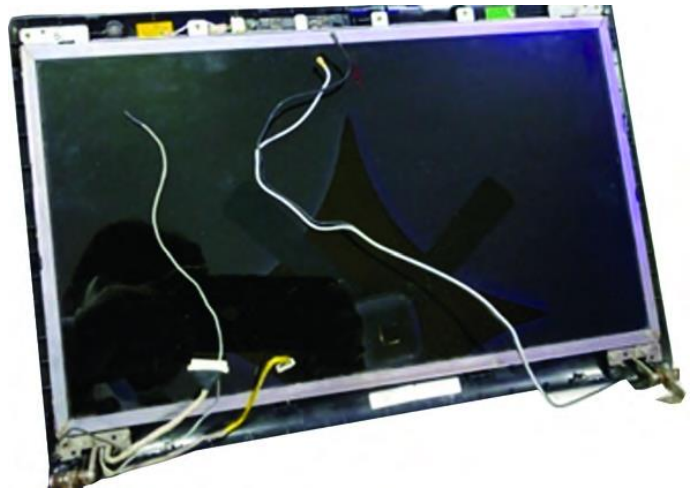


Fig. 79: Separate LCD screen from back cover

Step 6: Now you can access the video cable connector (see Figure 80).

Step 7: Peel off the grounding tape from the screen.

Step 8: Peel off the clear tape securing the connection and unplug the video cable from the screen.



Fig. 80: Disconnect video cable from screen



Fig. 81: Remove and replace LCD screen

Step 9: Remove the LCD screen completely and replace if necessary (see Figure 81).

Step 10: You can find a new LCD screen using the model number from the original one.

Result:

Thus, the assembly and disassembly of laptop were studied.