**A STUDY ABOUT LEDS**

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Application

*By*

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**CHAPTER -1**

**INTRODUCTION**

A light releasing diode is an electric component that emits light when the electric current flows through it. It is a light source based on semiconductors. When current passes through the LED, the electrons recombine with holes emitting light in the process. It is a specific type of diode having similar characteristics as the p-n junction diode. This means that an LED allows the flow of current in its forward direction while it blocks the flow in the reverse direction. Light-emitting diodes are built using a weak layer of heavily doped semiconductor material. Based on the semiconductor material used and the amount of doping, an LED will emit a colored light at a particular spectral wavelength when forward biased.

**CHAPTER – 2**

**LED SYMBOL**

Below is the demonstration of the LED symbol. The symbol is similar to that of the [p-n junction](https://byjus.com/physics/p-n-junction/) diode. The difference between these two symbols is that the two arrows indicate that the diode is emitting the light.

Cathode

Anode

### 2.1 LED Circuit

The LEDs also have a specific drop in voltage forward in cases where it is used typical circuits like a conventional diode. The drop in voltage depends on the current of the LED, the color of the produced light, etc. There are different values in the drop of voltage that would vary from 1.5V to 2.5 V current for 10 to 50 mA current.

V

R

LED Circuit

LED

**CHAPTER – 3**

## WORKING PRINCIPLE OF LED

The light-emitting diode simply, we know as a diode. When the diode is forward biased, then the electrons & holes are moving fast across the junction and they are combined constantly, removing one another out. Soon after the electrons are moving from the n-type to the p-type silicon, it combines with the holes, then it disappears. Hence it makes the complete atom & more stable and it gives the little burst of energy in the form of a tiny packet or photon of light.

4

n - type

p - type

1

2

5

3

The above diagram shows how the light-emitting diode works and the step by step process of the diagram.

* From the above diagram, we can observe that the N-type silicon is in left side including the electrons which are indicated by the black circles.
* The P-type silicon is in the right side and it contains holes, they are indicated by the white circles.
* The power supply across the p-n junction makes the diode forward biased and pushing the electrons from n-type to p-type. Pushing the holes in the opposite direction.
* Electron and holes at the junction are combined.
* The photons are given off as the electrons and holes are recombined.

**CHAPTER – 4**

**LED CIRCUIT FOR BIASING**

Most of the LEDs have voltage ratings from 1 volt-3 volt whereas forward current ratings range from 200 mA-100 mA.

If the voltage (1V to 3V) is applied to the LED, then it functions properly due to the flow of current for the applied voltage will be in the operating range. Similarly, if the applied voltage to an LED is high than the operating voltage then the depletion region within the light-emitting diode will break down due to the high flow of current. This unexpected high flow of current will damage the device.

This can be avoided by connecting a resistor in series with the voltage source & an LED. The safe voltage ratings of LEDs will be ranges from 1V to 3 V whereas safe current ratings range from 200 mA to 100 mA.

Here, the resistor which is arranged in between the voltage source and LED is known as the current limiting resistor because this resistor restricts the flow of current otherwise the LED may destroy it. So this resistor plays a key role in protecting the LED.

Mathematically, the flow of current through the LED can be written as

**IF = Vs – VD/Rs**

Where,

‘IF ‘is forward current

‘Vs’ is a voltage source

‘VD’ is the voltage drop across the light-emitting diode

‘Rs’ is a current limiting resistor

The amount of voltage dropped to defeat the barrier of the depletion region. The LED voltage drop will range from 2V to 3V while Si or Ge diode is 0.3 otherwise 0.7 V.

Thus, the LED can be operated by using high voltage as compared with Si or Ge diodes.  
Light-emitting diodes consume more energy than silicon or germanium diodes to operate.

**CHAPTER – 5**

**HISTORY OF LED**

* In the year 1927, Oleg Losev (Russian inventor) was created the first LED and published some theory on his research.
* In the year 1952, Prof. Kurt Lechovec has tested the theories of Losers theories and explained about the first LEDs
* In the year 1958, the first green LED was invented by Rubin Braunstein & Egon Loebner
* In the year 1962, a red LED was developed by Nick Holonyak. So, the first LED is created.
* In the year 1964, IBM implemented LEDs on a circuit board for the first time on a computer.
* In the year 1968, HP (Hewlett Packard) started using LEDs in calculators.
* In the year 1971, Jacques Pankove & Edward Miller were invented a blue LED
* In the year 1972, M. George Crawford (Electrical Engineer) was invented the yellow color LED.
* In the year 1986, Walden C. Rhines & Herbert Maruska from the University of Stafford invented a blue color LED with Magnesium including future standards.
* In the year 1993, Hiroshi Amano & Physicists Isamu Akaski has developed a Gallium Nitride with high-quality blue color LEDs.
* An electrical engineer like Shuji Nakamura was developed the first blue LED with high-brightness through Amanos & Akaski developments, which rapidly leads to the expansion of white color LEDs.  
  In the year 2002, white color LEDs were used for residential purposes which charger around £80 to £100 for each bulb.
* In the year 2008, LED lights have become very popular in offices, hospitals & schools.
* In the year 2019, the LEDs have become the main light sources;
* The LED development is incredible, as it is ranged from small indication to light the offices, homes, schools, hospitals, etc.

**CHAPTER – 6**

**CONCLUSION**

Light-emitting diodes, or LEDs, are widely used as a standard source of light in electrical equipment. It has a wide array of applications ranging from your mobile phone to large advertising billboards. They find applications in devices for showing what the time is and for displaying different types of data. In this article, the main focus would be on learning a lot about LEDs, such as its symbol, working and history.

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