Unit- II

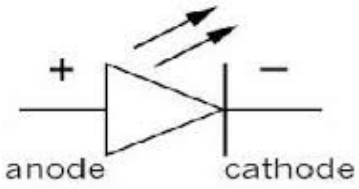
LED:

A Light-emitting diode (LED) is a Semiconductor device that emits light when an electric current flows through it. When an electric current through on LED. The electrons recombined with holes. emitting light in the process. the LEDS allows current do flow in the forward direction & blocks the current in the reverse direction.

Light &-emitting diodes are heavily depend P.N Junction Based on the semiconductor material used & the amount of doping, on LED will emit colored light at a particular spectral wavelength when forward biased. As shown in the figure, on LED is encapsulated with La transparent cover so that emitted light Can Come out.

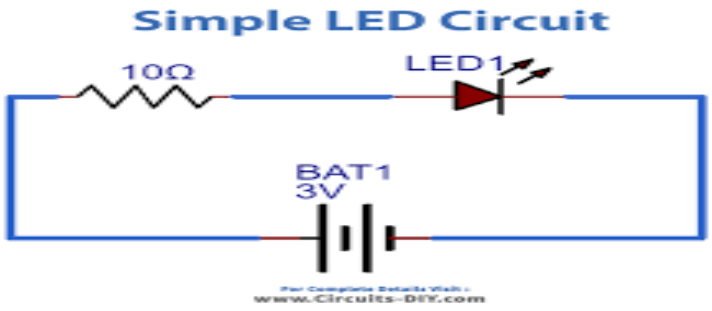
LED Symbol

The IFD Symbol is the standard Symbol for clade with the addition of two Small of light arrows denoting the emission of light.



Simple LED Circuit:

[The figure below shows a simple LED circuit.



The Circuit Consists of an LED a voltage Supply & a Current & voltage. resistor to regulate the current and voltage.

What is the Construction of an LED?

The Semiconductor material used in LED is Gallium Arsenide (Ga As), Gallium Phosphide (Gap or 6 Gallium Arsenide phosphide (Ga As P) Any of the above mentioned. Compounds can be used for the Construction of LED but the color of radiated light changes with the change in material. Below are Some of the material & their respective color of Light which they emit. In addition to it the ranges of typical Forward voltage are also given below.

Light-Emitting Diodes

Color	Construction	Typical Forward Voltage (V)
Amber	AlInGaP	2.1
Blue	GaN	5.0
Green	GaP	2.2
Orange	GaAsP	2.0
Red	GaAsP	1.8
White	GaN	4.1
Yellow	AlInGaP	2.1

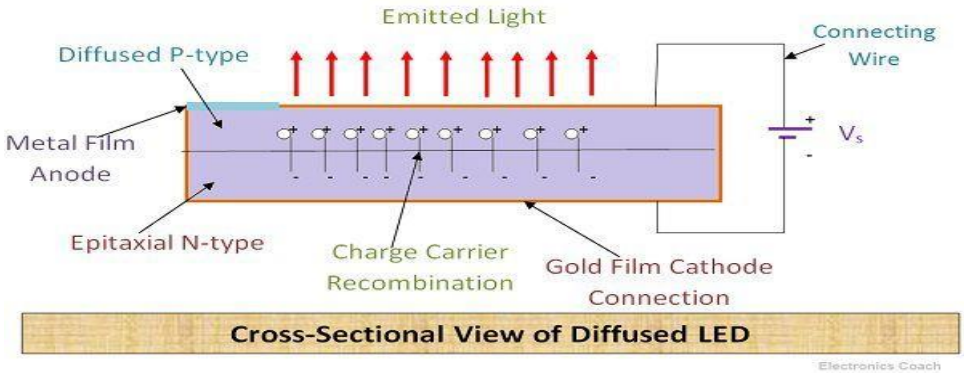
Internal Architecture of LED

The Semiconductor layer of P-type is placed above N-type because the change Carrier recombination in P-type.

Besides it is the Surface of the device thus the light emitted can be easily seen on the Surface.

If P-type will be placed below the light will be emitted from the Surface of P-type but we will not be able to see it.

This is the reason that P- type is placed above.



The P-type Layer is formed from diffusion of Semiconductor material on the other hand in N-type region the epitaxial layer is grown on the N-type Substrate.

The metal film is used on the P type layer to provides anode connection to the diode Similarly, God film layer is Cathod on N-type to provide cathod connection.

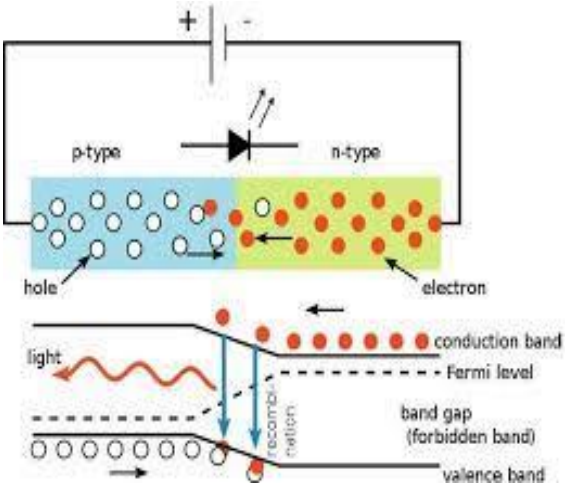
How does on LED Work?

When the diode is forward biased the minority electrons Sent P-> N while the minority holes are sent from n-p.

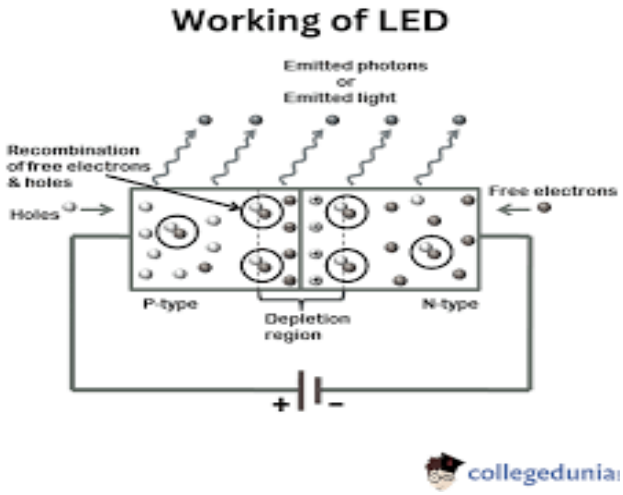
At the junction boundary the concentration of minority carries increases.

The excess minority caries increase

The excess minority carries at the junction recombine with the majority changes carries.



or



The energy is released in the form of photons recombination.

In standard diodes the energy is released in the form of heat.

But in light emitting diodes the energy is released in the form of photons.

We call this phenomenon where a material emits light in response to an electric current passed through it.

As the forward voltage increase the intensity of the light increase and reaches maximum.

USE OF LED

LEDs find applications in various fields, including optical Communication, alarm and Security systems remote controlled operations robotics, etc.

Finds usages in many areas because of its long-lasting capability, low power, many areas requirements, swift response time, and fast Switching capabilities.

Below a few standards LED uses

Used for TV Back-lighting

Used in displays

Used in Automotives.

LEDs used in the dimming of lights.

Types of LED

Below is the list of different types of LED that are designed using Semiconductor.

High- power LEDS

Flash LEDS

Bi and Tri-Color

Red Green Blue LEDS

Alphanumeric LED

Lighting LED