

## 1.8 OPTICAL SOURCES

### Light Emitting Diode (LED) Principle:

- It's a device used to convert the electrical energy into light energy.
- When it is forward biased, the majority charge carriers of electrons from n-type and holes from p-type are diffuse into each other.
- At the junction the electron hole recombination process takes place and energy is emitting in the form of visible light and IR region.

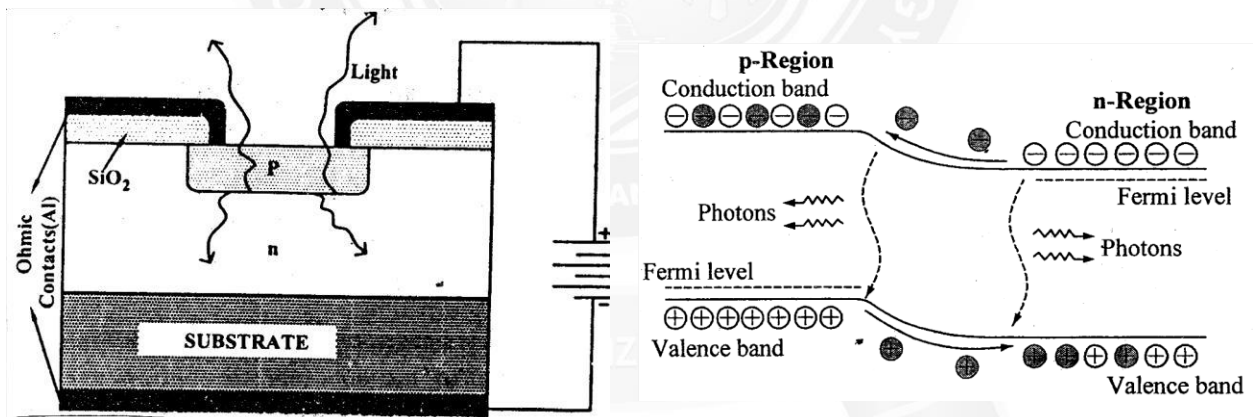
### Construction:

The light emitting diode is made by Gallium Arsenide semiconductors. First the PN Junction is formed by epitaxial growth technique.

Si+Ga=n-type; Si+As=p-type.

The thickness of the n-layer is always larger than the p-layer, because of increasing the radioactive recombination.

Proper electric connection (forward bias) given to the semiconductor through aluminium contact. P-jn is slightly open for out coming light rays.



**Figure 1.8.1 Structure of Light Emitting Diode**

[Source: "Optical Fibre Communications" by J.M.Senior, Page: 182]

### Working:

- When the p-n junction diode is forward biased, the barrier width is reduced, raising the potential energy on the n-side and lowering that on the p-side.
- The free electrons and holes have sufficient energy to move into the junction region. If a free electron meets a hole, it recombines and releases a photon.

- Thus, light radiation from the LED is caused by the recombination of holes and electrons that are injected into the junction by a forward bias voltage.

### Advantages of LED

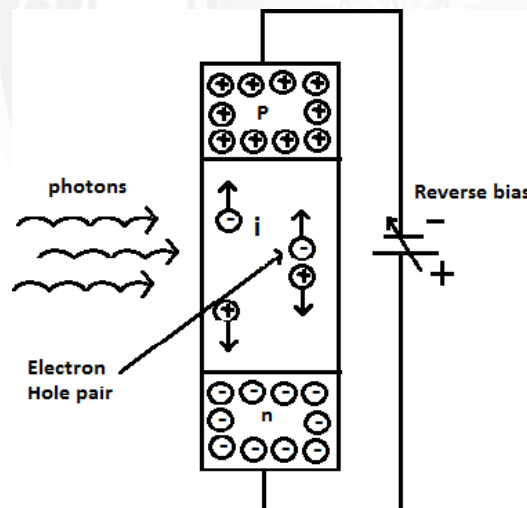
1. Very small in size
2. Less cost and long life time.
3. It needs less voltage for operate

### Disadvantages of LED

1. It requires high power.
2. Its preparation cost is high.

## PHOTO DETECTORS

### PIN Diode Principle:



**Figure 1.8.2 Structure of PIN Diode**

[Source: "Optical Fibre Communications" by J.M.Senior, Page: 184]

This is a device used to convert the light energy into electrical energy.

Under the reverse bias condition, if the light ray is incident over the intrinsic region, then it will produce the electron hole pair. The accelerated electron-hole pair charges carrier produce the photo-current.

**Construction:**

- It consists of three layers such as p, n and intrinsic region with proper biasing.
- The P and N region are heavily doped.
- The intrinsic layer is slightly larger than both the p- type and n-type for receive the light photons.

**Working:**

- The PIN diode is heavily reverse biased.
- When a photon of higher energy is incident over the larger width intrinsic semiconductor layer, then the electron hole pairs are created.
- The mobile charges are accelerated by the applied voltage, which gives rise to photo current in the external circuit.
- It is a linear device because the photo-current is directly proportional to the incident optical power on the PIN photo-diode.

