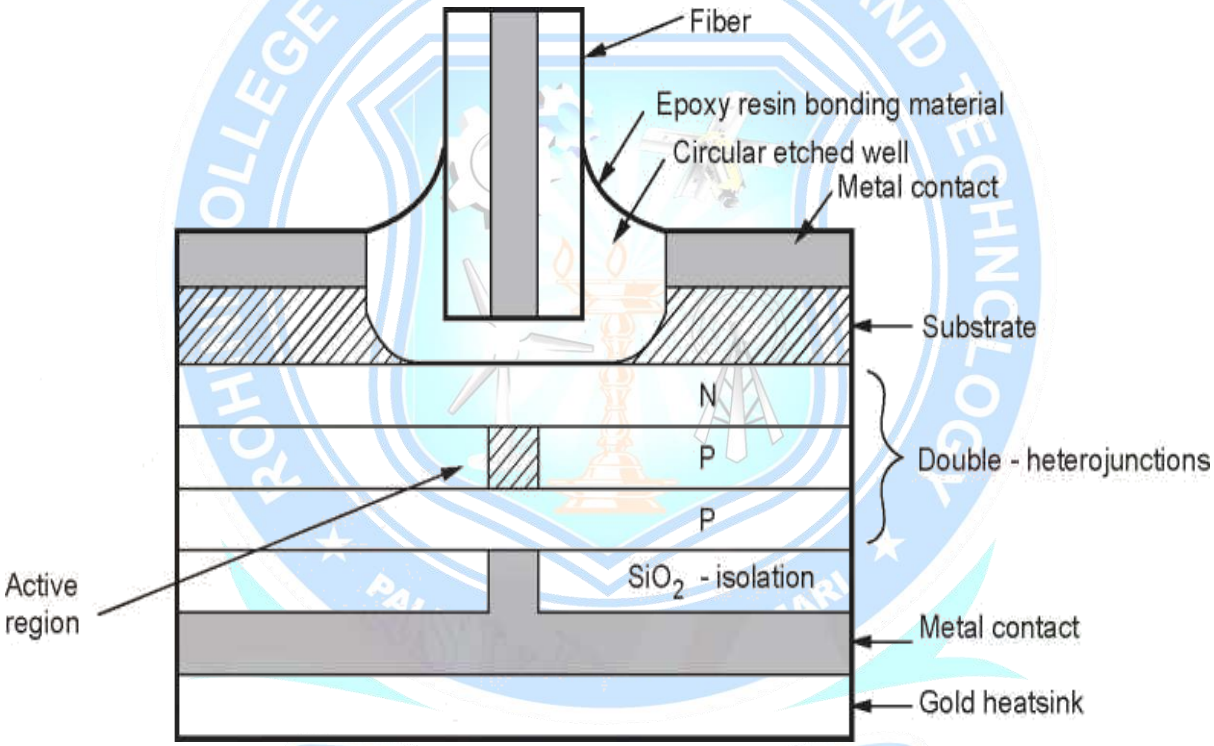
3.3 LED Configurations

- At present there are two main types of LED used in optical fiber links
  Surface emitting LED. (SLED)
  Edge emitting LED. (ELED)

Both devices uses a DH structure to constrain the carriers and the light to an active layer

Surface Emitting LEDs (SLED)

- In surface emitting LEDs the plane of active light emitting region is oriented perpendicularly to the axis of the fiber. A DH diode is grown on an N-type substrate at the top of the diode as shown in Fig.



- A circular well is etched through the substrate of the device. A fiber is then connected to accept the emitted light.
- At the back of the device is a gold heat sink. The current flows through the p-type material and forms the small circular active region resulting in the intense beam of light.

Diameter of circular active area = 50 µm

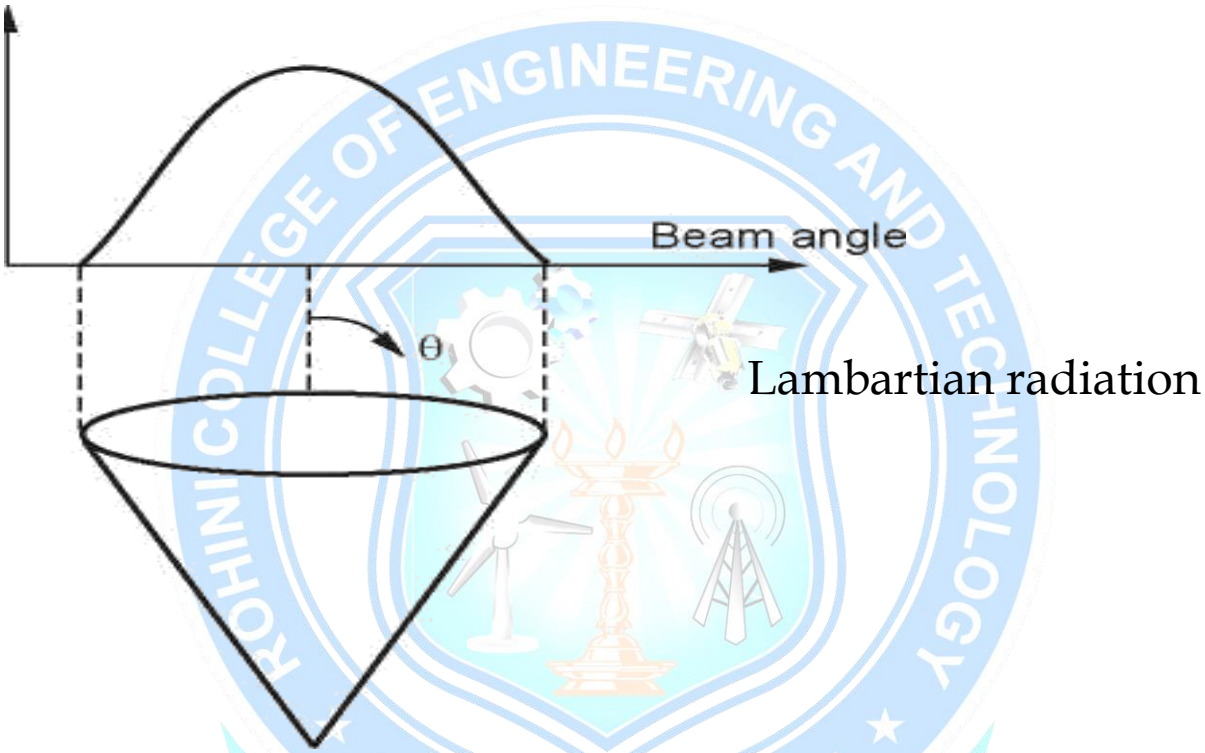
Thickness of circular active area = 2.5 µm

Current density = 2000 A/cm^2 half-power

Emission pattern = Isotropic, 120° beamwidth.

Lambartian Radiation

- The isotropic emission pattern from surface emitting LED is of Lambartian pattern.
- In Lambartian pattern, the emitting surface is uniformly bright, but its projected area diminishes as cos 0, where 0 is the angle between the viewing direction and the normal to the surface as shown in Fig. 3.2.3. The beam intensity is maximum along the normal.

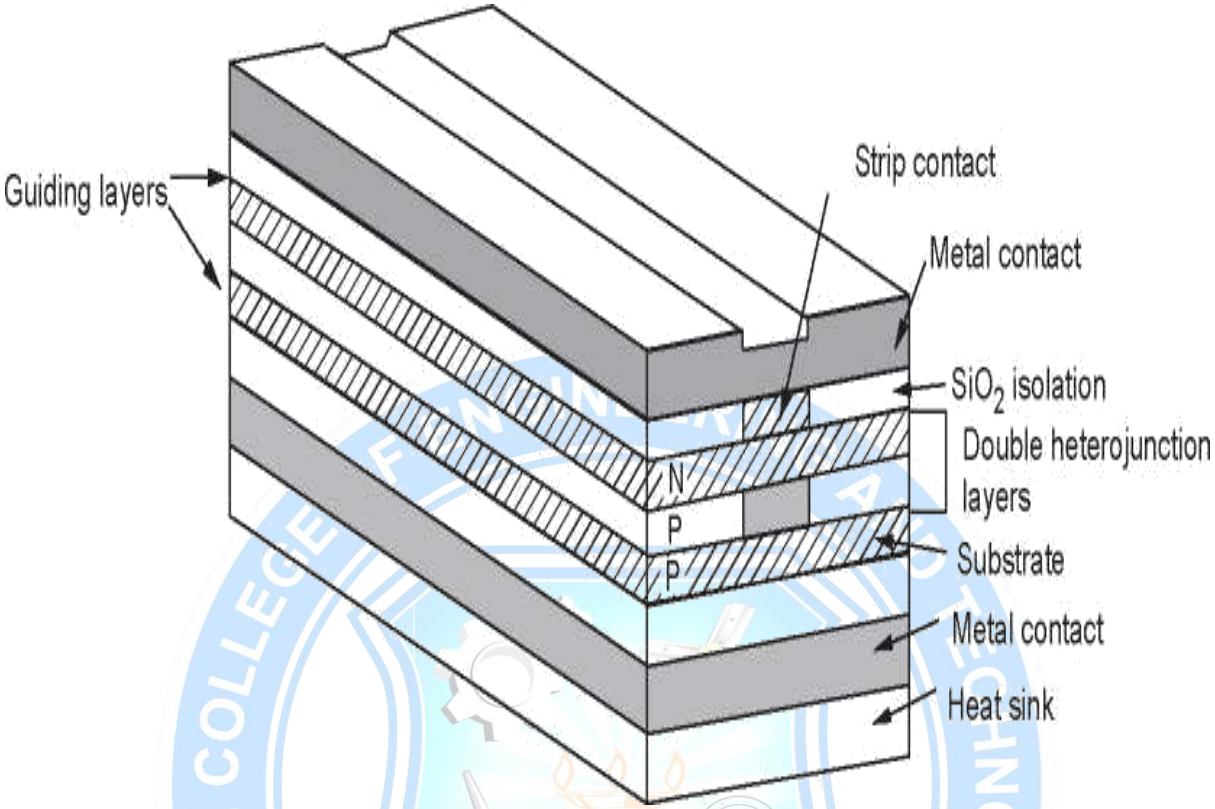


Lambartian radiation

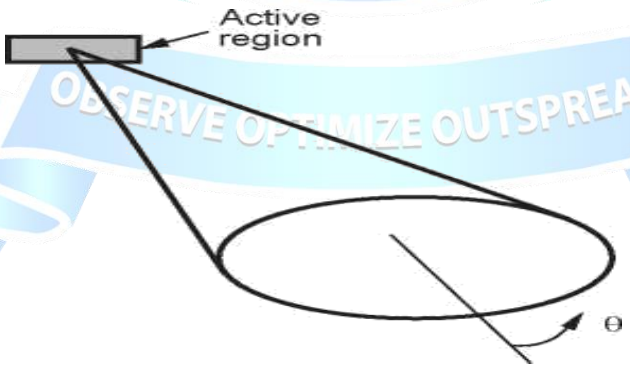
- The power is reduced to 50 % of its peak when 0 = 60°, therefore the total half-power beamwidth is 120°. The radiation pattern decides the coupling efficiency of LED

Edge Emitting LEDs (ELEDs)

- In order to reduce the losses caused by absorption in the active layer and to make the beam more directional, the light is collected from the edge of the LED. Such a device is known as **edge emitting** LED or ELED.
- It consists of an active junction region which is the source of incoherent light and two guiding layers.
- The refractive index of guiding layers is lower than active region but higher than outer surrounding material. Thus a waveguide channel is form and optical radiation is directed into the fiber.
- Edge emitter's emission pattern is more concentrated (directional) providing improved coupling efficiency.



- The beam is Lambartian in the plane parallel to the junction but diverges more slowly in the plane perpendicular to the junction. In this plane, the beam divergence is limited. In the parallel plane, there is no beam confinement and the radiation is Lambartian.
- To maximize the useful output power, a reflector may be placed at the end of the diode opposite the emitting edge



Unsymmetric radiation from an edge

Features of ELED :

1. Linear relationship between optical output and current.
2. Spectral width is 25 to 40 nm for X = 0.8 - 0.9 |im.

3. Modulation bandwidth is much large.
4. Not affected by catastrophic gradation mechanisms hence are more reliable.
5. ELEDs have better coupling efficiency than surface emitter.
6. ELEDs are less temperature sensitive

Usage :

1. LEDs are suited for short range narrow and medium bandwidth links.
2. Suitable for digital systems up to 140 Mb/sec.
3. Long distance analog links.