Dr. Supriya Kumari
J.N.C, Madhubani
Deptt. of Physics.

Electronics : LED

2-1 (S)

It is a heavily-doped forward-biased p-n junction which spontaneously converts the biasing electrical energy into optical energy, like infrared and visible light.

LED is represented by either of the two symbols shown below. Its actual shape is also shown, the shorter lead responds to n- or cathode side while the longer lead corresponds to p- or another side.

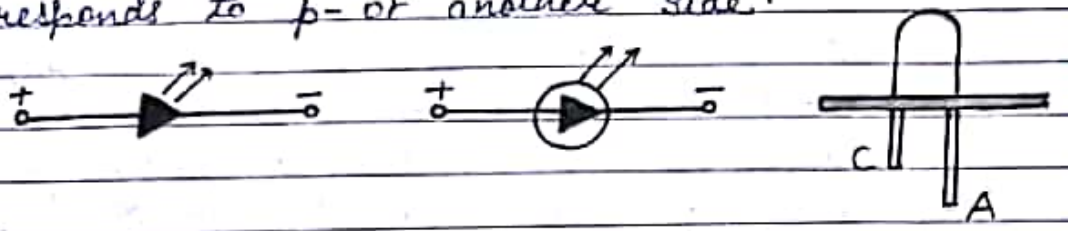

Fig.1 :- LED symbol and shape

A p-n junction made from a translucent semiconductor like gallium arsenide or indium phosphide is provided with metallised contacts as shown in fig. 2. When it is forward biased through a series resistance R, light photons are emitted from the non-metallised surface of the n-region.

The series resistance R limits the current through the LED and hence controls the intensity of light emitted by it.

When the p-n junction is forward biased, electrons

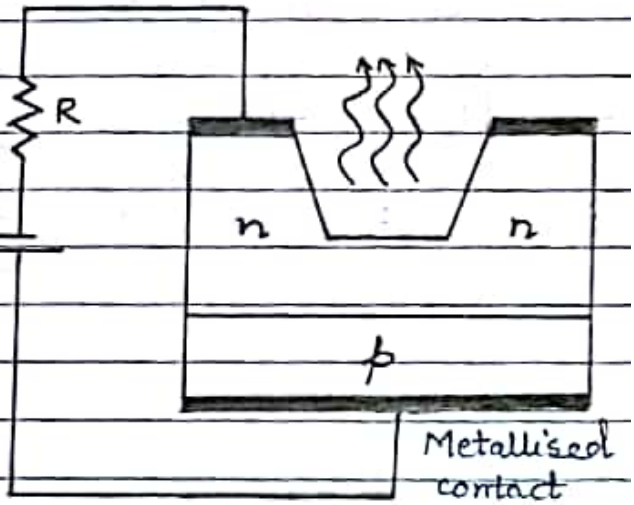

Fig.2 :- A forward biased LED

are sent from n-region → p-region (where they are minority carriers) and holes are sent from p-region → n-region (where they are minority carriers). Near the junction, the concentration of minority carriers increase as compared to the equilibirium concentration (i.e, when there is no bias). On either side near junction, the excess minority carriers combine with the majority carriers. On recombination, the energy is released in the form of photons. Photons with energy equal to or slightly less than band gap are emitted. When the forward bias of the diode is small, the intensity of emitted light is small. As the forward current increases, intensity of light increases and reaches a maximum. Further increase in forward current ~~reach~~ decreases the light intensity. The general shape of the I-V characteristics of an LED is similar to that of a normal p-n junction diode, as shown in fig. 3. However, the barrier potential changes slightly with the colour.

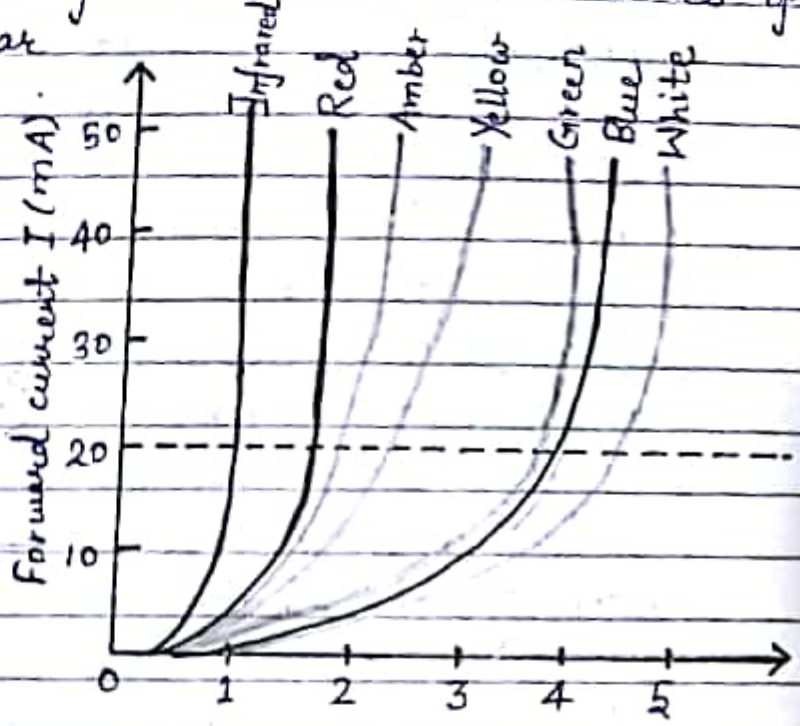

Fig. 3 :- I-V characteristics of LED

Two important features of LEDs are :

(1.) The colour of light emitted by an LED depends on its band-gap energy.

(2.) The intensity of light emitted is determined by the forward current conducted by the p-n function.

Uses of LEDs :-

1.) Infrared LEDs are used in burglar-alarm systems.

2.) In optical communication.

3.) In image scanning circuits for picture phones.

4.) LEDs are used as indicator lamps in radio recievers and other electronic equip

5.) In remote controls.

6.) In digital display lights of calculato cash registers, digital clocks, etc.