

Government Polytechnic College Alwar

Department of Electrical Engineering

Second Mid Term Test 2017-18
Basic Electronics Engineering (EE-201)

Time: 1 Hr

Date: 15/01/2018

Max Marks: 15

Attempt all Questions.

- Q: 1 Explain the construction, working and characteristics of LED. **5 marks**
- Q: 2 Demorganize the function $A + D(\overline{B + \overline{D} + E})$ realize the output equation using logic gates. **5 marks**
- Q: 3 Solve $Y(A,B) = \sum m(1,2,3)$ using K-map and realize the output equation using logic gate. **5 marks**

sol. ①:-

LED:- It is known as Light emitting diode which is designed to emit light

Construction:-

To construct a LED a direct band gap semiconductor material such as Gallium Arsenide (GaAs), Gallium Arsenide Phosphide (GaAsP) or Gallium Phosphide (GaP) is used.

In this an N-type epitaxial layer is grown upon a substrate and the P-Region is created by diffusion.

Electron-hole recombination takes place in P-region hence, this region is kept uppermost. A metal film anode connection is done over P-region surface.

A gold film is applied to the bottom of the substrate to provide cathode connections to reflect as much as possible of the light towards the external surface of the device through the shallow P-region. The back radiations (in the direction of the substrate) are absorbed by the lattice.

The whole unit is now enclosed in a hermetically sealed enclosure. There is a plastic window on the

top of the enclosure, which incorporates a plastic lens also. This lens helps to focus the light out of LED structure.

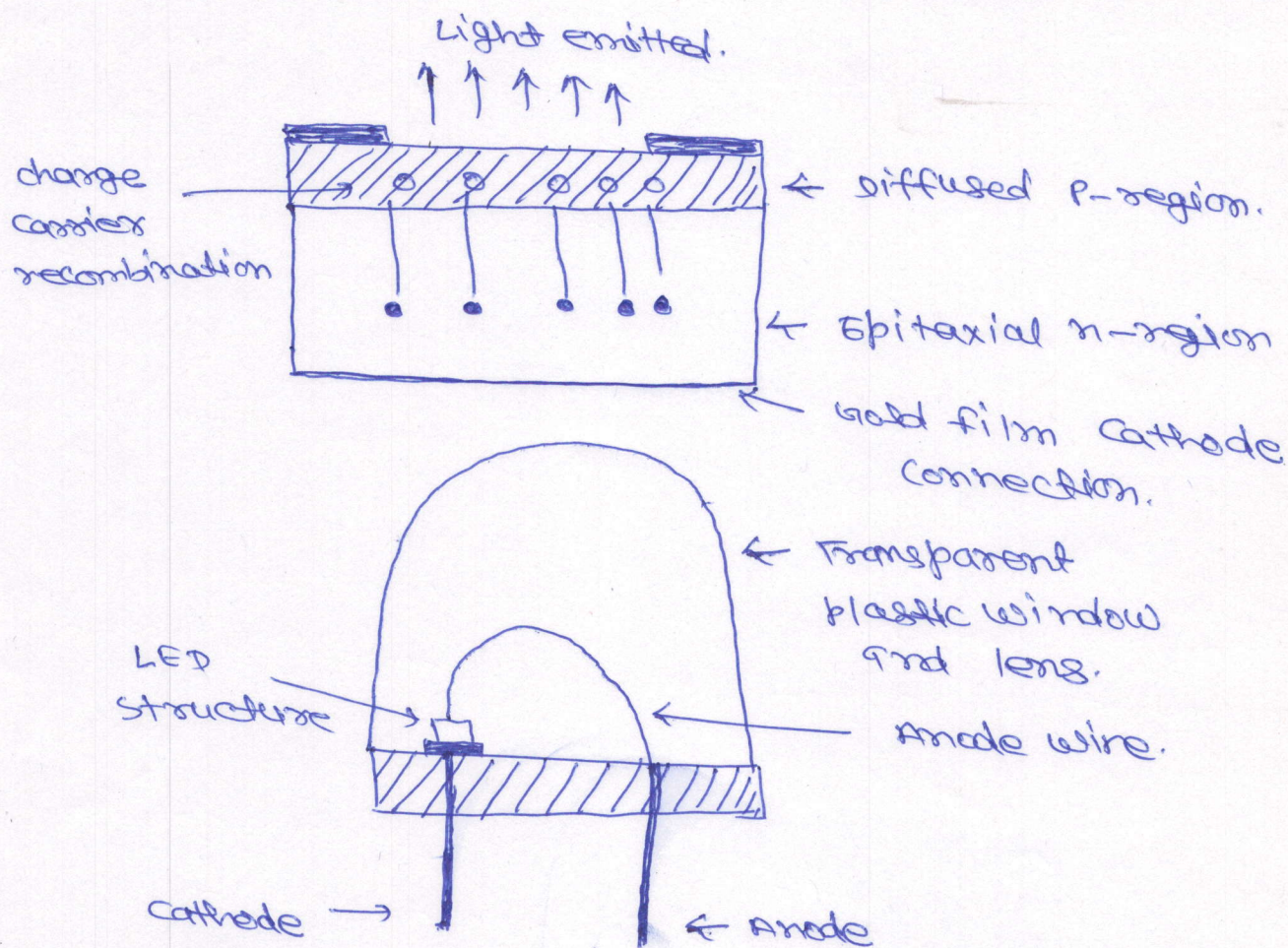
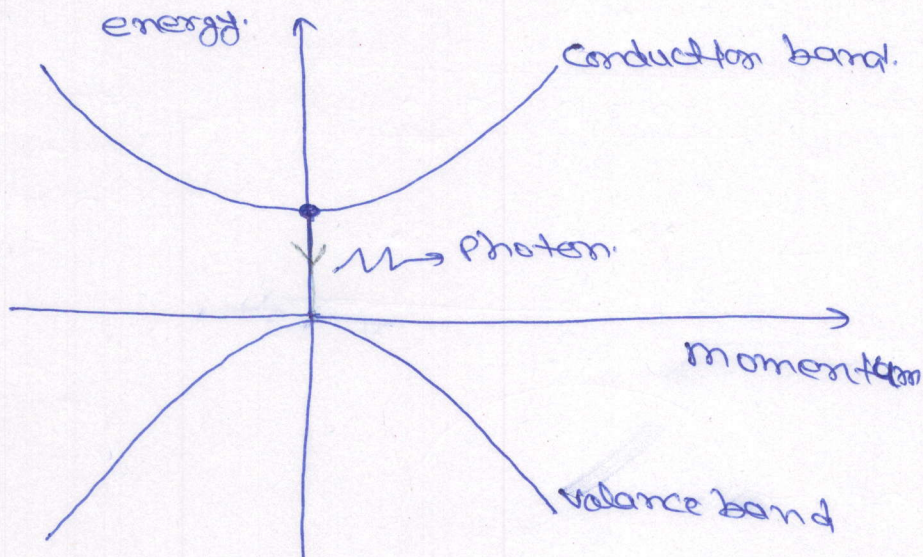


fig:- LED in Plastic Enclosure

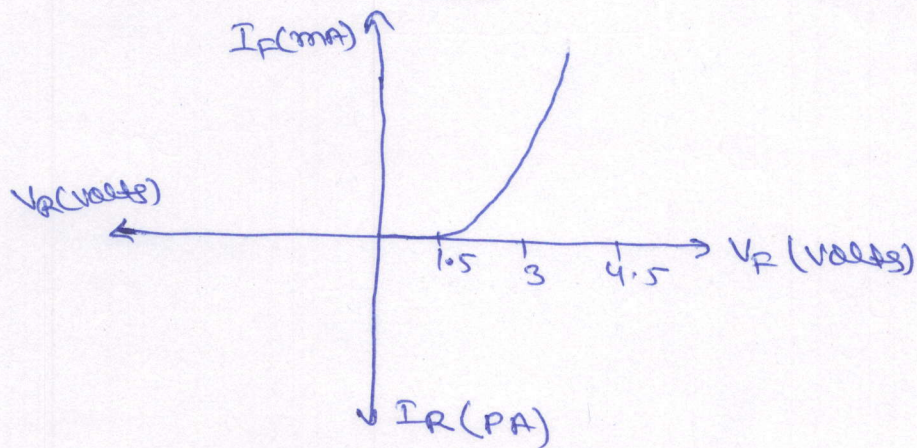
Working principle of LED:-

When a P-N junction diode forward biased, the forward ~~biased~~ current flows due to free electrons crossing from N-side and recombining with holes on P-side. We know that, free electrons are found in conduction band. Hence they have greater energy than holes, which are found in valance band. When ever an electron recombines with the hole, it falls from conduction band to valance band i.e. from

Higher energy level to lower energy level. Due to this, the electron release energy. This energy is released in the form of either heat or light.



Characteristics of LED -



The cut-in voltage of the LED is about 1.5V, which is considerably larger than of ordinary diode. When the p-n junction is forward biased with a voltage greater than about 1.5V, electron-hole recombination takes place. During recombination process electrons release energy in the form of light.

Sol. ② :-

$$Y = A + D \overline{(B + \bar{D} + E)}$$

Now we know in De Morgan's theorems

$$\overline{A+B} = \bar{A} \cdot \bar{B} \quad \& \quad \overline{A \cdot B} = \bar{A} + \bar{B}$$

Now

$$= A + D (\overline{B + \bar{D} + E})$$

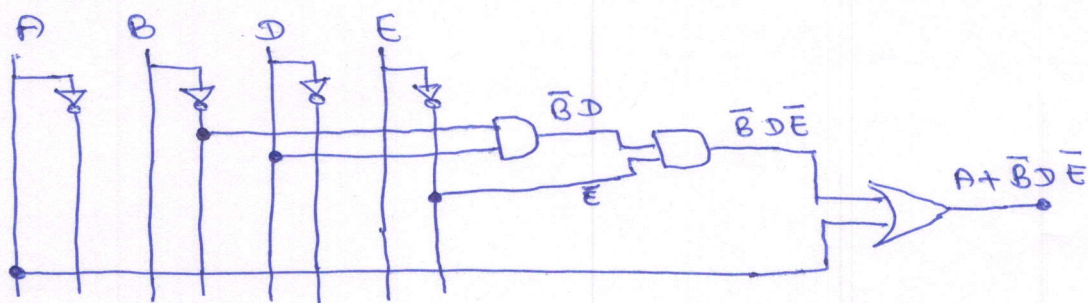
$$= A + D \bar{E} (\overline{B + \bar{D}})$$

$$= A + D \bar{E} (\bar{B} + D)$$

$$= A + D \bar{E} \bar{B} + D \bar{E} D$$

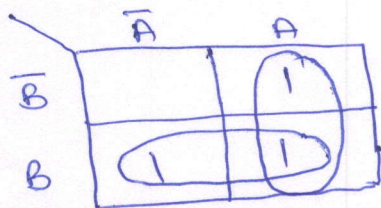
$$Y = A + \bar{B} D \bar{E}$$

Gate Realization:-



Soln ③ :-

$$Y(A, B) = \sum m(1, 2, 3)$$



$$Y = A + B$$

Gate Realization:-

