



SNS COLLEGE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)

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Department of Biomedical Engineering

Course Name: 23BMB101-Electron Devices and Circuits

I Year : II Semester

Unit I –Semiconductor Diodes

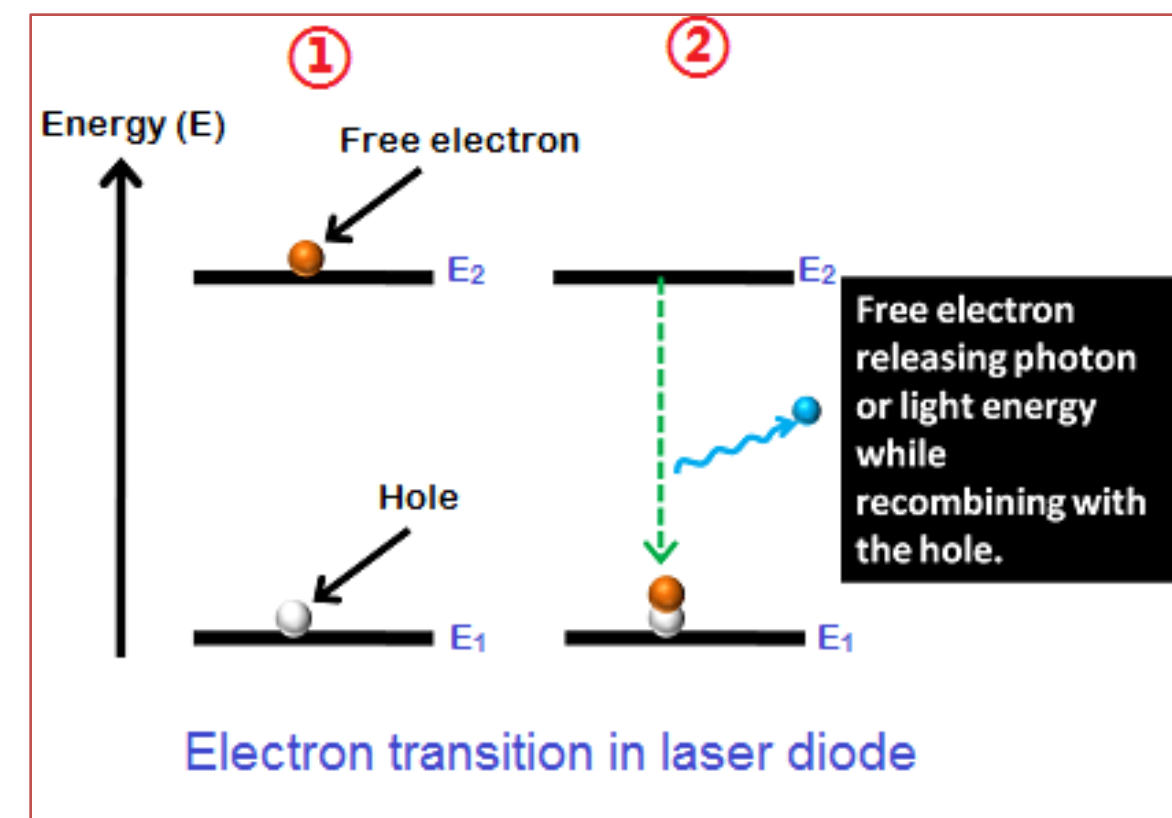
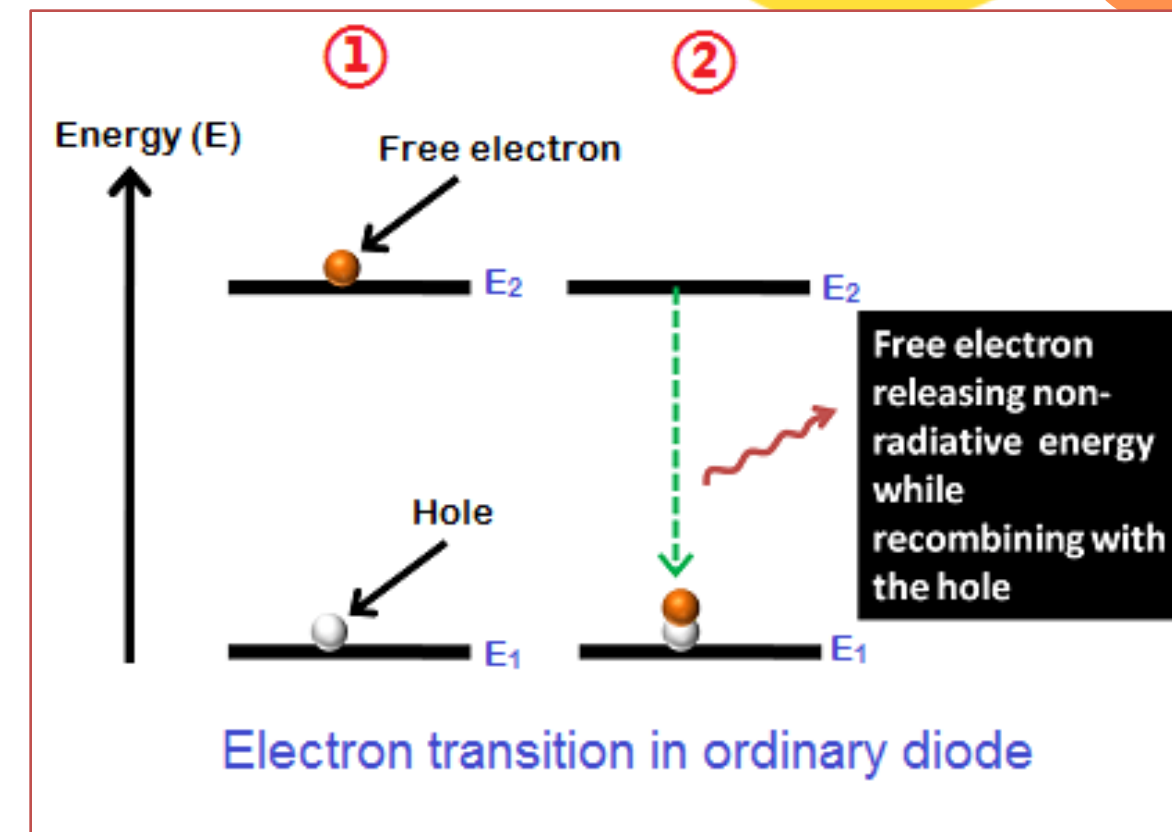
Topic : LASER Diode

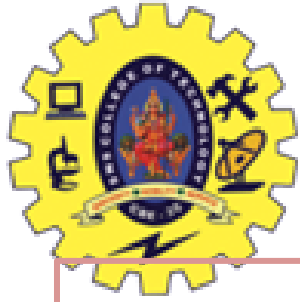


INTRODUCTION

- A laser diode is an optoelectronic device, which converts electrical energy into light energy to produce high-intensity coherent light.
- In a laser diode, the p-n junction of the semiconductor diode acts as the laser medium or active medium.
- The main difference between the LED and laser diode is that the LED emits incoherent light whereas the laser diode emits coherent light.

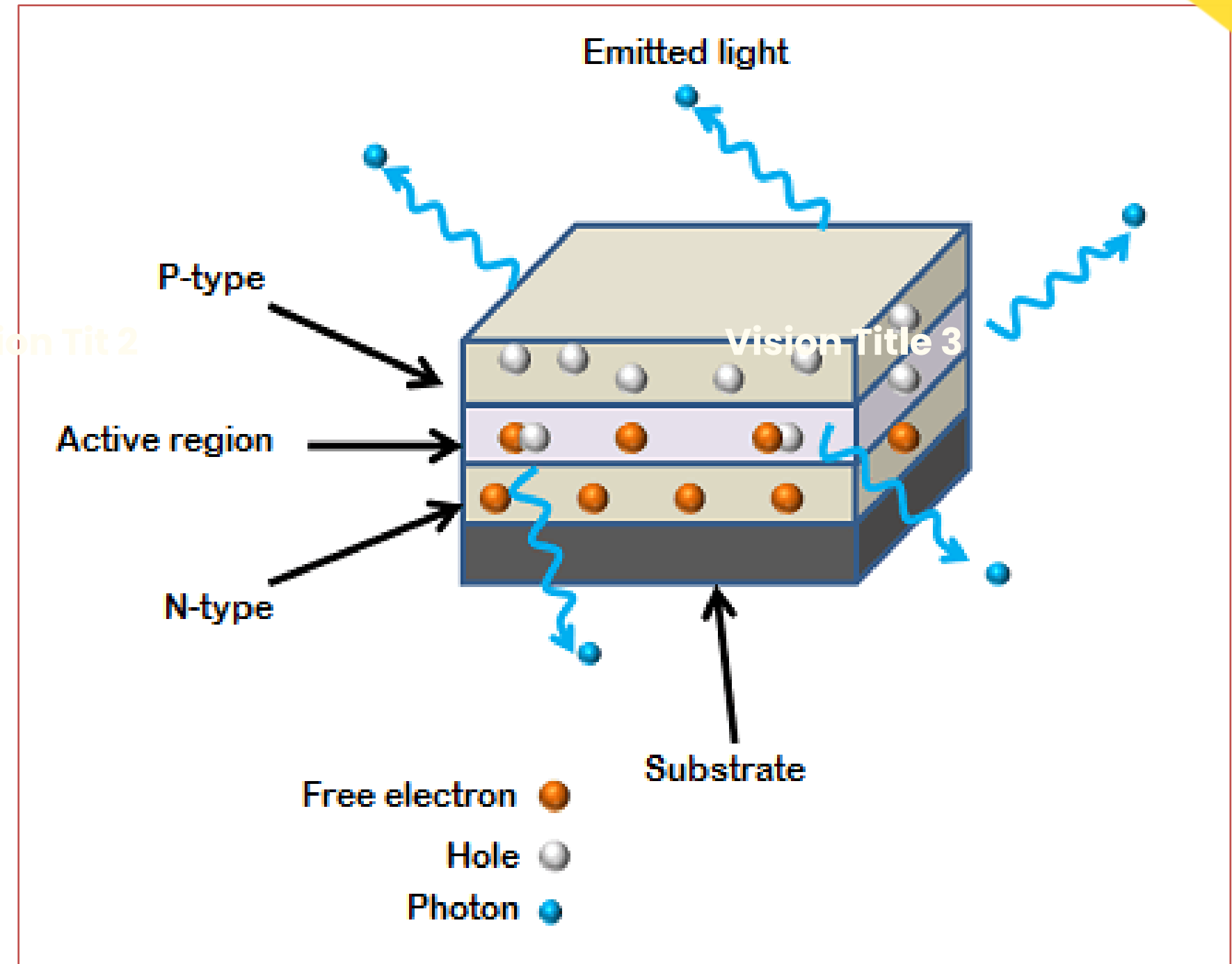
Vision Tit 2

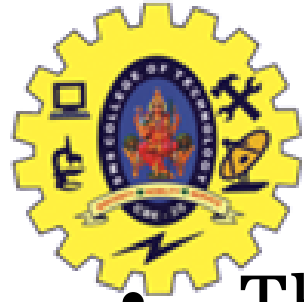




Laser Diode construction

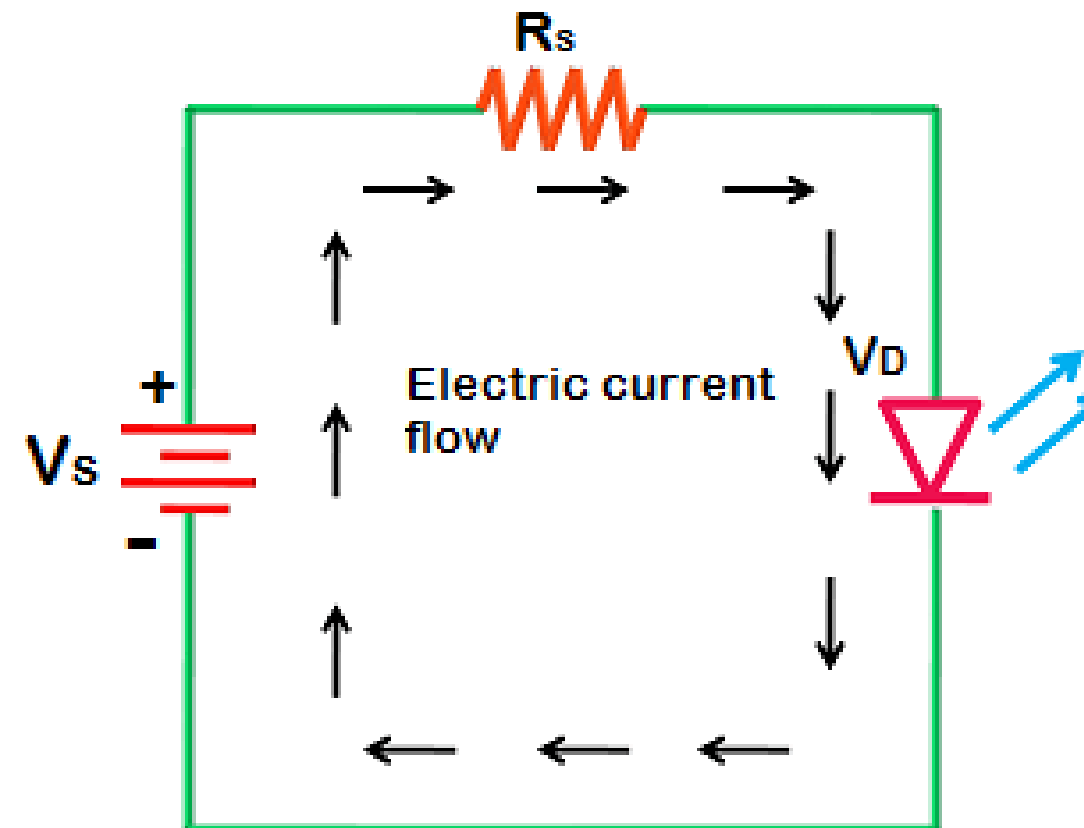
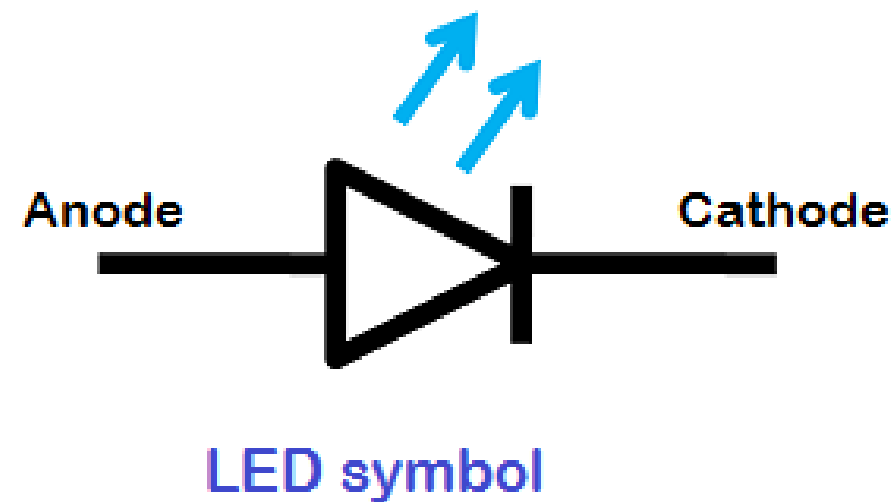
- The laser diode is made of two doped gallium arsenide layers.
- One doped gallium arsenide layer will produce an n-type semiconductor whereas another doped gallium arsenide layer will produce a p-type semiconductor.
- Along with this, an additional active layer of undoped GaAs is placed between the two layers.
- In laser diodes, polishing at the two ends of the junction is done in order to provide a mirror-like surface.





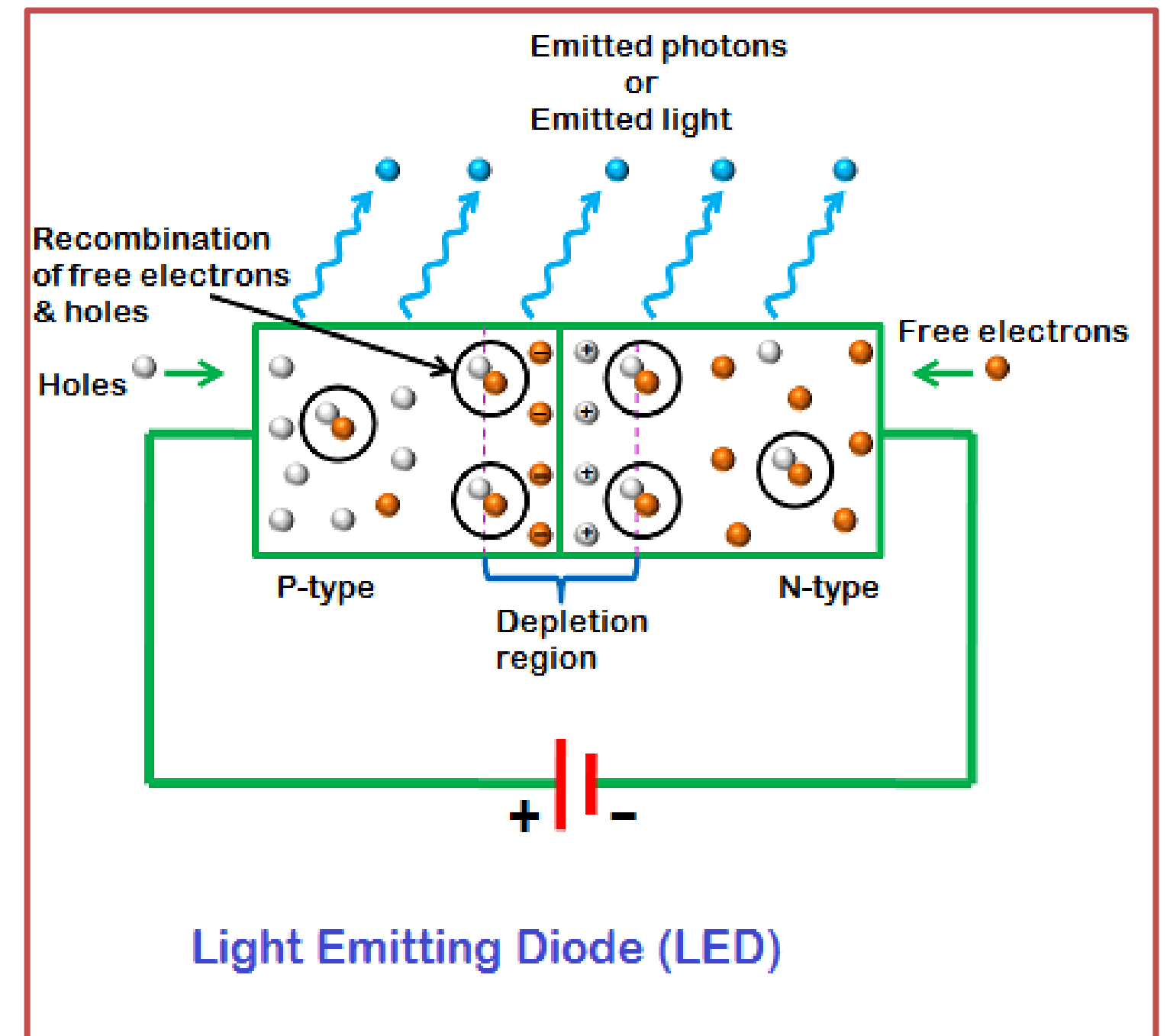
Biasing of LED

- The safe forward voltage ratings of most LEDs is from 1V to 3 V and forward current ratings is from 200 mA to 100 mA.
- The resistor placed between LED and voltage source is called current limiting resistor. This resistor restricts extra current which may destroy the LED.



Working

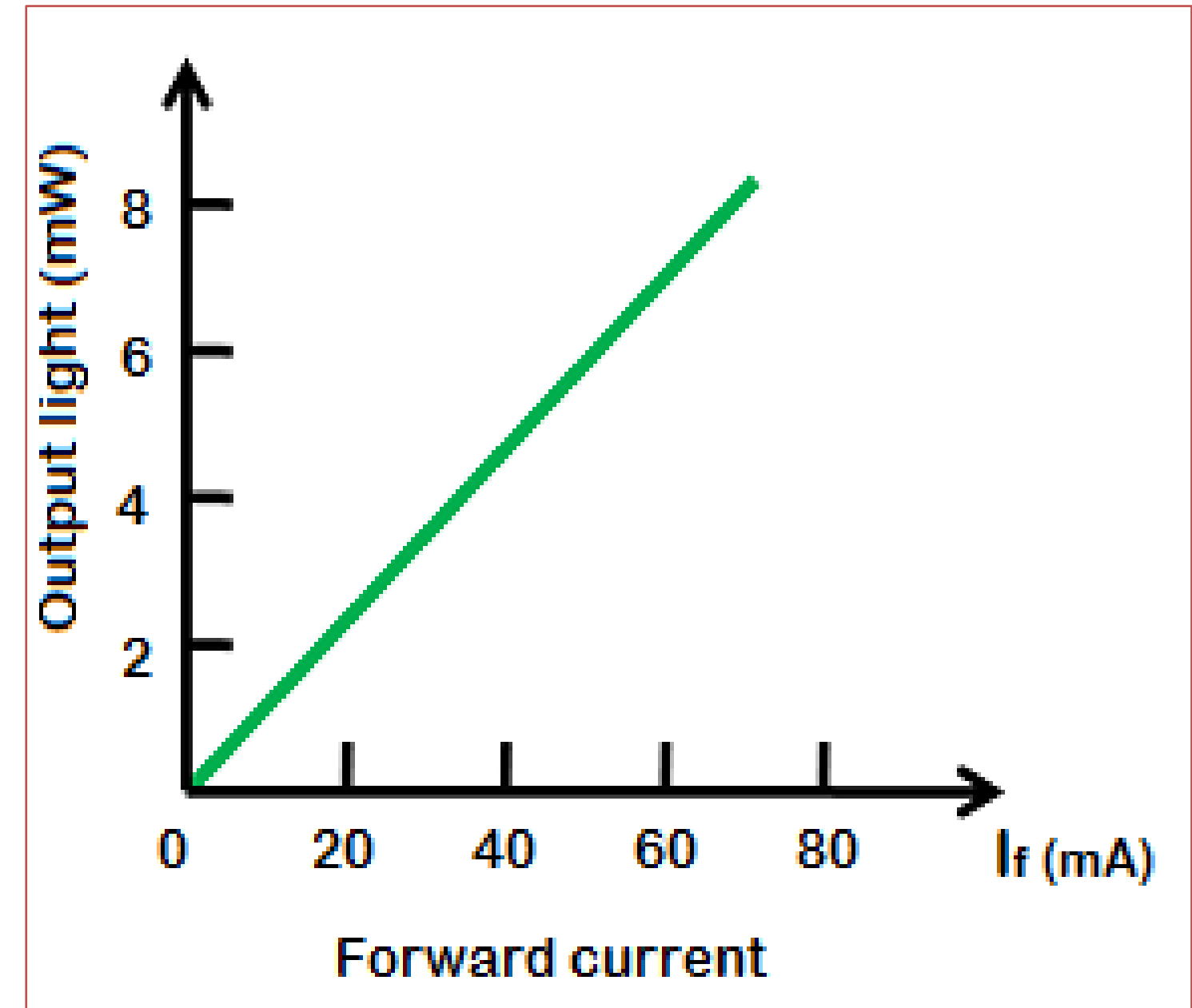
- Light Emitting Diode (LED) works only in forward bias condition.
- When Light Emitting Diode (LED) is forward biased, the free electrons from n-side and the holes from p-side are pushed towards the junction.
- Because of the recombination of free electrons and holes in the depletion region, the width of depletion region decreases. As a result, more charge carriers will cross the p-n junction.





Characteristics of LED

- The amount of output light emitted by the LED is directly proportional to the amount of forward current flowing through the LED.
- The brightness of the emitted light depends on the material used for constructing LED and forward current flow through the LED.
- LEDs are mainly classified into two types: visible LEDs and invisible LEDs.





Colour of LED

- The material used for constructing LED determines its colour. In other words, the wavelength or colour of the emitted light depends on the forbidden gap or energy gap of the material. Gallium arsenide LEDs emit red and infrared light.

Vision Tit 2

- ✓ Gallium nitride LEDs emit bright blue light.
- ✓ Yttrium aluminium garnet LEDs emit white light.
- ✓ Gallium phosphide LEDs emit red, yellow and green light.
- ✓ Aluminium gallium nitride LEDs emit ultraviolet light.
- ✓ Aluminium gallium phosphide LEDs emit green light.



Advantages & Disadvantages



| Advantages | Disadvantages |
|---|--|
| The brightness of light emitted by LED is depends on the current flowing through the LED. | LEDs need more power to operate than normal p-n junction diodes. |
| Light emitting diodes consume low energy | Luminous efficiency of LEDs is low. |
| LEDs are very cheap and readily available | |
| Smaller in size and light in weight | |
| LEDs operates very fast. They can be turned on and off in very less time. | |
| LEDs do not contain toxic material like mercury which is used in fluorescent lamps. | |
| LEDs can emit different colours of light. | |



Applications



LED Applications

