



TRINITY COLLEGE FOR WOMEN NAMAKKAL

Department of Physics

ELECTRONICS

21PPH03 - ODD Semester

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LIGHT EMITTING DIODES [LEDs]

INTRODUCTION TO LEDs

- LEDs are promising light source whose efficiency was 10 times greater than the incandescent lighting.
- Long operating life and reliability has made LEDs as a potential choice for next generation lighting systems, including automotive, emergency, backlight, indoor and outdoor.
- LED lighting can also be referred to as solid-state lighting (SSL) because an LED is solid-state technology. **[Solid State Semiconductor Device]**
- LEDs were first developed in 1960s and its characteristics decides this light source is suitable for **indication** not **illumination**.



Indication:

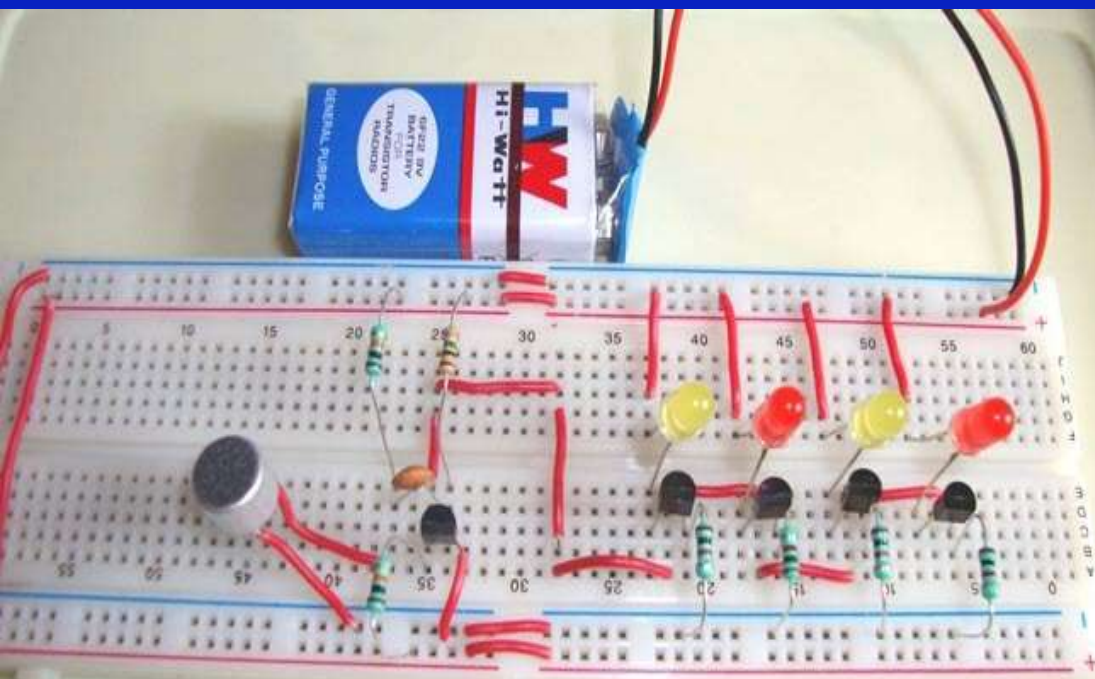
Indication – refers – use of light source – viewed directly – self luminous object.
Ex: Signs, signals, indicator lights in electronic equipments.

Illumination:

Illumination – refers – use of light source – view other object by the light reflected from those object.

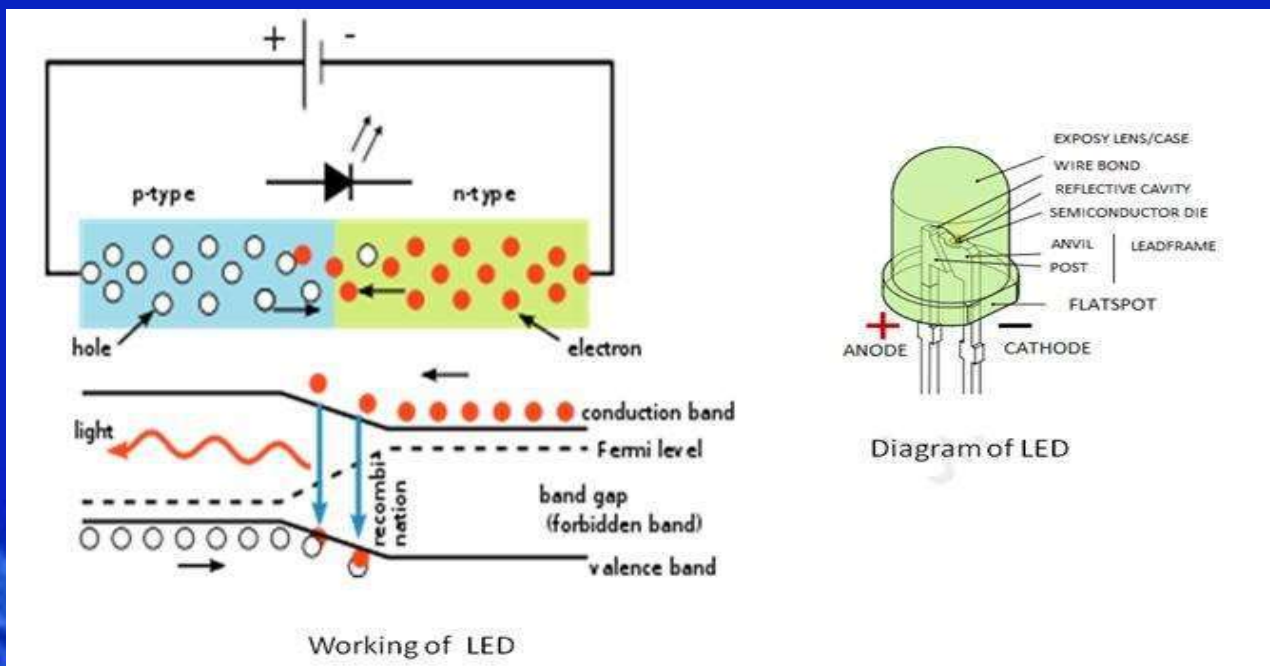
Ex: Lightings found in rooms and Task lightings in desk.

- LEDs are quite effective and efficient for **colored light applications**.



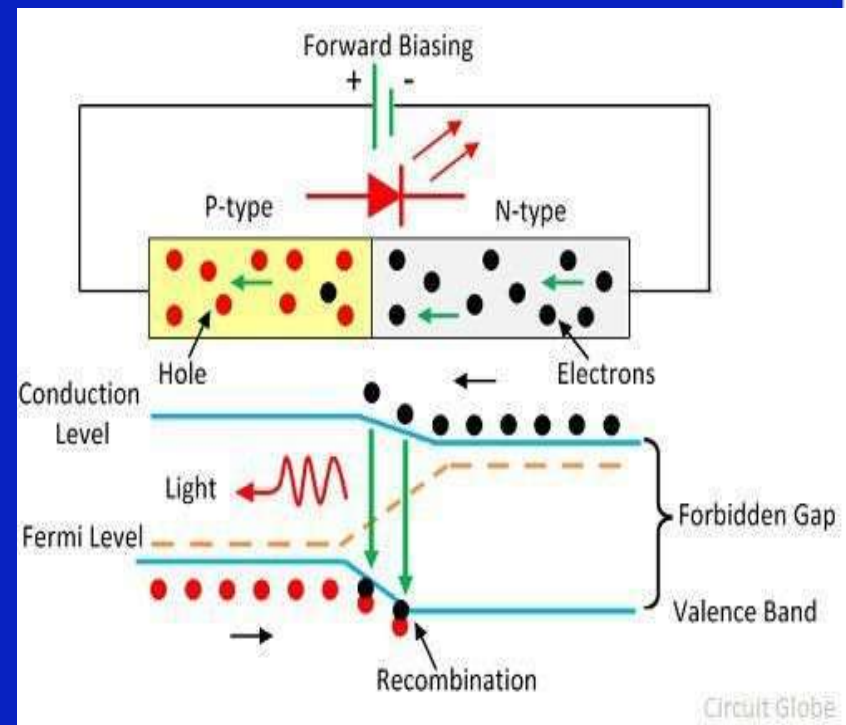
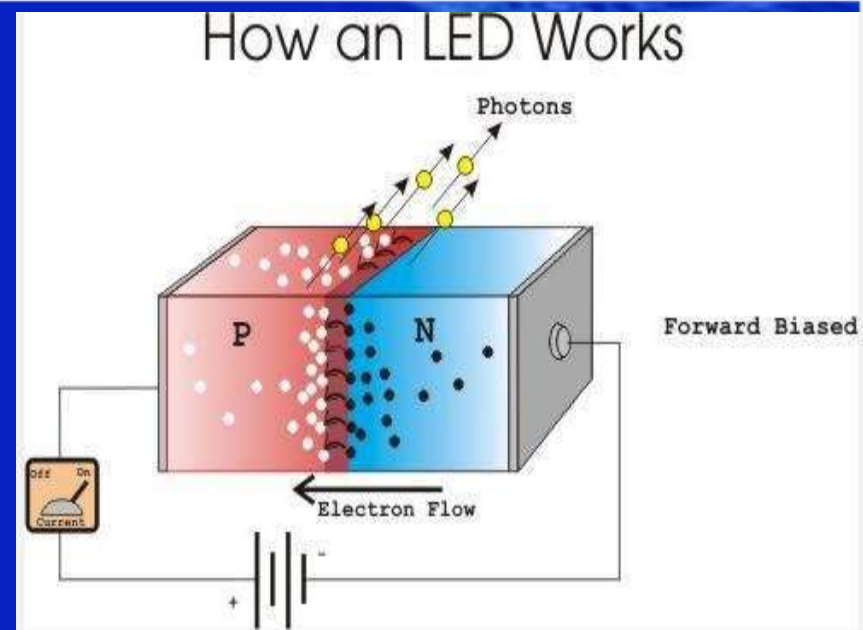
WHAT IS AN LED?

- LEDs are **semiconductor diodes**, electronic devices that permit current to flow in only one direction.
- The diode is formed by bringing two slightly different materials together to form a **PN junction**.
- In a PN junction, the P side contains excess positive charge ("**holes**," indicating the absence of electrons) while the **N** side contains excess negative charge (**electrons**).



HOW LED WORKS?

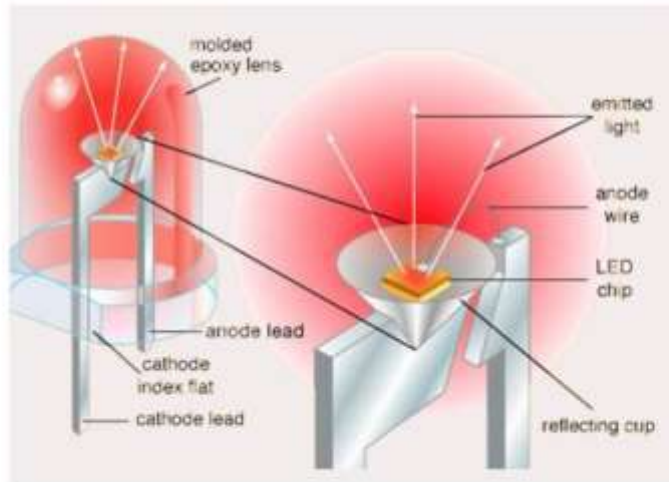
- When current flows across a diode
- Negative electrons move one way and positive holes move the other way
- The holes exist at a lower energy level than the free electrons.
- Therefore when a free electrons falls it losses energy
- This energy is emitted in a form of a photon, which causes light. The color of the light is determined by the fall of the electron and hence energy level of the photon.



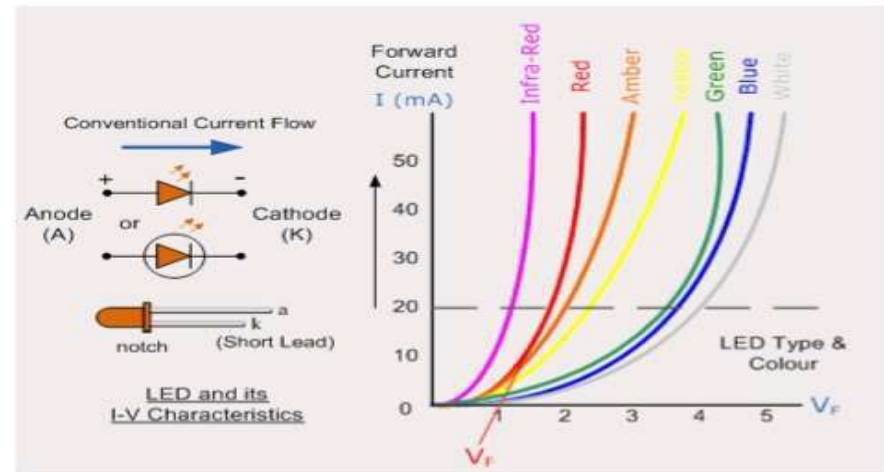
ELECTRICAL CHARACTERISTICS OF LED

- Individual LEDs are low voltage devices.
- Single indicator LEDs require 2 to 4 volts of direct current, with current in the range from 1 to 50 milliamperes.
- An illumination-grade LED containing a single semiconducting element requires the same voltage, but operating currents are much higher, typically several hundred milliamperes.
- A device containing multiple elements connected in series will require higher voltage corresponding to the larger number of individual elements in the device.
- Reverse polarity destroys an LED.
- Manufacturers provide specifications about the maximum reverse voltages acceptable for LED devices; 5 volts is a typical maximum rating.

LED Construction



V-I Characteristics of LED

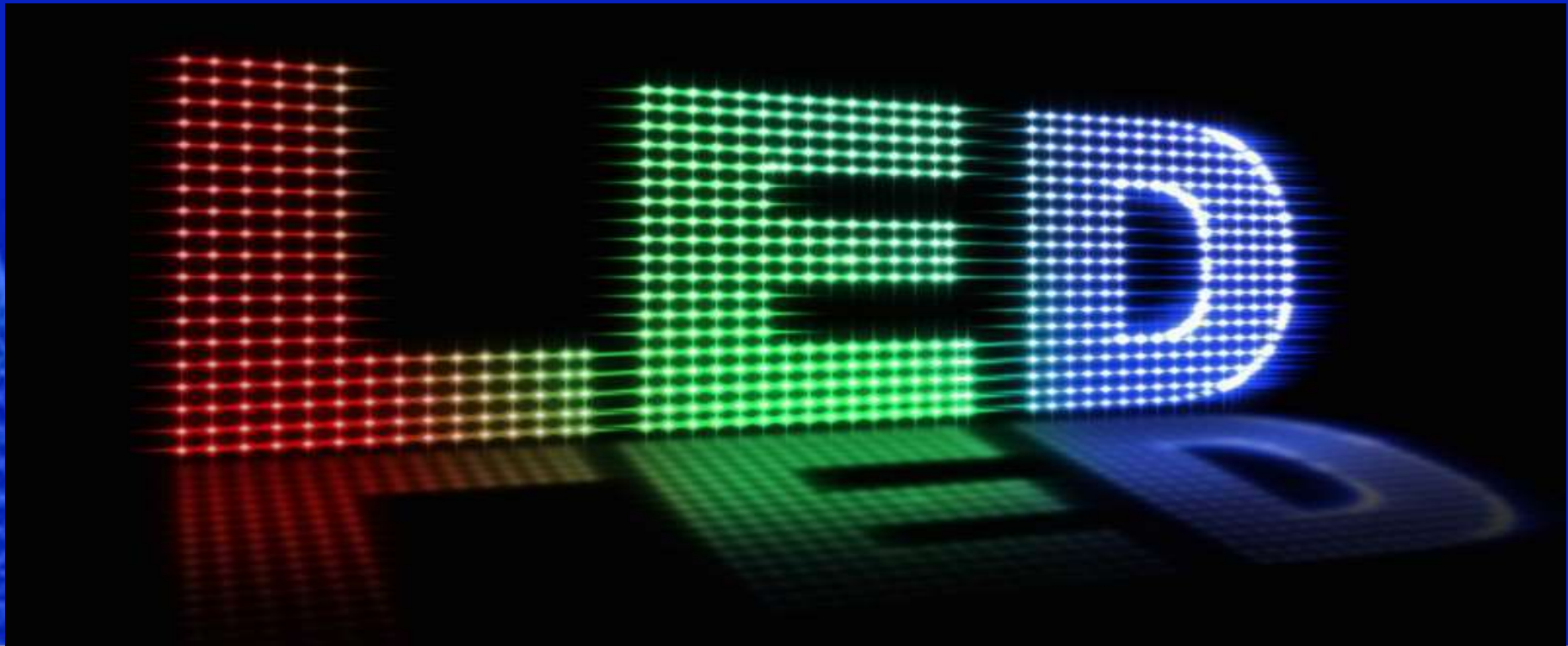


How much light do LEDs produce?

Color	Light output (lm)
White	18-87
Blue	7-30
Green	25-120
Yellow	20-69
Red	25-55

FEATURES & BENEFITS OF LED

- LED's do not emit ultraviolet (UV) or infrared (IR) radiation. They do not radiate heat in the direction of the illuminated object, they can therefore be used to illuminate materials that fade easily, food, works of art etc.
- LED's are durable against impact and vibration.
- LED's can be dimmed.
- Coloured light can be produced effectively – over 16 million colours.



COMMON APPLICATION

- Display lighting - compact displays are possible with low operating temperatures
 - Display case, museum and shop lighting
 - illumination of sensitive objects at close range with ultraviolet (UV) and infrared(IR) free light
 - Underwater lighting - low voltage supply for safety and low maintenance
 - Outside lighting - coloured effects to enhance outdoor spaces
 - Sign lighting - strips of LED's can be used to light signage in many different colours
 - Low level lighting - LED luminaires are cool to touch and are therefore suitable for us in domestic situations where children may come into contact with them
 - Architectural detail lighting.
- -LED's can be used in applications which traditionally used neon or cold cathode.



THANK YOU

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