Lab 2 – LIGHT EMITTING DIODE

Introduction:

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.

Objective:

Educational:

V-I characteristics stand for voltage-current characteristics of an electrical component or device. The V-I graph yields valuable information about the resistance and breaks down an electronic component. It also provides the operating region of a component. By studying these characteristics, we can understand where and how to use a component in an electric circuit.

Experimental:

To study the V-I characteristics of light emitting diode and find the Threshold voltage and forward resistance of LED

Pre Lab:

Reading:

Construction and working of Light Emitting Diode, and V-I characteristics of different Light Emitting Diodes.

Written:

Keep the worksheet ready with required write up, Formulae, Tabular columns and theoretical values.

Apparatus Required:
Light emitting diode, 0-5V variable Supply, 0-10v Voltmeter, 0-50mA DC Ammeter.

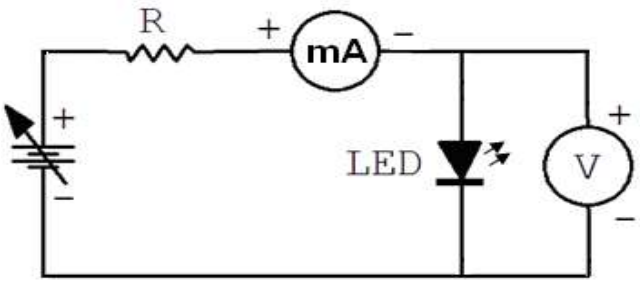
Back Ground:

In a PN junction charge carrier recombination takes place when the electrons cross from the N-layer to the P-layer. The electrons are in the conduction band on the P-side while holes are in the valence band on the N-side. The conduction band has a higher energy level compared to the valence band and so when the electrons recombine with a hole the difference in energy is given out in the form of heat or light. In case of silicon or germanium, the energy dissipation is in the form of heat, whereas in case of gallium-arsenide and gallium phosphide, it is in the form of light. This light is in the visible region. Germanium and silicon, which have E_g about 1ev cannot be used in the manufacture of LED. Hence Gallium arsenide, Gallium phosphide which emits light in the visible region are used to manufacture LED.

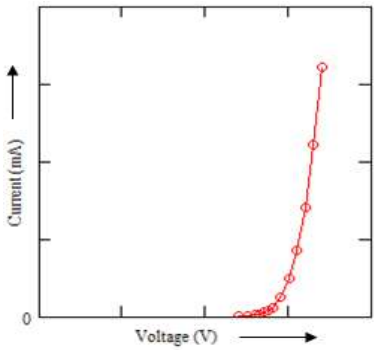
Procedure for V-I Characteristics:

1. Connect the Light emitting diode as shown in figure.
2. Slowly increase forward bias voltage in steps of 0.1 volt.
3. Note the current passing through the LED.
4. Do not exceed 30mA current.
5. Plot a graph of light emitting diode
6. Voltage vs light emitting diode current.

Circuit diagram:



Model graph:



Observation table:

S. No.	Voltage (Volts)	Current (mA)
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Result :

V-I characteristics of given LED are studied.

Calculated Threshold Voltage V_{th} = _____V.

Forward Resistance R_f = _____Ω.

Viva Voce

1. What are p-type and n-type semiconductors?
2. Define threshold voltage.
3. What is depletion layer?
4. What is a forward biased diode?

Probing further Experiments

1. Study the characteristics of Laser diode
2. Plot the V-I characteristic curves for the different colors of light emitted by LED's.