

1. LED & LASER CHARACTERISTICS

AIM:

Study the V-I characteristics of the given LED.

Apparatus:

LED, resistors, connecting wires and voltmeter and milli ammeter, variable battery.

Principle:

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a basic p-n junction diode, which emits light when connected in forward biased. When a proper voltage is applied to the leads, electrons are able to recombine with holes within the depletion region, releasing energy in the form of photons.

Theory:

The LED is a type of diode converting electrical energy into light. LED (light emitting diode) is a p-n diode but the main difference is that diode is made of Indirect Semiconductor (Si, Ge) material and LED is made of direct semiconductor material (GaAs). GaAs devices generate less noise than most other types of semiconductor components. This is important in weak-signal amplification. Gallium arsenide is used in the manufacture of light-emitting diodes (LEDs), which are found in optical communications and control systems.

Light emitting diodes are made from a very thin layer of fairly heavily doped semiconductor material and depending on the semiconductor material used and the amount of doping, when forward biased an LED will emit a colored light at a particular spectral wavelength. When it is forward biased the holes move from p to n and electrons flow from n to p. This current flow will cause electrons and holes to move in a manner that an electron will move to fill a hole. When this happens, the electron will fall to a lower energy level and this will release an amount of energy in the form of photons. In a larger scale, these photons will produce light. Thus LED emits light under forward biased condition. Under reverse biased condition, there is no recombination due to majority carriers, so there is no emission of light. Different LED compounds emit light in specific regions of the visible light spectrum and therefore produce different intensity levels. The exact choice of the semiconductor material used will determine the overall wavelength of the photon light emissions and therefore the resulting color of the light emitted.

The general notation of LED along with its terminals when it is in forward biased is shown in the

Open Source Physics Lab Manual Light

Dr. J. P. Goel



Open Source Physics Lab Manual Light:

Lab Manual Latest Edition Dr. J. P. Goel, 2016-12-17 Lab E Manual Physics For XIIth Practicals A Every student will perform 10 experiments 5 from each section 8 activities 4 from each section during the academic year Two demonstration experiments must be performed by the teacher with participation of students The students will maintain a record of these demonstration experiments B Evaluation Scheme for Practical Examination One experiment from any one section 8 Marks Two activities one from each section 4 4 8 Marks Practical record experiments activities 6 Marks Record of demonstration experiments Viva based on these experiments 3 Marks Viva on experiments activities 5 Marks Total 30 Marks Section A Experiments 1 To determine resistance per cm of a given wire by plotting a graph of potential difference versus current 2 To find resistance of a given wire using metre bridge and hence determine the specific resistance of its material 3 To verify the laws of combination series parallel of resistances using a metre bridge 4 To compare the emf of two given primary cells using potentiometer 5 To determine the internal resistance of given primary cells using potentiometer 6 To determine resistance of a galvanometer by half deflection method and to find its figure of merit 7 To convert the given galvanometer of known resistance and figure of merit into an ammeter and voltmeter of desired range and to verify the same 8 To find the frequency of the a c mains with a sonometer Activities 1 To measure the resistance and impedance of an inductor with or without iron core 2 To measure resistance voltage AC DC current AC and check continuity of a given circuit using multimeter 3 To assemble a household circuit comprising three bulbs three on off switches a fuse and a power source 4 To assemble the components of a given electrical circuit 5 To study the variation in potential drop with length of a wire for a steady current 6 To draw the diagram of a given open circuit comprising at least a battery resistor rheostat key ammeter and voltmeter Mark the components that are not connected in proper order and correct the circuit and also the circuit diagram Section B Experiments 1 To find the value of v for different values of u in case of a concave mirror and to find the focal length 2 To find the focal length of a convex lens by plotting graphs between u and v or between $1/u$ and $1/v$ 3 To find the focal length of a convex mirror using a convex lens 4 To find the focal length of a concave lens using a convex lens 5 To determine angle of minimum deviation for a given prism by plotting a graph between angle of incidence and angle of deviation 6 To determine refractive index of a glass slab using a travelling microscope 7 To find refractive index of a liquid by using i concave mirror ii convex lens and plane mirror 8 To draw the I V characteristic curve of a p n junction in forward bias and reverse bias 9 To draw the characteristic curve of a zener diode and to determine its reverse break down voltage 10 To study the characteristics of a common emitter npn or pnp transistor and to find out the values of current and voltage gains Activitie 1 To study effect of intensity of light by varying distance of the source on a L D R 2 To identify a diode a LED a transistor and IC a resistor and a capacitor from mixed collection of such items 3 Use of multimeter to i identify base of transistor ii distinguish between npn and pnp type transistors iii see the unidirectional flow of current in case of a diode and a LED iv

check whether a given electronic component e g diode transistor or I C is in working order 4 To observe refraction and lateral deviation of a beam of light incident obliquely on a glass slab 5 To observe polarization of liquid using two Polaroids 6 To observe diffraction of light due to a thin slit 7 To study the nature and size of the image formed by i convex lens ii concave mirror on a screen by using a candle and a screen for different distances of the candle from the lens mirror 8 To obtain a lens combination with the specified focal length by using two lenses from the given set of lenses Suggested Investigatory Projects 1 To investigate whether the energy of a simple pendulum is conserved 2 To determine the radius of gyration about the centre of mass of a metre scale as a bar pendulum 3 To investigate changes in the velocity of a body under the action of a constant force and determine its acceleration 4 To compare effectiveness of different materials as insulators of heat 5 To determine the wavelengths of laser beam by diffraction 6 To study various factors on which the internal resistance emf of a cell depends 7 To construct a time switch and study dependence of its time constant on various factors 8 To study infrared radiations emitted by different sources using photo transistor 9 To compare effectiveness of different materials as absorbers of sound 10 To design an automatic traffic signal system using suitable combination of logic gates 11 To study luminosity of various electric lamps of different powers and make 12 To compare the Young s modulus of elasticity of different specimens of rubber and also draw their elastic hysteresis curve 13 To study collision of two balls in two dimensions 14 To study frequency response of i a resistor an inductor and a capacitor ii RL circuit iii RC circuit iv LCR series circuit

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