ZENER-DIODE

AIM:-To Study V-I Characteristics of a Zener Diode.

Apparatus required:-A variable D-C supply, a zener Diode, voltmeter (0-50V) and an ammeter(0-250 μA)

Theory:

A Zener Diode is a special kind of diode which permits current to flow in the forward direction as normal, but will also allow it to flow in the reverse direction when the voltage is above the breakdown voltage or 'zener' voltage.

Zener diodes are designed so that their breakdown voltage is much lower .When a reverse current above the Zener voltage passes through a Zener diode, there is a controlled breakdown which does not damage the diode. The voltage drop across the Zener diode is equal to the Zener voltage of that diode no matter how high the reverse bias voltage is above the Zener voltage.

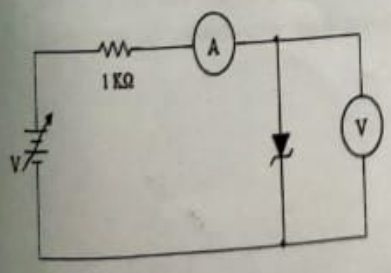
Formula Used:- Ohm's Law

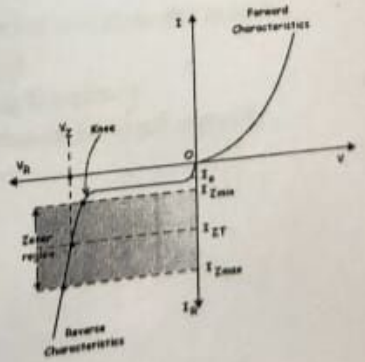
$V \alpha I$

$V = IR$ Where V = Voltage of the D-C supply

I = Current , R= Resistance

Circuit Diagram





Procedure :

1) Make the connection according to the circuit diagram.
2) Stating from very low value of input voltage increase it in small steps well above the zener voltage for the given diode. For each observation note the input voltage V_i and corresponding current in the input circuit.
3) Do the same for forward bias also.
4) Plot a graph between input voltage and current.

Observation Table

Series Resistance R_s= ----- Ω

S.No	Vi	I
1		
2		
3		
4		
5		

Result:- Plot a Graph between input Voltage and current.

Precautions & Sources of error :

1) Do not increase the voltage in reverse bias to a very high value.
2) A resistance must be connected in series to limit the current at breakdown and should be kept constant.
3) The voltage must be increased from a small value in small steps, up to a Point well above the zener voltage.
4) Always connect the voltmeter in parallel and ammeter in series.
5) Connection should be proper and tight.
6) Switch on the supply after completing the circuit.
7) Reading of voltmeter and ammeter should be noted correctly.

ZENER DIODE

1. What is Zener diode.

Ans. Zener diode is a p-n junction diode specially designed for operation in brerakdown region.

2. What is Zener voltage ? What is the range of available Zener voltages.

Ans. The reverse bias voltage at which the Zener diode breaks down is called Zener voltage. Zener diodes are available in the Zener voltage range of 2.4V to 200V.

3. What is the role of the resistor Rs in series with the Zener.

Ans. It is the current limiting resistor and avoids any accidental burn out of the diode.

4. What are the types of Semiconductor?

Intrinsic semiconductor, Extrinsic semiconductor.

5. What is Intrinsic Semiconductor?

Pure form of semiconductors are said to be intrinsic semiconductor. Ex: germanium, silicon.

6. What is Extrinsic semiconductor?

If certain amount of impurity atom is added to intrinsic semiconductor the resulting semiconductor is Extrinsic or impure Semiconductor.

7. What is N-type Semiconductor?

The Semiconductor which are obtained by introducing pentavalent impurity atom (phosphorous, antimony) are known as N-type Semiconductor.

8. How many types of break down are there in Zener diode.

There are two types of break down in case of a Zener diode.

1. Avalanche break down and 2. Zener breakdown.

9. What is avalanche breakdown.

The avalanche breakdown is observed in the Zener Diodes having V, having more than 8 V. In the reverse biased condition, the conduction will take place only due to the minority carriers. As we increase the reverse voltage applied to the Zener diode, these minority carriers tend to accelerated. Therefore, the kinetic energy associated with them increases. While travelling, these accelerated minority carriers will collide with the stationary atoms and impart some of the kinetic energy to the valence electrons present in the covalent bonds.

10. What is Zener breakdown.

The Zener Breakdown is observed in the Zener diodes having Vz less than 5V or between 5 to 8 volts. When a reverse voltage is applied to a Zener diode, it causes a very intense electric field to appear across a narrow depletion region. Such an intense electric field is strong enough to pull some of the valence electrons into the conduction band by breaking their covalent bonds. These electrons then become free electrons which are available for conduction. A large number of such free electrons will constitute a large reverse current through the Zener diode and breakdown is said to have occurred due to the Zener effect.

11. Application of zener diode.

Zener diodes are widely used as voltage stabilizer, meter protection, wave shaping circuit, Bluetooth circuit

12. What is 'fermi level.

Fermi level" is the term used to describe the top of the collection of electron energy levels at absolute zero temperature.

13. What is fermi energy.

It is the energy possessed by electron at absolute zero temperature.