Ex.No.1

Date:

V-I CHARACTERISTICS OF PN JUNCTION DIODE

AIM:

To study the PN junction diode characteristics under Forward & Reverse bias conditions.

APPARATUS REQUIRED

S.No.	Name	Range	Type	Qty
1	R.P.S	(0-30)V		1
2	Ammeter	(0–100)μA		1
3	Voltmeter	(0–1)V		1

COMPONENTS REQUIRED

S.No.	Name	Range	Type	Qty
1	Diode	IN4001		1
2	Resistor	1kΩ		1
4	Wires			

THEORY:

A PN junction diode is a two terminal junction device. It conducts only in one direction (only on forward biasing).

FORWARD BIAS:

On forward biasing, initially no current flows due to barrier potential. As the applied potential exceeds the barrier potential the charge carriers gain sufficient energy to cross the potential barrier and hence enter the other region. The holes, which are majority carriers in the P-region, become minority carriers on entering the N-regions, and electrons, which are the majority carriers in the N-region, become minority carriers on entering the P-region. This injection of Minority carriers results in the current flow, opposite to the direction of electron movement.

REVERSE BIAS:

On reverse biasing, the majority charge carriers are attracted towards the terminals due to the applied potential resulting in the widening of the depletion region. Since the charge carriers are pushed towards the terminals no current flows in the device due to majority charge carriers. There will be some current in the device due to the thermally generated minority carriers. The generation of such carriers is independent of the applied potential and hence the current is constant for all increasing reverse potential. This current is referred to as

Reverse Saturation Current (I_O) and it increases with temperature. When the applied reverse voltage is increased beyond the certain limit, it results in breakdown. During breakdown, the diode current increases tremendously.

PROCEDURE:

FORWARD BIAS:

1. Connect the circuit as per the diagram.
2. Vary the applied voltage V in steps of 0.1V.
3. Note down the corresponding Ammeter readings I_f.
4. Plot a graph between V_f & I_f

OBSERVATIONS

1. Find the d.c (static) resistance = V_f / I_f.=
2. Find the a.c (dynamic) resistance r = δV / δI (**r = V/ I) =** $\frac{V_2 - V_1}{I_2 - I_1}$.=
3. Find the forward voltage drop = [Hint: it is equal to 0.7 for Si and 0.3 for Ge]=

REVERSE BIAS:

1. Connect the circuit as per the diagram.
2. Vary the applied voltage V_r in steps of 0.5V.
3. Note down the corresponding Ammeter readings I_r.
4. Plot a graph between V_r & I_r
5. Find the dynamic resistance **r = δV / δI.**

FORMULA FOR REVERSE SATURATION CURRENT (I_O):

$$I_o = \partial I/[\exp(\partial V/\eta V_T)]-1=$$

Where V_T is the voltage equivalent of Temperature = kT/q

k is Boltzmann's constant, q is the charge of the electron and T is the temperature in degrees Kelvin.

η =1 for Silicon and 2 for Germanium

Specification for 1N4001: Silicon Diode

Peak Inverse Voltage: 50V

Maximum forward voltage drop at 1 Amp is 1.1 volts

Maximum reverse current at 50 volts is 5μA

RESULT:

Forward and Reverse bias characteristics of the PN junction diode was Studied and the dynamic resistance under

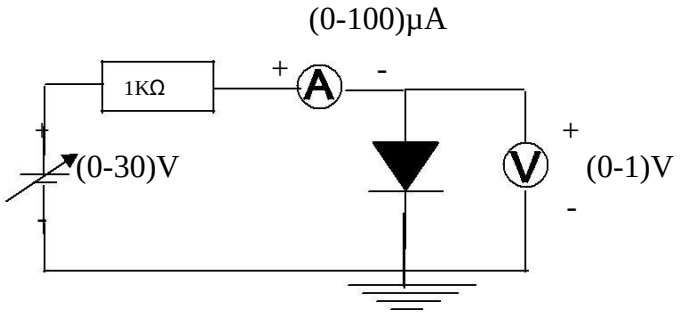
Forward bias = ----------

Reverse bias = ---------- .

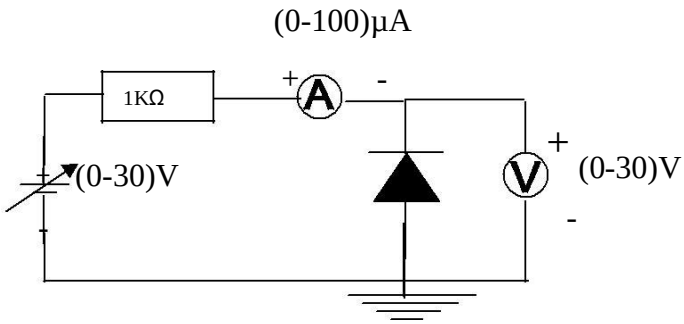
Reverse Saturation Current = ---------- .

CIRCUIT DIAGRAM:

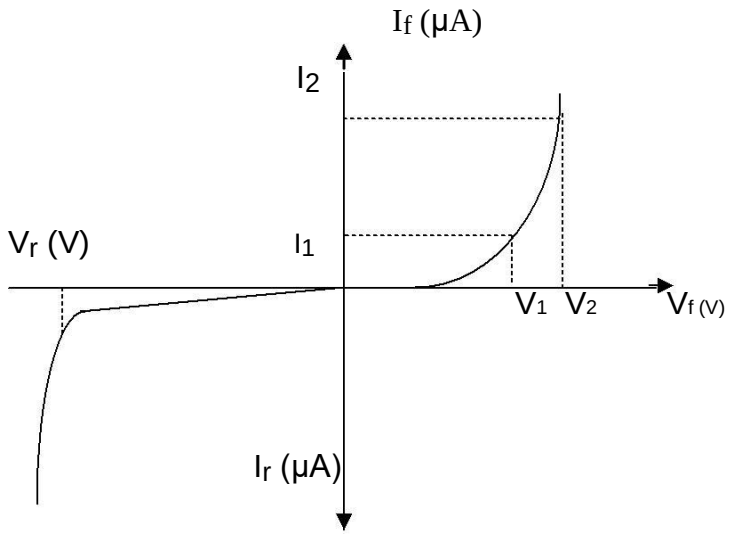
FORWARD BIAS:



REVERSE BIAS:



MODEL GRAPH



TABULAR COLUMN:

FORWARD BIAS: **REVERSE BIAS:**

S.No.	VOLTAGE(V_f) (In Volts)	CURRENT(I_f) (In μA)	S..No.	VOLTAGE(V_r) (In Volts)	CURRENT(I_r) (In μA)