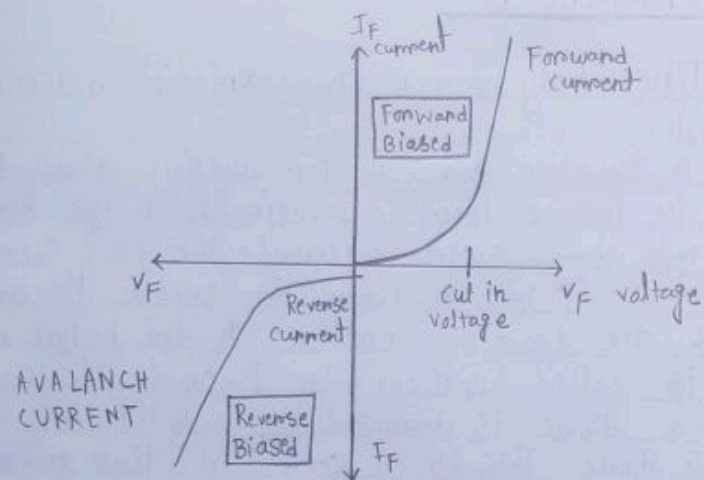


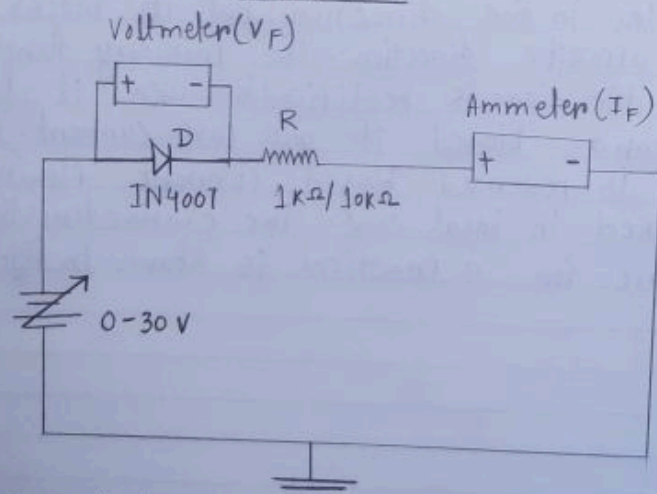
Experiment No. 3

◎ Title: Study of V-I characteristics of P-N junction diode.

P-N Junction diode: A P-N junction diode is a device formed from a junction of n-type and P-type semiconductor material. The lead connected to the P-type material is called the anode and the lead connected to the n-type material is called cathode. In general, the cathode of a diode is marked by a solid line on the diode. This is a component that restricts the direction of movement of charge carriers. Essentially, it allows an electric current to flow in one direction. But it blocks it in opposite direction. The primary function of the diode is rectification. When it is forward biased it will pass current. When it is reversed biased current flowing is blocked in ideal case. The characteristic curve for a practical is shown in fig.



characteristics curve of Forward and Reverse Biased P-N junction diode



circuit diagram of obtaining V-I characteristics curve of a forward biased P-N junction diode

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Date.

• Forward biased P-n junction diode:

when the higher Potential is connected to the anode lead of a P-n junction diode it will pass current. It is called forward biased P-n junction diode.

• Reverse biased P-n junction diode:

when the higher Potential is connected to the cathode lead of a P-n junction diode it will pass reverse saturation current. It is called Reverse biased P-n junction diode.

$$I = I_0 (e^{V_D / (\eta V_T)} - 1)$$

where, I = Diode current, I_0 = Reverse Saturation current, V_D = voltage across the diode, V_T = Threshold voltage, η = Intrinsic coefficient.

Cut in voltage (V_{cut-in}): The forward biased voltage at which a diode starts conducting is called cut-in voltage.

• Plotting of V-I characteristics curve of P-N junction diode

a) connect the circuit on the Bread board as shown in the figure.

b) Fill up the table.

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• Forward biased P-n junction diode:

when the higher potential is connected to the anode lead of a P-n junction diode it will pass current. It is called forward biased P-n junction diode.

• Reversed biased P-n junction diode:

when the higher potential is connected to the cathode lead of a P-n junction diode it will pass reverse saturation current. It is called Reverse biased P-n junction diode.

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where, I = Diode current, I_0 = Reverse saturation current, V_D = voltage across the diode, V_T = Threshold voltage, η = Intrinsic coefficient.

Cut in voltage (V_{cut-in}): The forward biased voltage at which a diode starts conducting is called cut-in voltage.

• Plotting of V-I characteristics curve of P-N junction diode

a) connect the circuit on the Bread board as shown in the figure.

b) Fill up the table.

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c) Draw the V - I characteristic curve of a forward biased P - N junction diode following result of V_F and I_F .

1. Experimental results:

SI NO.	R.P.S voltage (V) (Regulated Power supply)	V_F (Forward voltage through diode) (V)	I_F (Forward current through diode) (mA)
1	0.1	0.142	0
2	0.3	0.32	0
3	0.5	0.43	0.17
4	0.6	0.433	0.20
5	0.7	0.443	0.27
6	0.8	0.457	0.42
7	0.9	0.462	0.47
8	1	0.472	0.63
9	1.1	0.476	0.71
10	1.2	0.48	0.8
11	1.4	0.487	0.97
12	1.6	0.504	1.39
13	2	0.51	1.54
14	2.2	0.514	1.73
15	2.4	0.52	1.96
16	2.6	0.522	2.09
17	2.8	0.525	2.23
18	3.0	0.531	2.47

SI No.	R.P.S (Regulated Power supply) voltage (V)	V_F (Forward voltage through diode) (V)	I_F (Forward current through diode) (mA)
19	3.2	0.534	2.62
20	3.4	0.537	2.83
21	3.6	0.543	3.13
22	3.8	0.548	3.44
23	4.0	0.550	3.56
24	4.2	0.551	3.63
25	4.3	0.553	3.76
26	4.6	0.559	4.17
27	5.0	0.563	4.54

2. Observation from V-I characteristics curve of a forward biased P-n junction diode:

Diode Static Impedance $R_F = V_F / I_F$ (ohm)	1.54 Ω
Diode Dynamic Impedance $R_d = \Delta V_F / \Delta I_F$ (ohm)	0.02 Ω
cut in voltage V_{cut-in}	0.553 V

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