Expt. No. 3

Date 16/8/25

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Aim: To draw the forward characteristic curves of a semiconductor diode.

Apparatus required: Semiconductor diode, regulated power supply, 1000 Ω resistance, milliammeter, voltmeter, connecting wires.

Theory: A semiconductor diode allows current to flow only in one direction (forward bias) and blocks it in the reverse direction (reverse bias).

- In forward bias, when the positive terminal of the battery is connected to the p-side of the diode and the negative to the n-side, the depletion layer width decreases, and current starts flowing after the threshold voltage (~0.7 V for Si diode, ~0.3 V for Ge diode).

- In reverse bias, the diode ideally blocks the current, but a small leakage current flows due to minority carriers until breakdown occurs.

ANAYA

Teacher's Signature _____

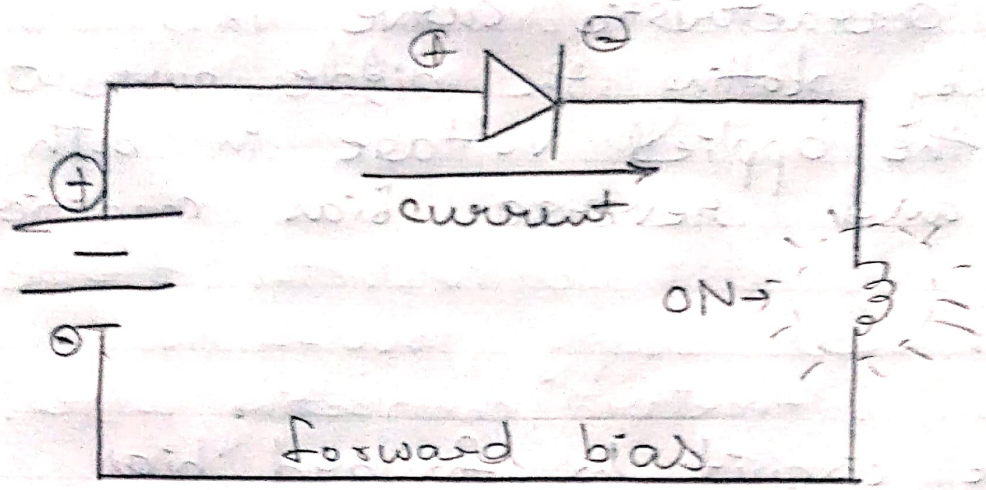
The V-I characteristic curve is obtained by plotting the diode current against the applied voltage in both forward and reverse bias conditions.

Procedure:

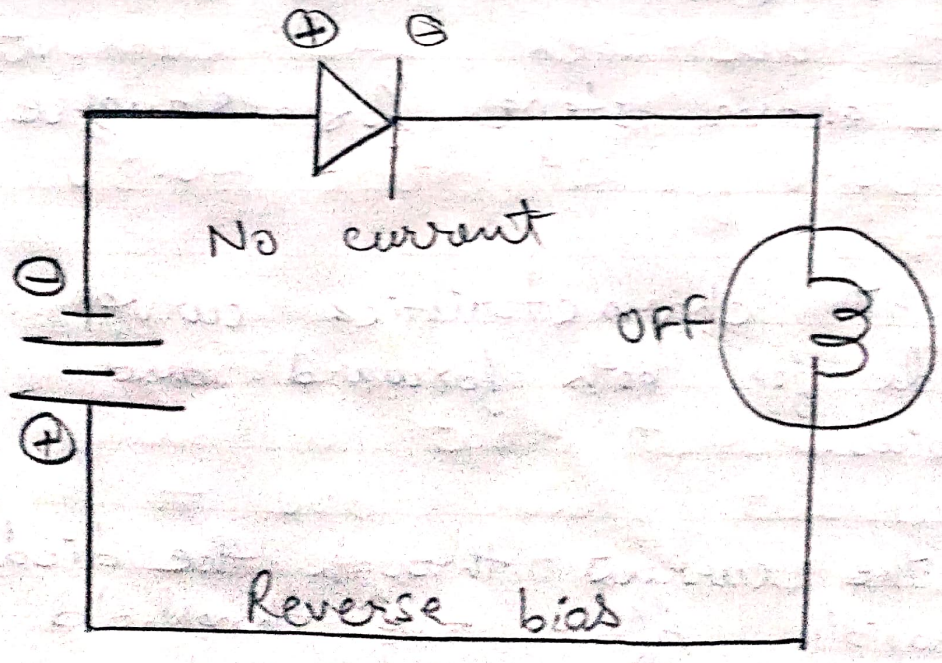
1. Connect the circuit for forward bias using the diode, power supply, 1000Ω resistance, milliammeter, and voltmeter.
2. Vary the input voltage in small steps and note the corresponding current through the diode.
3. Tabulate the readings of voltage (V) and current (I).
4. Repeat the above steps for reverse bias.
5. Plot the V-I characteristics curves of the diode for both forward and reverse bias.

Observation: The current through the diode increases rapidly after the threshold voltage in forward bias, while in reverse

forward bias :-



Reverse bias :-

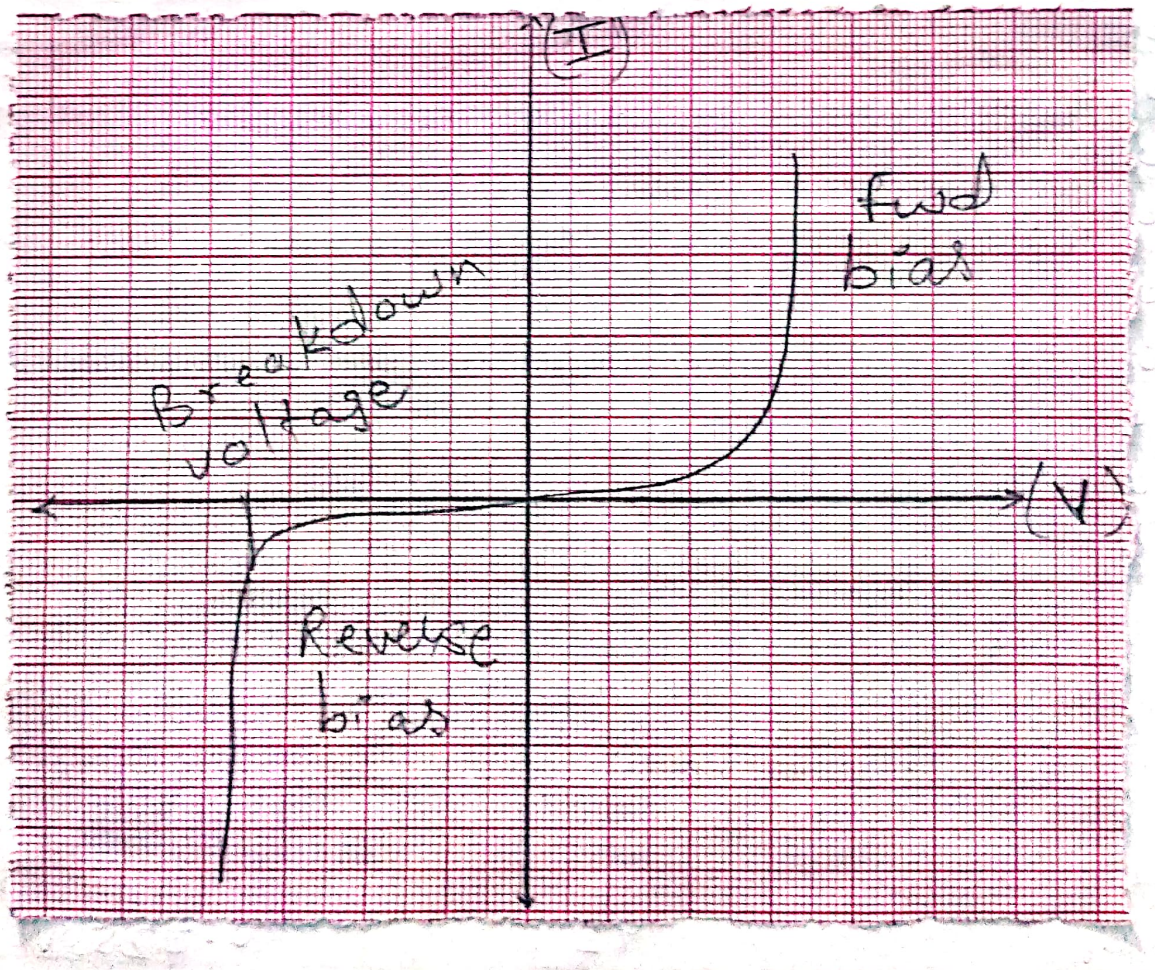


bias only a small leakage current flows.

observation Table :

- Foward bias :

Input Voltage	Current (mA)	Voutputs
0.1	0	0.011 V
0.2	0	0.013 V
0.3	0	0.015 V
0.4	0	0.015 V
0.5	0	0.514 V
0.6	2	0.616 V
0.7	7	0.657 V
0.8	18	0.681 V
0.9	25	0.690 V
1.0	32	0.697 V
1.1	40	0.703 V
1.2	52	0.709 V
1.3	68	0.715 V
1.4	80	0.719 V
1.5	84	0.721 V
1.6	92	0.725 V
1.7	100 +	0.726 V


(I)
Fwd bias
Breakdown voltage
(V)
Reverse bias

- Reverse bias:

Vinput	Current (μA)	Voutput
0	0	0
4.32	2	4.35
5.00	20	4.89
5.2	30	4.95
5.4	45	5.02
5.8	80	5.08
6.00	100	5.11
6.40	100	5.12

[constant]

Results:

- The forward characteristics curve of the diode shows conduction starts at ~0.7 V (for Si diode).
- In reverse bias, the current is very small until breakdown.

Precautions:

1. All connections should be tight and correct.
2. The voltage should be increased gradually to avoid damaging the diode
3. Milliammeter/Voltmeter should be connected with proper polarity.

4. The diode should not be heated excessively.

Conclusion :

The foward and reverse characteristic curves of the semiconductor diode were successfully drawn, and the threshdd voltage and leakage current were determined.

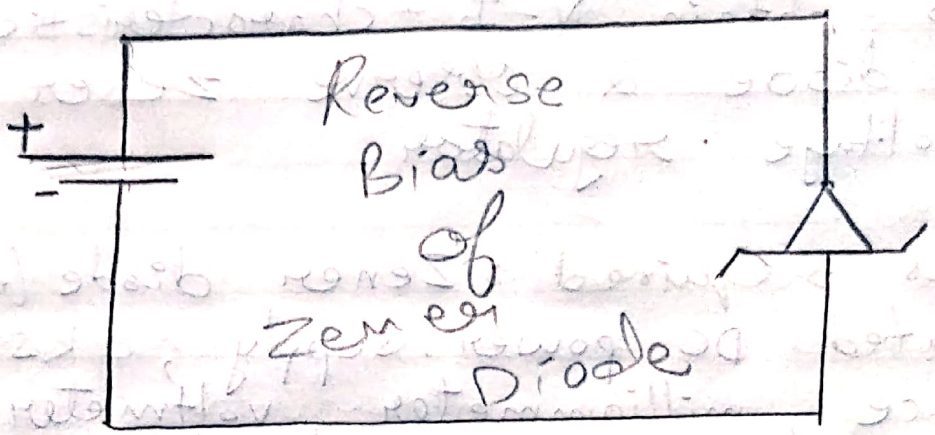
Aim: To obtain V-I characteristics of zener diode & observe zener as a voltage regulator.

Apparatus required: Zener diode (eg. 5.1V), regulated DC power supply, 1kΩ resistance, milliammeter, voltmeter, connecting wires.

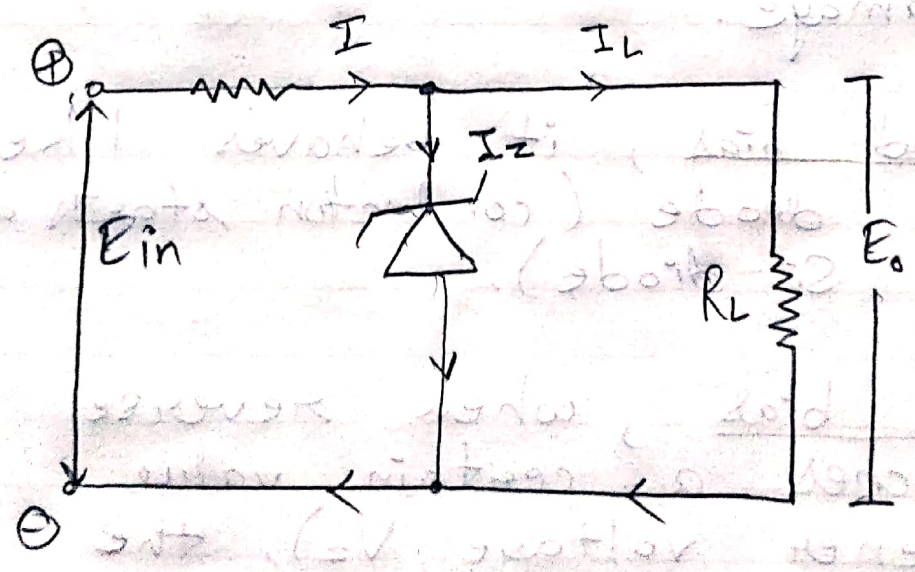
Theory:

- A zener diode is a specially designed diode that can operate in reverse breakdown region without damage.
- In forward bias, it behaves like a normal diode (conduction starts at ~0.7V for Si diode).
- In reverse bias, when reverse voltage reaches a certain value (called Zener voltage, V_z), the diode conducts heavily while keeping the voltage across it almost constant.
- This property is used in voltage regulation, where the zener diode maintains a nearly constant output voltage despite variations in input

• Zener diode -(Reverse Biased)



• Zener Diode - As Voltage Regulator



(Circuit Diagrame)

voltage or load resistance.

Procedure :

1. Connect the Zener diode circuit in forward bias using 1kΩ series resistor, ammeter, voltmeter, Vary input voltage and note diode current and voltage.

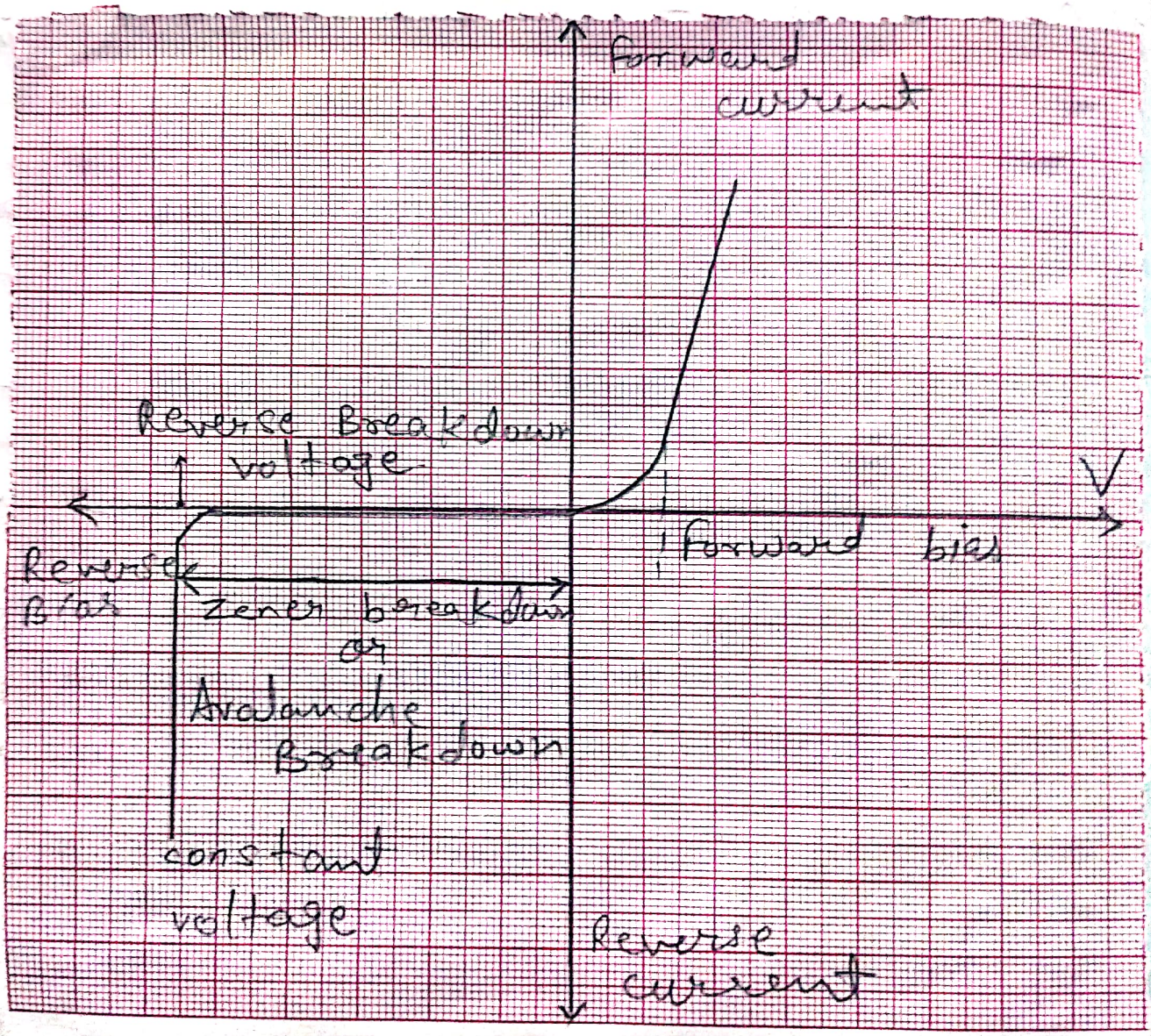
2. Reverse the diode connection (reverse bias) and increase input voltage slowly. Record current and voltage values.

3. Plot V-I characteristics for forward and reverse bias.

4. For voltage - regulator setup :-

- Connect zener diode in ~~diode in~~ reverse across the load.

- Vary the input voltage and observe that output across Zener remains nearly constant after Zener Voltage (V_z).



Zener Diode V-I Characteristic

Observation :

- In forward bias: Zener behaves like a normal diode, conduction starts near 0.7 V.
- In reverse bias: Current remains small until Zener voltage (V_Z) is reached, after which current rises sharply but voltage across diode stays nearly constant.

Results :

1. The forward bias characteristics of Zener diode are similar to a normal diode with threshold ~0.7V.
2. In reverse bias, the Zener breakdown voltage (V_Z) is obtained ($\approx$ 5.1V for given diode).
3. As a voltage regulator, Zener maintains nearly constant output voltage despite changes in input voltage.

Observation
Table

Precautions:

1. Connect ammeter in series and voltmeter across Zener correctly.
2. Do not exceed the rated Zener current (use series resistance)
3. Increase input voltage gradually in reverse bias.
4. Avoid loose connections.

Conclusion:

The V-I characteristics of Zener diode were successfully obtained. It was also verified that the Zener diode maintains a nearly constant voltage beyond the breakdown region, hence it can be used as a voltage regulator.