

Practical No.16 : Connect the Zener diode in the circuit and test its operation in forward and reverse bias mode.

I Practical Significance:

Zener diodes are widely used as voltage references and as shunt regulators to regulate the voltage across small circuits. The student will be able to plot the forward and reverse characteristics of the Zener diode and measure the Zener voltage

II Industry/Employer Expected Outcome(s):

Electrical and Electronic industries use different types of DC power supplies with different voltage and current ratings. Zener diode works as a voltage regulator in DC power supply. The Employee should be able to test Zener diode for its ratings.

III Course Level Learning Outcome(s):

Use relevant diode in different Electronic circuits.

IV Laboratory Learning Outcome(s):

LLO Check the forward and reverse VI characteristics of Zener diode.

V Relevant Affective Domain related outcome(s):

1. Handle components and equipment carefully.
2. Follow the safety precautions.

VI Relevant Theoretical Background (With diagrams if required):

Zener diode is formed by combining highly doped P and N semiconductor materials. It works on the principle of Zener breakdown and is normally operated in reverse breakdown region. In reverse breakdown region, high current flow through the diode leading to high power dissipation.

The Zener breakdown occurs when the electric field across the junction produced due to the reverse voltage is sufficiently high, this breaks covalent bonds. Thus a large numbers of carriers are generated which causes a more current to flow. This mechanism is called as Zener breakdown. After Zener breakdown the reverse current increases sharply but voltage across Zener diode remains constant. Zener resistance of a Zener diode is a ratio of reverse Zener voltage to the reverse Zener current.



Figure 1: Symbol of Zener diode

XI Required Resources/apparatus/equipment with specifications:

S. No	Instruments/Components	Suggested broad specification	Quantity
1	Zener Diode	IN 4735	1
2	Resistor	1K Ω	1
3	Digital Multimeter	digital multimeter	2

XII Actual procedure followed:

1. Switch ON the power supply
2. Record the forward voltage and forward current in the observation table no.
3. increase the input voltage in step of 0.1V.
4. plot the graph of for Reverse bias characteristics of zener diode by taking V_R on x-axis & I_R on y-axis

Table 1: Measurement of V_F and I_F

SR.NO	V_F (volt)	I_F (mA)
1	0	0
2	0.579	1.54
3	0.588	3.60
4	0.595	5.66
5	0.604	9.26
6	0.613	14.4
7	0.617	17.0
8	0.607	10.8
9	0.619	19.0

Table 2: Measurement of V_R and I_R

SR.NO	V_R (volt)	I_R (mA)
1	2.22	0.100
2	4.36	0.100
3	8.16	0.100
4	13.1	0.100
5	15.9	0.100
6	20.6	0.100
7	27.0	0.100
8		
9		

Calculations: $R_F = \Delta V_F / \Delta I_F$ ohm

$R_Z = \Delta V_R / \Delta I_R$ ohm

XIV Results:

1. Zener breakdown voltage = 0.6 V.
2. Zener resistance = 100 Ω

XV Interpretation of Results:

We have learn to connect the Zener diode in the circuit and test its operation in forward and reverse bias mode.

XVI Conclusions & Recommendations:

We have learn to connect the Zener diode in the circuit and test its operation in forward and reverse bias mode.

XVII Practical Related Questions:

1. What is the value of Zener voltage for given zener diode?
2. What is the maximum value of reverse current for given zener diode?
3. What is the effect on voltage across zener diode and current flowing through it, when reverse voltage across it is more than breakdown voltage?
4. What portion of zener diode characteristics is most useful for voltage regulation applications?

[Space for Answers]

Q.1 - - - - ?

→ 0.6 is the value of zener voltage for given zener diode.

Q.2 - - - - ?

→ 0.100 mA is the maximum value of reverse current for given zener diode.

Q.3 - - - - ?

→ Once the zener diode exceeds knee voltage, the voltage across the load will become constant and the junction experiences a breakdown, allowing current to flow in the opposite direction.

Q.4 - - - - ?

→ The important portion is the reverse breakdown voltage which ensures that the voltage across the diode in the reverse direction is almost constant despite large variations of current.

