

EXPERIMENT 2: ZENER DIODE

AIM: Obtain IV Characteristics of zener diode & also observe zener as a voltage regulator. Calculate its load & line regulation.

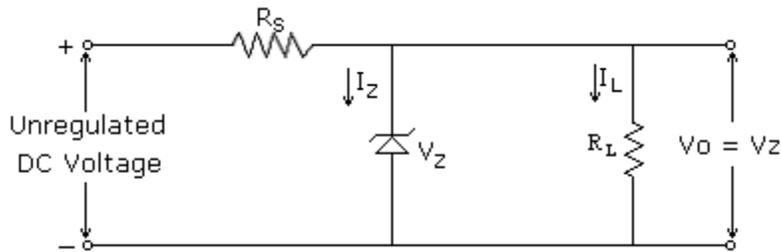
APPARATUS: Zener diode , Bread board, Resistor (1K ohm), Connecting wires, Ammeters (0-10mA, 0-100 μ A), DC power supply (0-30V), 10 K ohm pot , multimeter.

THEORY: Zener diode is a special diode with increased amounts of doping. This is to compensate for the damage that occurs in the case of a *pn* junction diode when the reverse bias exceeds the breakdown voltage and thereby current increases at a rapid rate. Applying a positive potential to the anode and a negative potential to the cathode of the zener diode establishes a forward bias condition. The forward characteristic of the zener diode is same as that of a *pn* junction diode i.e. as the applied potential increases, the current increases exponentially. Applying a negative potential to the anode and positive potential to the cathode reverse biases the zener diode.

When reverse bias increases the current increases rapidly in a direction opposite to that of the positive voltage region. Thus under reverse bias condition breakdown occurs. It occurs because there is a strong electric field in the region of the junction that can disrupt the bonding forces within the atom and generate carriers. The breakdown voltage depends upon the amount of doping. For a heavily doped diode depletion layer will be thin and breakdown occurs at low reverse voltage and the breakdown voltage is sharp, whereas a lightly doped diode has a higher breakdown voltage. This explains the zener diode characteristics in the reverse bias region. The maximum reverse bias potential that can be applied before entering the zener region is called the Peak Inverse Voltage referred to as PIV rating or the Peak Reverse Voltage Rating (PRV rating).

VOLTAGE REGULATOR

Voltage regulator is nothing but an electronic ckt which keeps o/p voltage constant irrespective of changes in line voltage & load current.

**Operation:-**

The I/p voltage V_{in} is from the o/p of unregulated power supply. R_s is a series resistor used to control the current. The I/p voltage should be greater than V_z , then only zener diode will work in zener region.

If V_{in} is higher than V_z the current through Zener diode increases & $I_L \downarrow$ we will get constant o/p voltage. If I_L changes, then I_z changes in such a way that at the o/p we get constant dc voltage.

OBSERVATION:

Forward Biased

Sr. No.	Supply Voltage (V)	V_D (V)	V_R (V)	I_D (mA)
	0.1			
	0.2			
	.			
	.			
	.			
	1			
	1.5			
	2			
	2.5			
	.			
	.			
	10			

Reversed Biased

Sr. No.	Supply Voltage (V)	V_D (V)	V_R (V)	I_D (mA)
	1			
	2			
	.			
	.			
	.			
	10			

Line Regulation:Take $R_L=1K\Omega$

Vin	Vout
1	
2	
.	
.	
.	
15	

Load Regulation:Set $V_{in}=10V$

R_L	Vout
1K	
2K	
.	
.	
.	
10K	

PROCEDURE:**A) V.I. Characteristics of Zener Diode**

- 1) Identify the components required and make the connections on bread board as per circuit diagram.
- 2) Connect the circuit diagram for diode in forward biasing mode.
- 3) Switch on the power supply and increase applied voltage gradually.
- 4) Note down voltmeter and ammeter readings.
- 5) Repeat steps 2 to 4 for reverse bias mode.
- 7) Tabulate the observations and plot the graphs for zener diode separately.
- 8) From your observations obtain the V_Z .

B) Zener diode as voltage regulator & find its line regulation

- 1) Identify the components required and make the connections on bread board as per circuit diagram.
- 2) Note down the no load voltage of circuit.
- 3) Vary V_{in} in steps of 1V & tabulate voltmeter and ammeter reading
- 4) Plot the graphs for V_{in} Vs V_L & Find % line regulation

C) Zener diode as voltage regulator & find its load regulation

- 1) Identify the components required and make the connections on bread board as per circuit diagram.
- 2) Note down the no load voltage of circuit.
- 3) Vary R_L in steps of 1K Ω & tabulate voltmeter and ammeter reading
- 4) Plot the graphs for V_L Vs I_L & Find % load regulation.

CALCULATION:

Cut in voltage = V

Break down voltage = ----- (v)

% line regulation = $[(V_2 - V_1) / V_2] * 100 = \text{-----}\%$

% load regulation = $[(V_{NL} - V_{FL}) / V_{NL}] * 100 = \text{-----}\%$

RESULT:

Cut in voltage = V

Break down voltage = ----- (v)

% line regulation = -----%

% load regulation = -----%

CONCLUSION: