

Ex. No. 8	ZENER VOLTAGE REGULATOR
Date:	

AIM

To design a DC shunt voltage regulator circuit to provide a constant 5V stabilized power supply from an unregulated power source.

APPARATUS REQUIRED

Sl. No.	Apparatus	Range	Quantity
1.	Zener Diode	5 V	1
2.	Regulated power supply	(0-30)V	1
3.	Decade resistance box		1
4.	Voltmeter	(0-10)V	1
5.	Connecting wires		Few

THEORY

Shunt voltage regulator

One of the simple Linear Power Supply is the Zener Shunt regulator. This type of regulator is typically used for very low voltage regulation for less than 200mW of a load. A series resistance(R) is placed between a higher voltage (V_{in}) and it is used to limit the current to the load and Zener diode. The Zener diode compensates for the variation in load current.

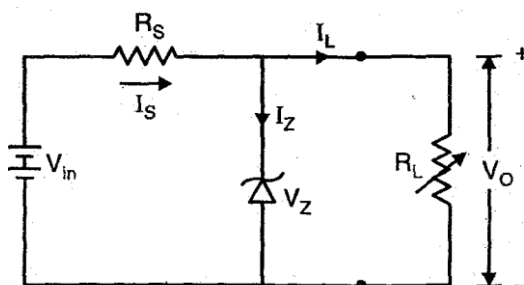
Design:

The Zener requires a current limiting resistor in series to it to restrict the current flow through the Zener. Also for proper operation of this circuit the voltage across the input of the regulator circuit must be greater than the voltage across the output. The equation of the circuit is given below.

- $V_{in} = (I_z + I_L)R_s + V_o$ (or)
- $V_{in} = (I_z + I_L)R_s + V_z$

Where

- V_{in} is the input voltage
- I_z – Zener current
- I_L – Load current
- R_s – Series resistance
- V_z – Zener voltage
- V_o – Output voltage



Basically, there are two type of regulations such as:

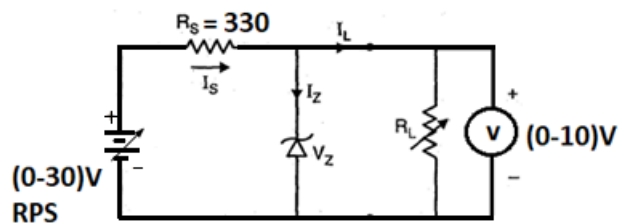
- a. **Line Regulation:** In this type of regulation, series resistance and load resistance are fixed, only input voltage is changing. Output voltage remains the same as long as the input voltage is maintained above a minimum value.

$$\text{Percentage of Line regulation} = \left[\frac{\Delta V_L}{\Delta V_{in}} \right] \times 100$$

- b. **Load Regulation:** In this type of regulation, input voltage is fixed and the load resistance is varying. Output voltage remains same, as long as the load resistance is maintained above a minimum value.

$$\text{Percentage of Load regulation} = \left[\frac{V_{NL} - V_{FL}}{V_{NL}} \right] \times 100$$

CIRCUIT DIAGRAM



Observation Table

a. Line regulation

1. Choose the Zener diode (number....) and connect the circuit as shown in Fig above.
2. Vary the supply voltage from in steps of 1 volt from (0- 15) volts.
3. Note down the corresponding input voltage and output voltage and tabulate it.
4. Plot the graph between V_{in} and V_L taking V_{in} on x-axis V_L on y-axis.

Trial No	V_{in} , in Volt	V_L , in Volt
1		
2		
3		
4		
5		
6		

a. Load Regulation

1. Connections are given as per the circuit diagram.
2. Fix the supply voltage at 15 V.
3. Without connecting the load R_L , note down the No-load voltage (V_{NL}).
4. Change the load Resistance with the interval of $1k\Omega$ from $1k\Omega$ - $10k\Omega$ up to maximum range.
5. Note the reading and tabulate it.
6. Plot the graph between V_L along x-axis and R_L along y-axis.

Trial No	R_L in Ohms	V_L , in Volt
1		
2		
3		
4		
5		
6		

MODEL GRAPH

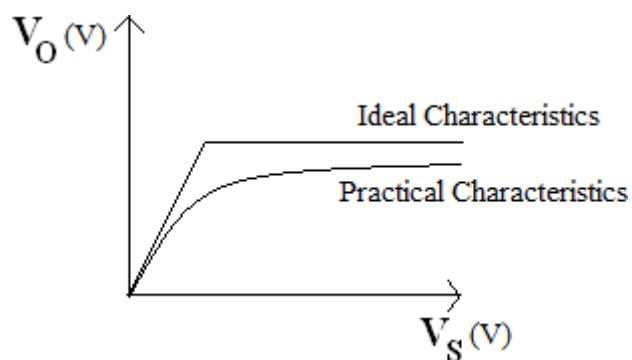


Fig.2 Line regulation

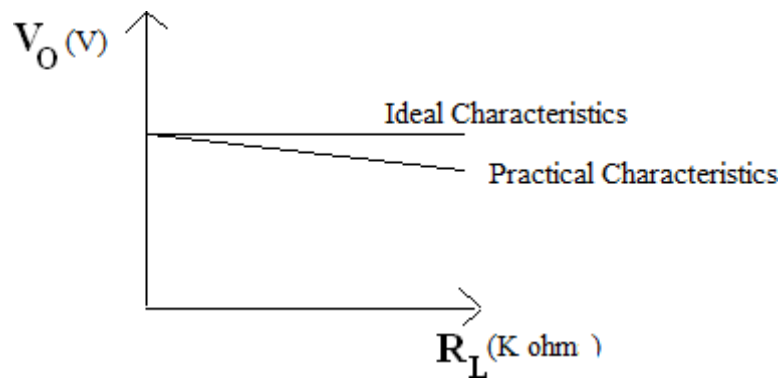


Fig. 3 Load regulation

RESULT

Thus, the Zener diode as a voltage regulator is designed to provide a stabilized output voltage and the circuit is analysed for the line regulation and load regulation.