LAB #05

Objectives

1. To study the characteristics of Zener diode.
2. To study the voltage regulation in Zener diode regulation circuit.

Theory

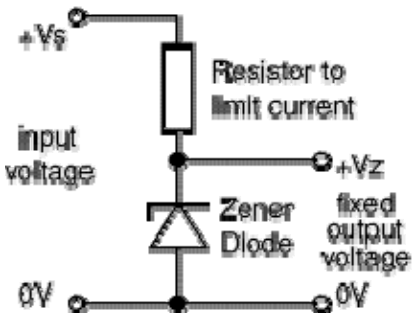
Zener diodes are used to maintain a fixed voltage. They are designed to 'breakdown' in a reliable and non-destructive way so that they can be used **in reverse** to maintain a fixed voltage across their terminals.

Example: 

a = anode, k = cathode

Circuit symbol: 

The diagram shows how they are connected, with a resistor in series to limit the current. Zener diodes can be distinguished from ordinary diodes by their code and breakdown voltage which are printed on them. Zener diode codes begin BZX... or BZY... Their breakdown voltage is printed with V in place of a decimal point, so 4V7 means 4.7V for example.



Zener diodes are rated by their breakdown voltage and maximum power:

- The minimum voltage available is 2.4V.
- Power ratings of 400mW and 1.3W are common.

Preparatory Exercise

Q1) How does the way zener diodes are connected in a circuit differ from conventional diodes?

_____

_____

_____

_____

Q2) What is zener breakdown?

_____

_____

_____
_____

Q3) Mention any one application of zener diode.

_____
_____
_____

Q4) What is the breakdown voltage of zener diode?

_____
_____
_____

Q5) What is the basic principle of zener diode?

_____
_____
_____
_____

Requirement

Instruments

1. DC power supply
2. Function Generator
3. Digital Multimeter (DMM)

Components

1. Diode : Zener (10-V)
2. Resistors: 0.1kΩ, 1kΩ(2 pcs), 3.3kΩ

Procedure

Part A: Zener Diode Characteristics

1. Construct the circuit of *Fig. 5.1*. Set the DC supply to 0 V and record the measured value of R.

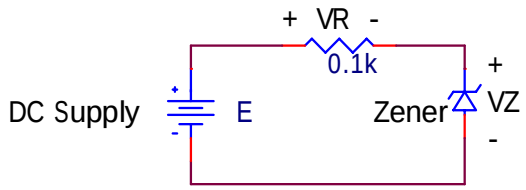


Fig. 5.1

2. Set the DC supply (E) to the values appearing in Table 5.1 and measure both V_Z and V_R. Calculate the Zener current, I_Z using the Ohm's law given in the table and complete the table.
3. Plot I_Z versus V_Z using the data in Table 5.1 on a graph paper.

Part B: Zener Diode Regulation

1. Construct the circuit of *Fig. 5.2*. Record the measured value of each resistor.

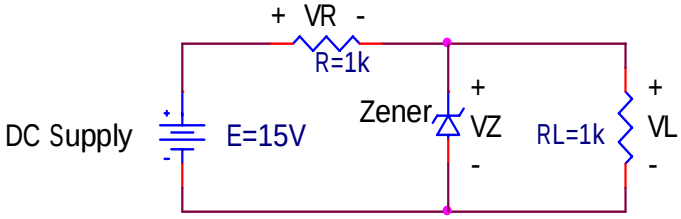


Fig. 5.2

2. Measure the value of V_L and V_R. Using the measured values, calculate the value for current across R, I_R, current across R_L, I_L, and current across the zener diode, I_Z.
3. Change R_L to 3.3 kΩ and repeat Step 2.
4. Comment on the results obtained in Steps 2 and 3.

Observation

Results and Calculations

Part A: Zener Diode Characteristics

1. R (measured) = _____

2.

E (V)	0	1	3	5	7	9	11	13	15
V_Z (V)									
V_R (V)									
$I_Z = V_R / R_{meas}$ (mA)									

Table 5.1

Part B: Zener Diode Regulation

1. R (measured) = _____, R_L (measured) = _____
2. V_R (measured) = _____, V_L (measured) = _____

   $I_R = V_R / R$ = _____, $I_L = V_L / R_L$ = _____,

   $I_Z = I_R - I_L$ = _____

3. Change R_L to 3.3kΩ;

   R_L (measured) = _____,

   V_R (measured) = _____, V_L (measured) = _____

   $I_R = V_R / R$ = _____, $I_L = V_L / R_L$ = _____,

   $I_Z = I_R - I_L$ = _____