East West University
Department of Computer Science and Engineering

Course: CSE251 Electronic Circuits
Expt No: 03
Title: Study of Zener Diode.

Objectives:
1. To measure the I-V characteristics of Zener diode.
2. To determine the voltage regulation for variable resistance and variable supply voltage.

Introduction:
The diodes we have studied before do not operate in the breakdown region because this may damage them. A *Zener diode* is different; it is a silicon diode that the manufacturer has optimized for operation in the breakdown region. It is used to build voltage regulator circuits that hold the load voltage almost constant despite large change in line voltage and load resistance. Figure shows the symbol of the Zener diode.

Fig.1: Symbol of Zener diode

The Zener diode may have a breakdown voltage from about 2 to 200 V. These diodes can operate in any of the three regions: forward, leakage and breakdown. Figure shows the 1-V graph of Zener diode.

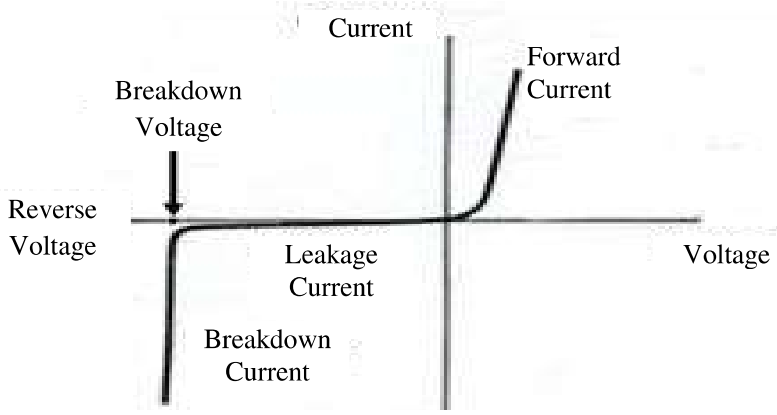
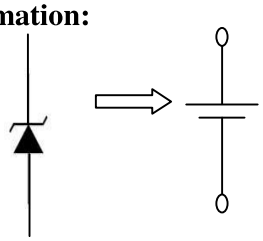


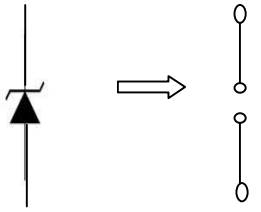
Fig. 2: I-V characteristic curve

- In the forward region it works as an ordinary diode.
- In the leakage region (between zero and breakdown) it has only a small reverse saturation current.
- In the breakdown it has a sharp knee, followed by an almost vertical increase in current
  without changing the voltage.
- The voltage is almost constant, approximately equal to V_z over most of the breakdown region.

Approximation:



"On" $[V \geq V_z]$



"Off" $[V_z > V > 0]$

Pre-Lab Report:

1. Draw the I-V characteristic of Fig. 3 (circuit with no load)and
2. calculate V_L, V_R, I_Z for 10 V supply voltage.
3. Consider $R_L = 220\ \Omega$ and write down the condition for conduction.
4. Calculate R_{Lmin}, R_{Lmax}, I_{Lmin} for I_{Lmax} for I_{zmax}= 7.2mA and 10 V supply voltage in Fig. 4.
5. Calculate $V_{i\ min}$, and $V_{i\ max}$ for I_{zmax}= 7.2mA of Fig. 5.

Equipments:

1. Zener diode (6.2 volt)
2. Resistance (220 Ω, 470 Ω, 1 kΩ)
3. POT 10 kΩ
4. DC Power supply
5. Bread board
6. Multimeter.
7. Ammeter.

Experimental Setup:

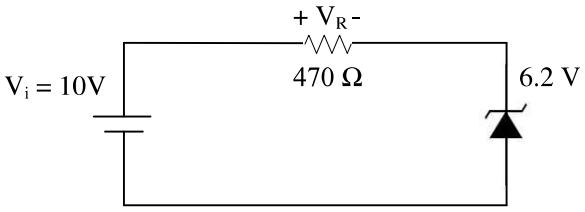


Fig. 3: Circuit with No Load

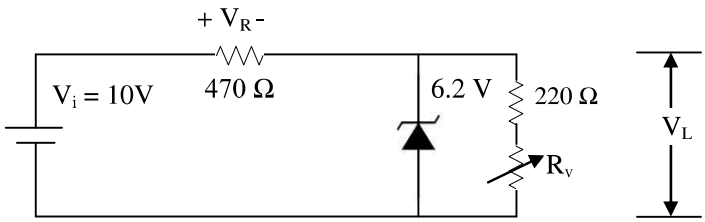


Fig. 4: Circuit with variable load

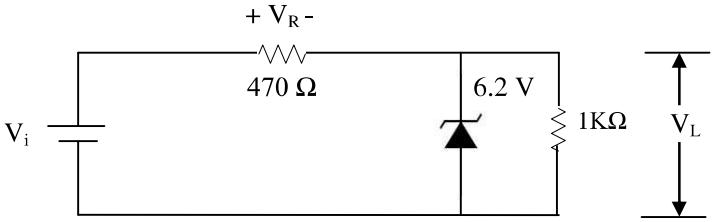


Fig. 5: Circuit with variable supply voltage.

Procedure:

1. Connect the circuit as shown in the Figure 3.
2. Vary the supply voltage from zero to 10 volts and complete Table 1.
3. Now, connect the circuit as shown in figure 4.
4. Keep the POT (variable resistance R_v) at its maximum value which you have calculated from pre lab.

5. Gradually decrease the POT resistance upto minimum R_v which you have calculated from pre lab , next calculate I_L by ohm's law.
6. complete the Table 2.
7. Replace load with 1 kΩ resistance, vary the supply voltage V_i and complete table 3.

V_i (Volt)	V_R (Volt)	V_z (Volt)	$I_z = V_R/R$ (mA)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Table 1: Data for I-V characteristics

Vi (Volt) =10V	V_L(Volt)	I_L(Amp)

Table 2: Data for regulation due to load variation

V_i (Volt)	V_L(Volt)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Table 3: Data for regulation due to supply voltage variation

Post Lab Report Questions:

1. Plot the I-V characteristics of the Zener diode. Determine the Zener breakdown voltage from the plot.
2. Plot I_L Vs V_L for the data of table-2. Find the load regulation and compare it with the pre-lab data.
3. Plot V_L Vs V for the data of table 3. Find the line regulation compare it with the pre-lab data.