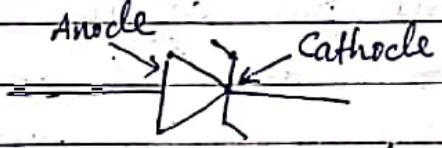
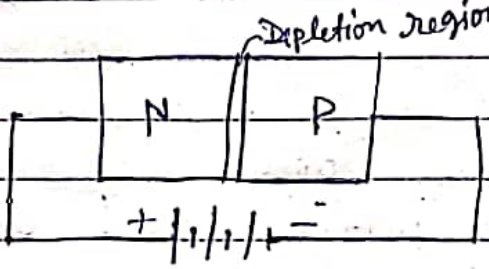
* Zener Diode :-

It is a special purpose diode, used for operation in reverse biasing, Sometimes it is also known as Breakdown Diode
The symbol of zener diod is given as

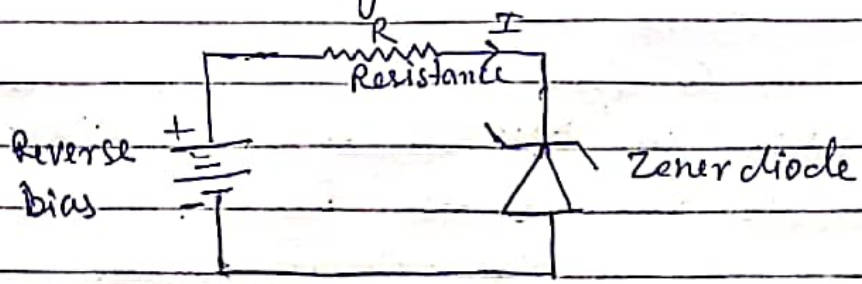


working :-



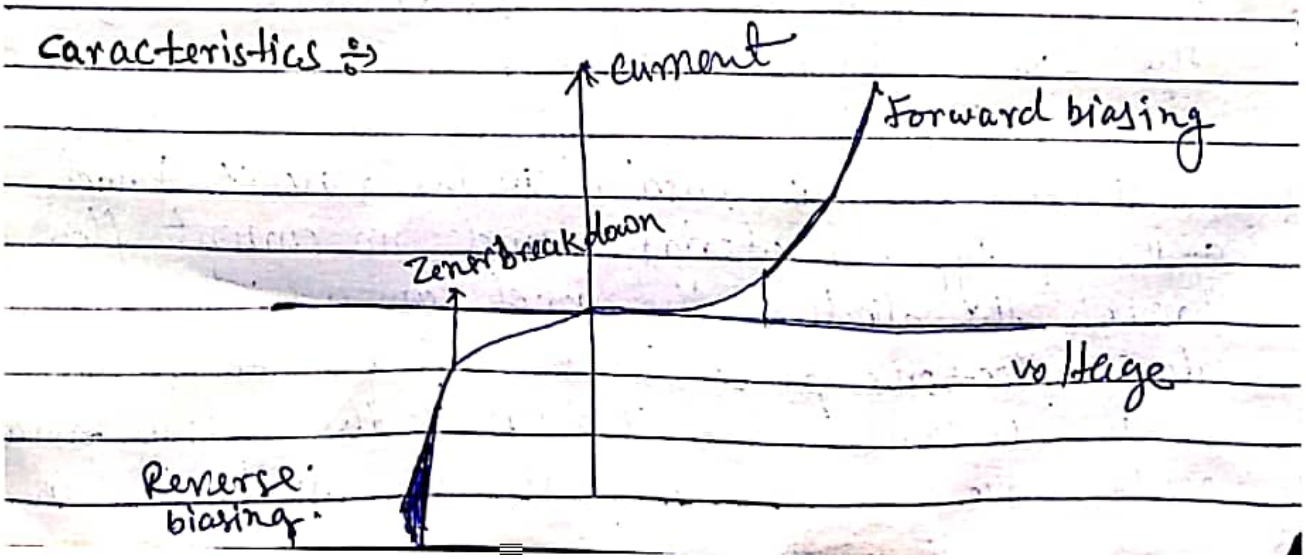
The zener diode is madeup of heavily doped semiconductor material. The heavily doped means the high level impurities is added to the material for making it more conductive.
The depletion region of the zener diode is very thin because of the impurities. The heavily doped material increase the intensity of the electric field across the depletion region of the zener diode even for the small reverse voltage.
When no biasing is applied across the zener diode, the electrons remain in the valence band of the p-type material and no current flow through the diode. The band in which the valence electrons place is known as valence band electrons. The electrons of the valence band easily move from one band to another when

the external energy is applied across it.



When the reverse bias applies across the diode and the supply voltage is equal to the zener voltage then it starts conducting in the reverse bias direction. The zener voltage is the voltage at which the depletion region completely vanish. The reverse bias applies across the diode increase the intensity of electric field across the depletion region. Thus, it allows the electrons to move from the valence band of P-type material to the conduction band of N-type material. This transfering of valence band electrons to the conduction band reduces the barrier between the P-type and N-type material. When the depletion region becomes Completely vanish the diode starts conducting in the reverse biased.

Caracteristics :-



The V-I characteristics of zener diod are shown in the above figure, this curve shows that the zener diode, when connected in forward bias behaves like an ordinary diode. But when the reverse voltage is applied across it and the reverse voltage rises beyond the predetermined rating, the zener breakdown occurs in the diode.

At zener breakdown voltage the current starts flowing in the reverse direction. The graph of the zener breakdown is not exactly vertical which shows that the zener diode has resistance. The voltage across the zener is represented by the equation

$$V = V_z + I_z R_z$$

Applications :-

① As voltage Stabilizer – The zener diode is used for regulating the voltage. It provides the constant voltage from the fluctuating voltage source to the load. The zener diode is connected in parallel across the load and maintain the constant voltage V_z and hence stabilises the voltage.

② For wave shaping – The zener diode is used for converting the sine wave into the square wave. This can be done by placing the two zener diodes in series with the resistance. The diode is connected back to back and in the opposite direction.

When the voltage applied across the terminal is

Less than the zener voltage the diodes offer a high resistive path to the current and the input voltage applied across a diode appeared at the output terminal. When the voltage rises beyond the zener voltage they offer a low resistance path and large current flow through the diode Due to which the heavy voltage drop occurs across the resistance and the input wave cut off at the peak. Thus the square wave appears across the output terminal.

(3) For meter protection :- The zener diode is generally used in multimeters for controlling the movement of the meter against accidental overload. It is connected parallel with the diode. When the over load occurs across the diode most of the current pass through the diode. Thus, protects the meter from damage.