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18/EIUG-06/045

Mechanical Eng

Zener diode Assignment

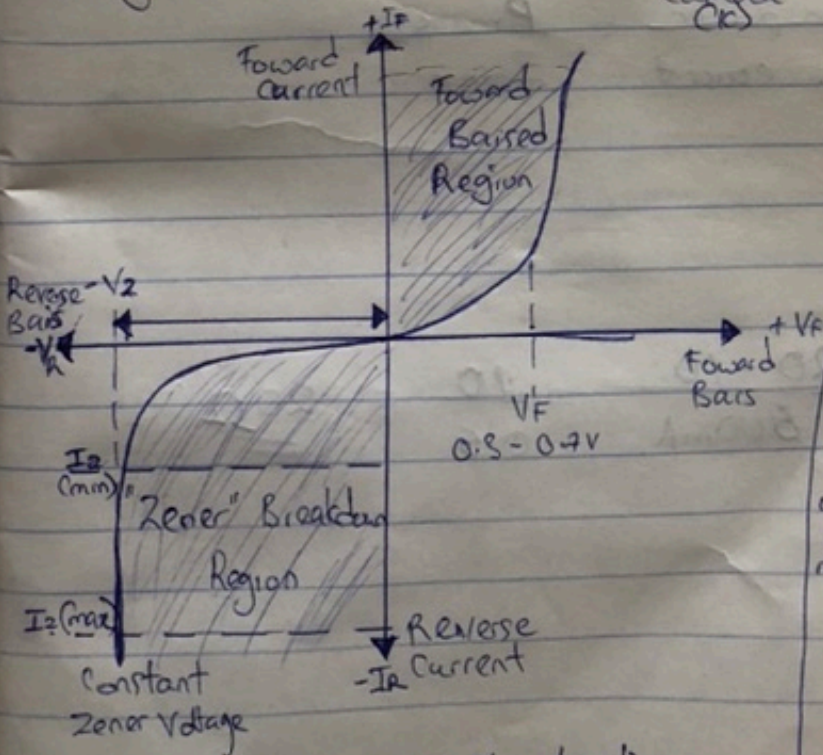
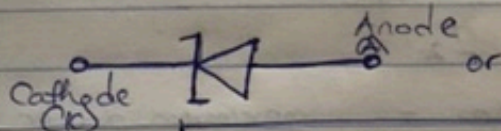
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- i) Describe a zener diode regulator and
- ii) Sketch the symbol and  $I-V$  characteristics curve
- iii) sketch and label circuit

Answer

i) A zener diode regulator is a semiconductor diode which blocks current in the reverse direction, but will suffer from premature breakdown or damage if the reverse voltage applied across becomes too high. The zener diode behaves like a normal general purpose diode consisting of a silicon PN junction and when biased in the forward direction, that is Anode ~~diode~~ positive with respect to its cathode, it behaves just like a normal signal diode passing the rated current.

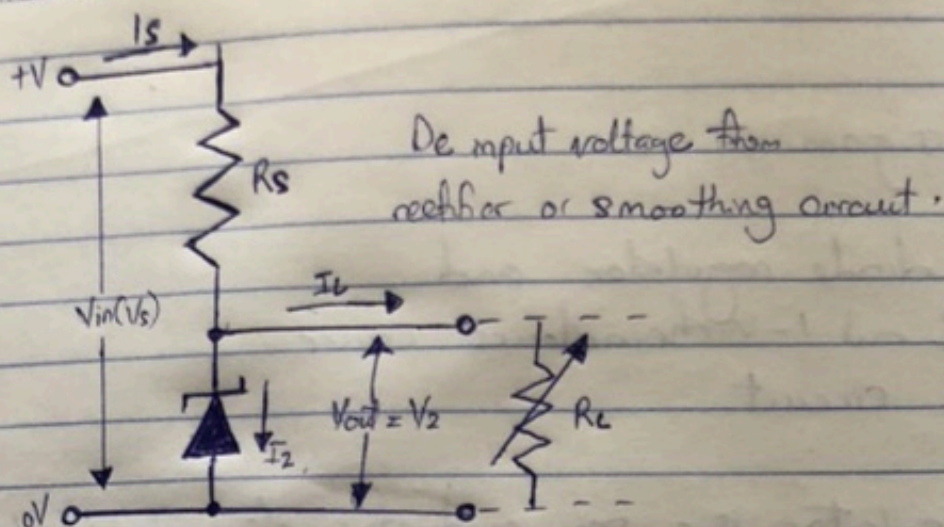
ii) Symbol of Zener diode



Zener diode can be used to produce a established voltage output with a low ripple under varying load current conditions. By passing a small current through the diode from a voltage source, via suitable current limiting resistor ( $R_s$ ), the zener will conduct sufficient current to maintain a voltage drop of  $V_{zst}$ .

Zener diode  $I-V$  Characteristics

i) Circuit of a Zener diode regulator.



A 5W maximum rated zener diode has 500mA maximum current flowing through it. If a 20V max bridge rectifier circuit is connected as input to the regulatory circuit. calculate:

i) The minimum value of the series resistor to the zener diode

Soln

$$\therefore R_s = \frac{V_s - V_z}{I_z}$$

$$\therefore \text{maximum voltage} = \frac{\text{maximum power}}{\text{maximum current}} = \frac{P_{max}}{I_{max}} =$$

$$P_{max} = 5W$$

$$I_{max} = 500mA = 0.5A$$

$$V_{max} = \frac{5}{0.5} = \underline{10V}$$

$$\therefore R_s = \frac{V_s - V_z}{I_z} = \frac{20 - 10}{500mA} = \frac{10}{0.5} = \underline{20\Omega}$$

$$\therefore R_s = 20\Omega$$

The current across the diode at full load of  $500\Omega$

$$\therefore I_L = \frac{V_Z}{R_L} = \frac{10V}{500\Omega} = 0.02A = \underline{20mA}$$

$\therefore$  The zener current at full load

$$\begin{aligned} I_Z &= I_S - I_L \\ &= 500mA + 20mA \\ I_Z &= \underline{480mA} \end{aligned}$$

Signed by Chandra (18/E10206/045) 