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18/ENG06/015

MECHANICAL ENGINEERING

ENG 222

1) Describe a zener diode

A zener diode voltage regulator consists of a current limiting resistor Rs connected in series with the input voltage Vs with the zener diode RL in the reversed biased condition.

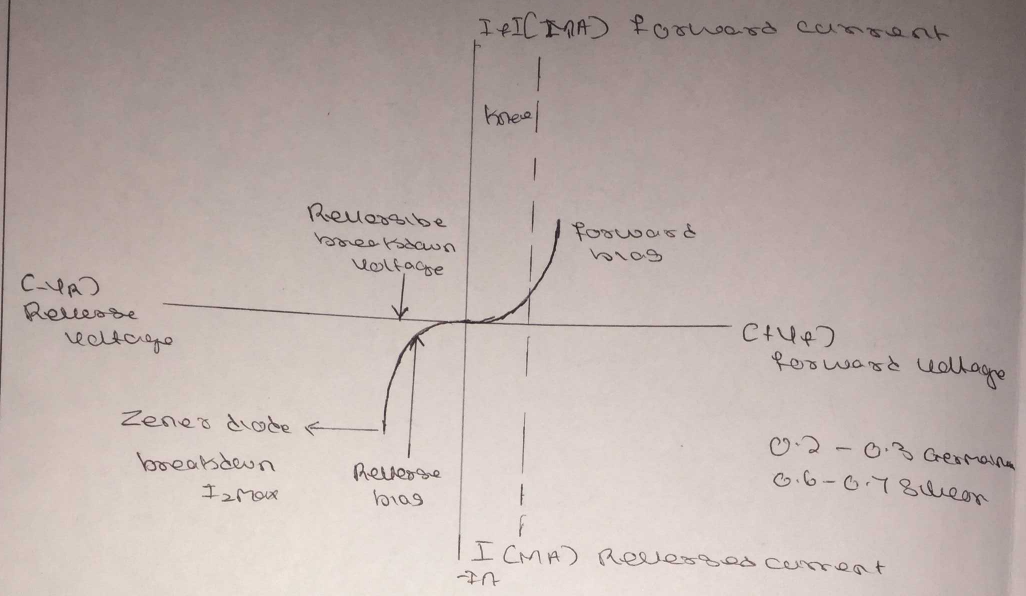
The function of the regulator is to provide a constant output voltage to a load connected in parallel with it in spite of the ripples in the supply voltage or the load current and the zener diode will continue to regulate the voltage until the diode current falls below the minimum $I_Z(min)$ values the reverse breakdown region.

There are two types of the regulator these are

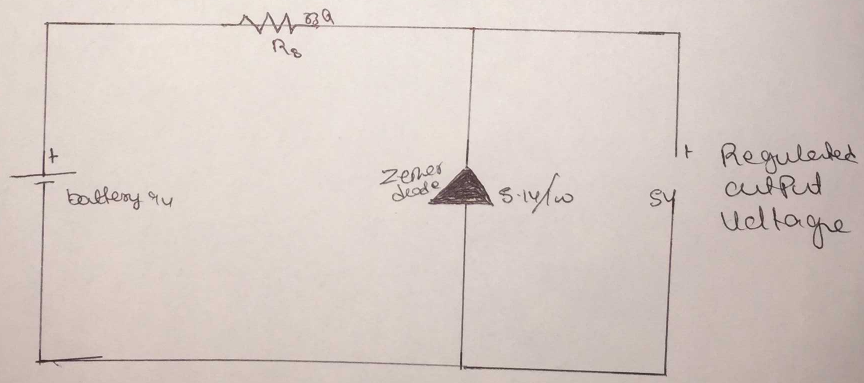
1) Regulation

2) Load Regulation.

I-V Characteristic Curve.



(iii) Zener diode regulator circuit



ii) Since it's connected in series with same current flow

$$I_S = I_Z + I_L$$

$$I_Z = I_S - I_L$$

$$I_L = \frac{V_Z}{R}$$

$$= \frac{10V}{500\Omega}$$

$$= 0.02A$$

$$= 20mA$$

$$I_Z = 500mA - 20mA$$

$$= 480mA$$

$$= 0.48A$$

2.) A 5W maximum rated Zener diode has 500mA maximum current flowing through it. If a 20Vmax bridge rectifier circuit is connected as input to the regulator circuit.

Solution

1.) The minimum value of the series resistor to the zener diode

$5W = P_Z$

Current = 500mA I_Z

20Vmax

Vmax to V_{DC},

$V_{DC} = \frac{2V_{max}}{\pi}$

$V_S = \frac{2 \times 20}{\pi} = 12.744V_{DC}$

$P = IV$

$\therefore V_Z = P_Z = \frac{5}{500 \times 10^{-3}}$

$V_Z = 10V$

Recalling $V_Z + V_R = V_S$

$V_R = V_S - V_Z$

$\frac{2 \times 20}{\pi} - 10$

$= 12.74 - 10$

$= 2.744$

$\therefore V = IR$

$R = \frac{V}{I} = \frac{2.74}{500 \times 10^{-3}}$

$R = 5.48\Omega$