ii) $P_Z = 5W$

$I_Z = 500mA$

$20V_{max}$

Convert V_{max} to V_{DC}

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

$$V_S = \frac{2 \times 20}{\pi} = 12.73V\,DC$$

Recall that $P = IV$

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

Recall that $V_Z + V_R = V_S$

$$V_R = V_S - V_Z$$

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

$$= 12.73 - 10 = 2.73V$$

$\therefore V = IR$

$$R = \frac{V}{I} = \frac{2.73}{500 \times 10^{-3}}$$

$$R = 5.46$$

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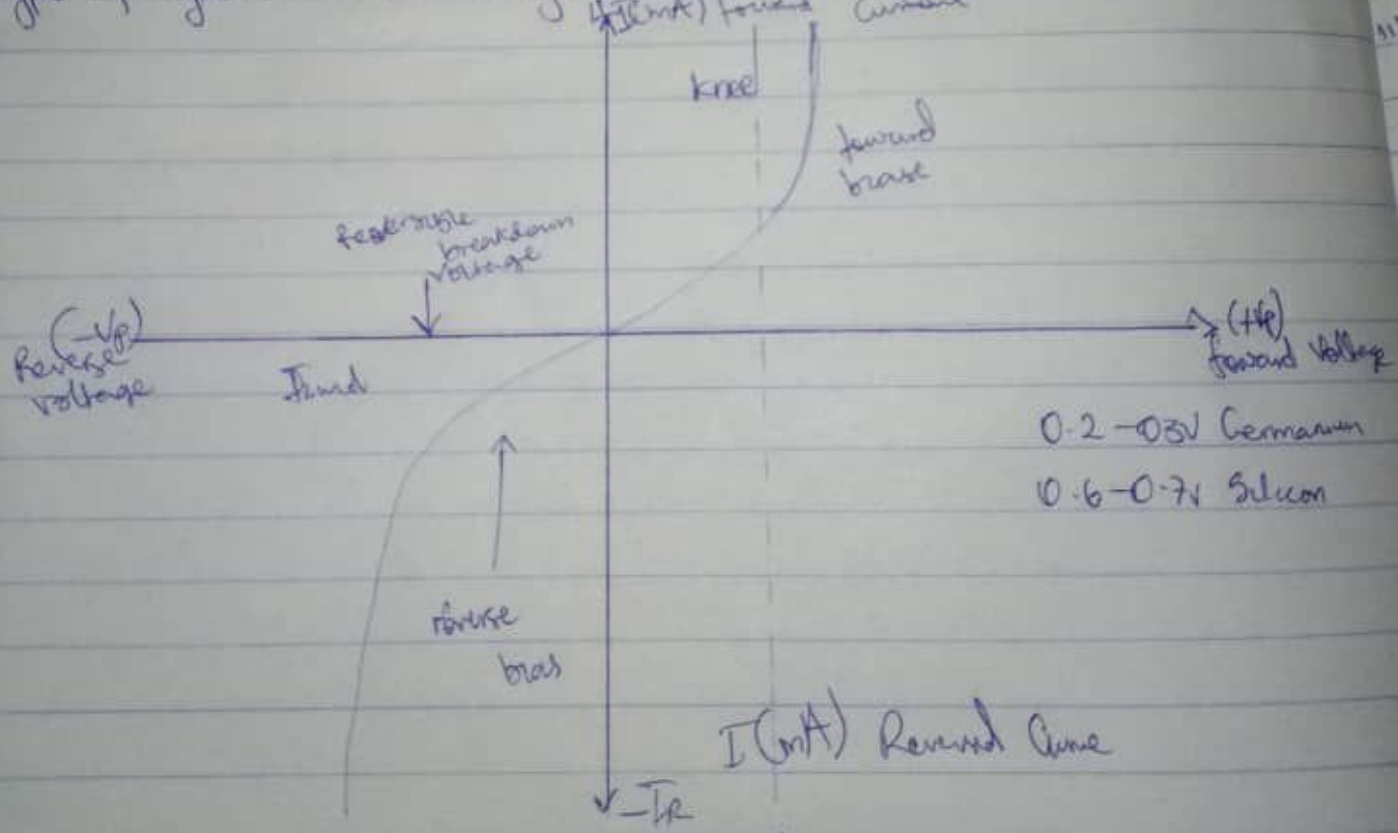
1) Describe a Zener diode regulator, and
ii) Sketch the symbol and I-V characteristics curve
iii) Sketch and label the circuit diagram

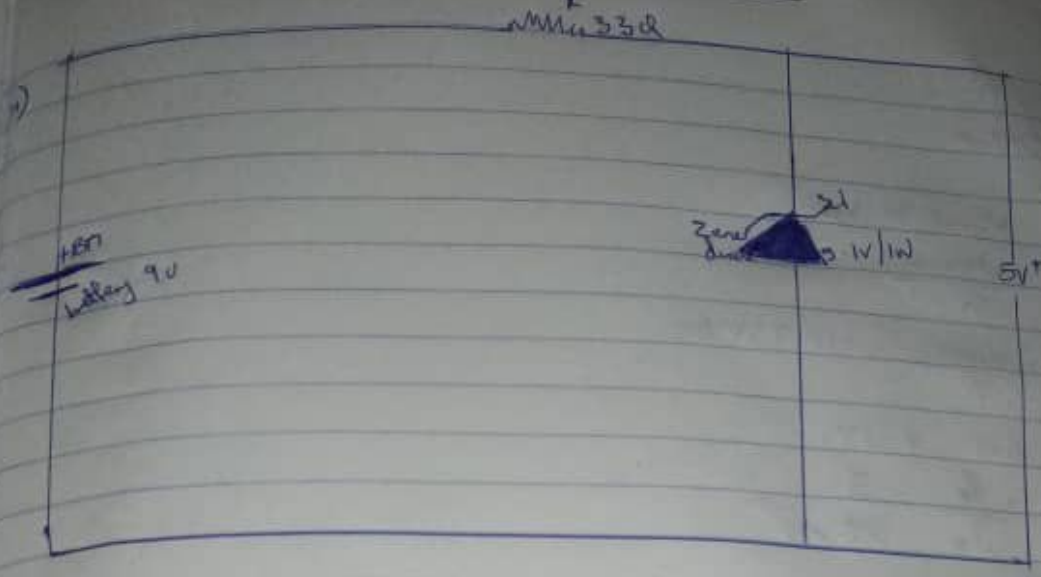
Answer

i) Zener diode voltage regulator consist of a current limiting resistor R_s connected in series with the input voltage V_i with the Zener diode R_L in the reversed biased condition. The stabilised output voltage is always selected to be the same as the breakdown voltage V_z of the diode. The function of a regulator is to provide a constant output voltage to a load connected in parallel with it in spites of the ripples in the supply voltage or the variation in the load current and the zener diode will continue to regulate the voltage until the diodes current falls below the minimum $I_{z(min)}$ value in the reversed breakdown region. There are two types of regulator such as line regulation and load regulation



I - V characteristics Curve

Zener diode Regulator Circuit



A 5V Maximum rated Zener diode has 500mA maximum current flowing through it if a 20V max bridge rectifier circuit is connected as input to the regulator circuit. Calculate:

i) The minimum value of the series resistor to the Zener diode
ii) The current across the diode at full load of 50Ω

Solution

i) Since the circuit is constructed in series, which means the same current flows

Therefore,

$$I_S = I_Z + I_L$$

$$I_Z = I_S - I_L$$

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

$$= \frac{10V}{500\Omega} = 0.02A = 20mA$$

$$I_Z = 500mA - 20mA$$

$$= 480mA = 0.48A$$