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MAT NO: 18/ENG01/014
COURSE: BASIC ELECT ASSIGNMENT

Q) Describe a zener diode regulator

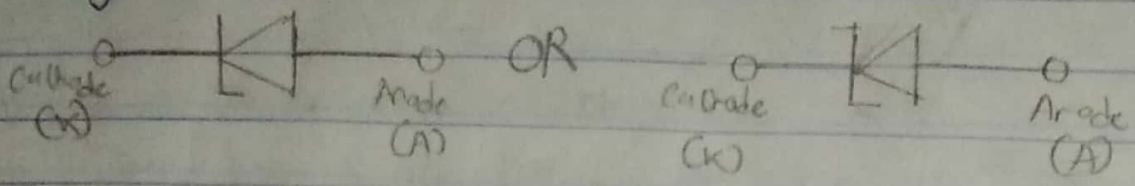
Zenor diodes can be used to produce a stabilised voltage output with low ripple under varying load current conditions. By passing a small current through the diode from a voltage source, via a suitable current limiting resistor (R_s), the zener diode will conduct sufficient current to maintain a voltage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

Zenor Diodes are widely used as shunt voltage Regulators to regulate voltage across small loads. Zener Diodes have a sharp reverse breakdown voltage and breakdown voltage will be constant for a wide range of currents. Thus we will connect the Zener diode parallel to the load such that the applied voltage will reverse bias it. Thus if the reverse bias voltage across the Zenor diode exceeds the knee voltage, the voltage across the load will be constant.

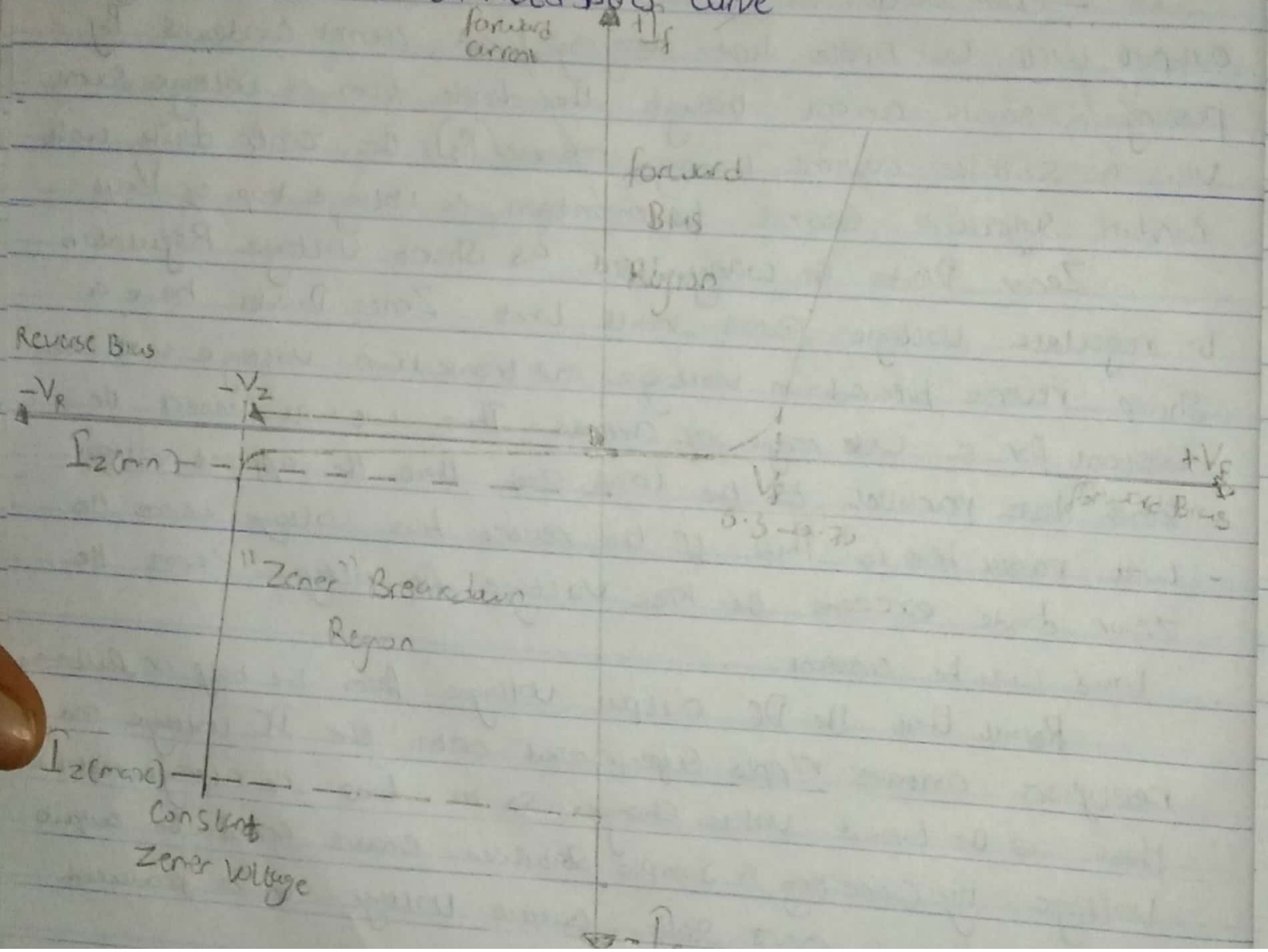
Recall that the DC output voltage from the half or full-wave rectifiers contains ripple superimposed onto the DC voltage and that as the load value changes so to does the average output voltage. By connecting a simple stabiliser circuit across the output of the rectifier, a more stable output voltage can be produced.

(1) Sketch the symbol and I-V Characteristics Curve.

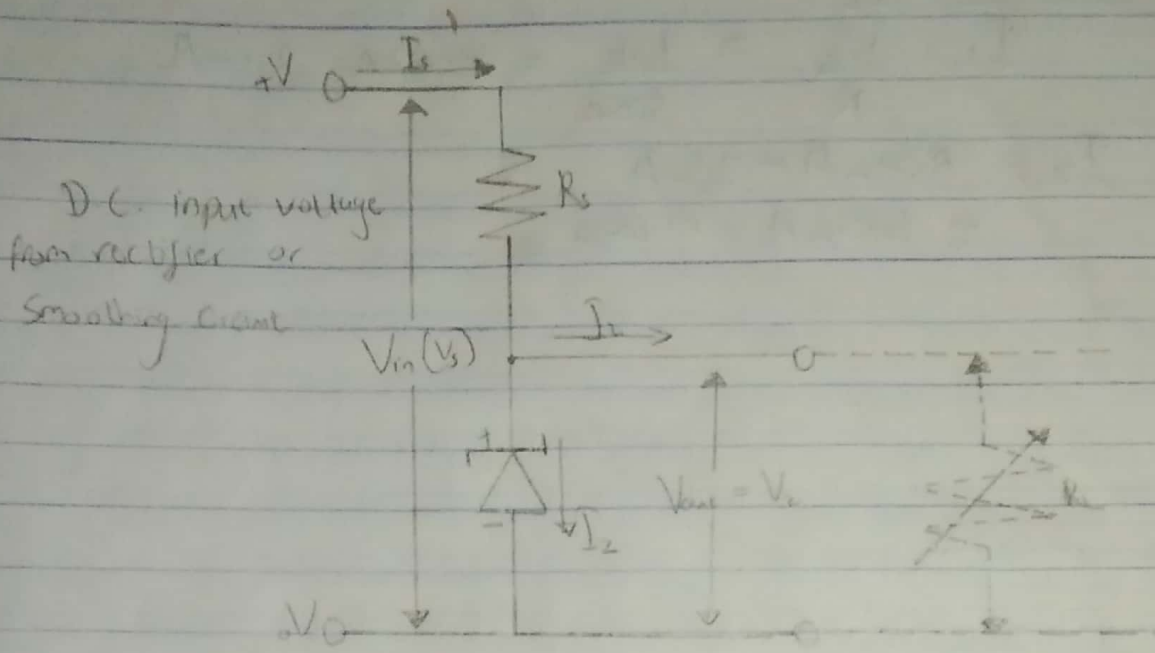
Symbol of Zener Diode



Zener Diode I-V Characteristics Curve



(ii) Sketch and label the circuit diagram



(iii) $P_z = 5W$ $I_z = 500mA$

$\hat{V}$ 20V max

To convert Vmax to VDC,

$$V_{dc} = \frac{2V_{max}}{\pi} = \frac{2\times 20}{\pi} = 12.73V_{DC}$$

Recall that $P = IV$

$$\therefore V_z = \frac{P_z}{I_z} = \frac{5}{500\times10^{-3}} = 10V$$

Recall that $V_z + V_R = V_s$

$$V_R = V_s - V_z = \frac{2\times20}{\pi} - 10$$

$$= 12.73 - 10 = 2.73V$$

$\therefore V = IR$

$$R = \frac{V}{I} = \frac{2.73}{500\times10^{-3}} = 5.46\Omega$$

(a) (iii) Since LEDs connected in series, and same current flows

$$I_S = I_2 + I_L$$

$$I_2 = I_S - I_L$$

$$I_L = \frac{V_2}{R} = \frac{10V}{500\Omega} = 0.02A = 20mA$$

$$I_2 = 500mA - 20mA$$

$$= 480mA = 0.48A$$