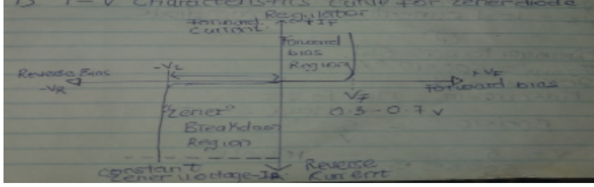
AKINWANDE SIMISOLA –
16/CM003/012
Civil

(1)

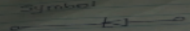
The Zener Diode is used in its "reverse bias" or reverse breakdown mode, i.e the diodes anode connects to the negative supply. The ability to control itself can be used to great effect to regulate a voltage across the ~~diode~~ source against supply. The fact that the voltage across the diode in the breakdown region is almost constant turns out be an important application of the zenerdiode as a voltage regulator.

The function of a 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 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 reverse breakdown region.

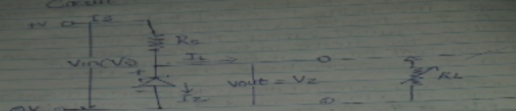
i) I – V Characteristics Curve for Zenerdiode Regulator



Symbol



Circuit



I_S – Current
R_S – Resistor (S) source
I_L – Load current.
R_L – Load resistance.
V_S – Voltage source.
V_Z – stabilised output voltage.
I_Z – Load current across zener diode

(b)

Maximum Power = 5W.
$I_{Z\,max} = 500\times10^{-3}$ A.
$20V_{max} = V_S$

i) Max current = $\frac{\text{Max Power}}{\text{voltage}}$.

$$500\times10^{-3} = \frac{5}{V}$$

$$V = \frac{5}{500\times10^{-3}} = 10 \text{ volts}$$

ii) Min resistance = $\frac{V_S - V_Z}{I_Z}$

$V_S = 0.637 \times V_{max}$
$V_S = 0.637 \times 20$
$= 12.74$ Vdc.

Min resistance $= \frac{12.74 - 10}{0.5} = \frac{2.74}{0.5}$
$= 5.48\,\Omega$

iii) Load current

$I_L = \frac{V_Z}{R_L} = \frac{10}{500} = 0.02$ A $\rightarrow$ 20mA.

$I_Z = I_S - I_L$
$= 500 - 20$
48mA.