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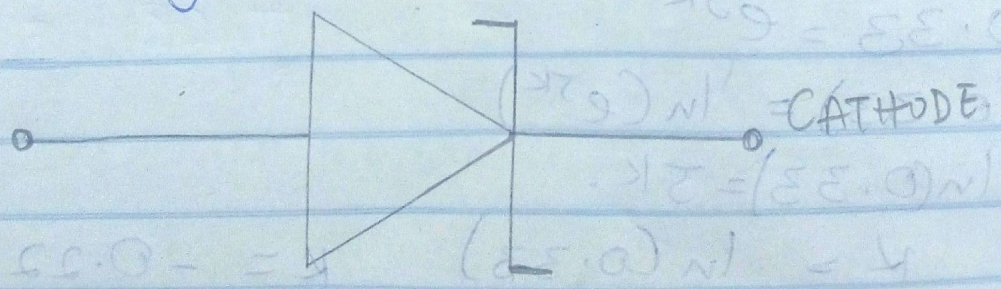
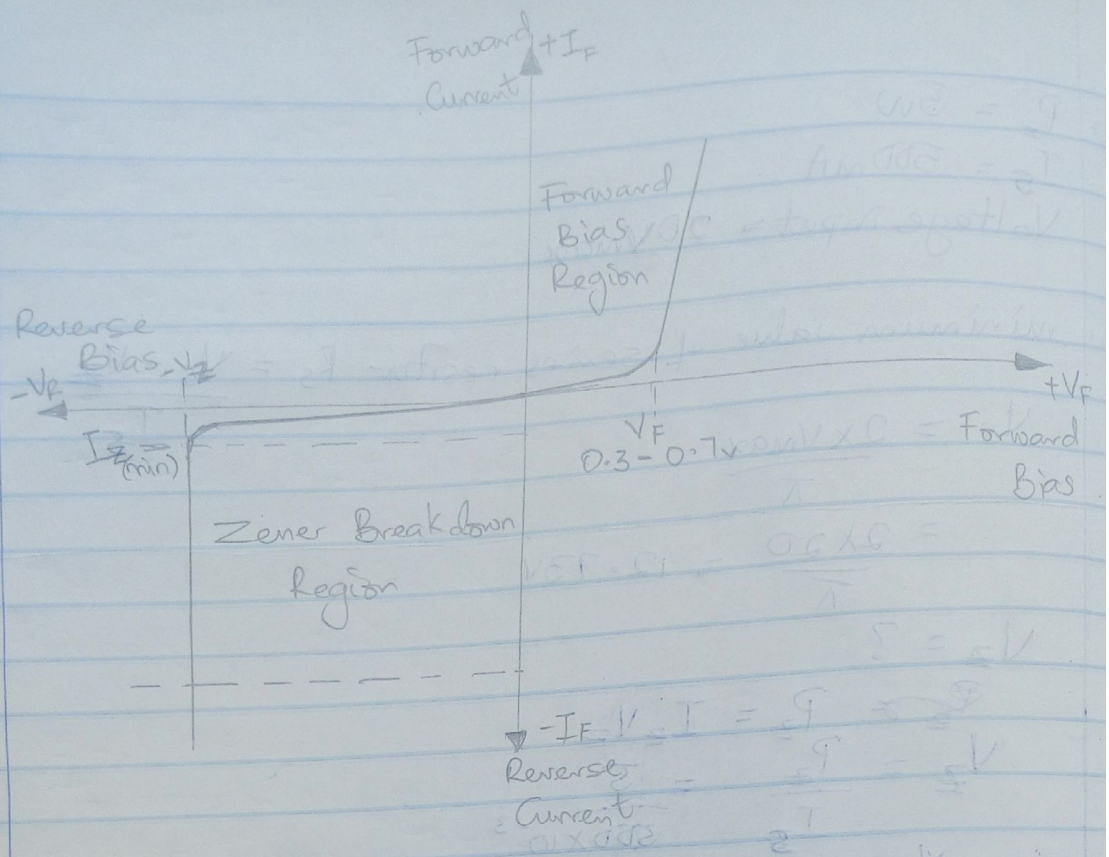
19/ENG03/032
CIVIL ENGINEERING
ENG 222.

1. A regulator provides a constant output of voltage to the load irrespective of voltage ripples. In this regard, a zener diode acts as an efficient regulator due to its having a region of constant voltage even with large changes in current.

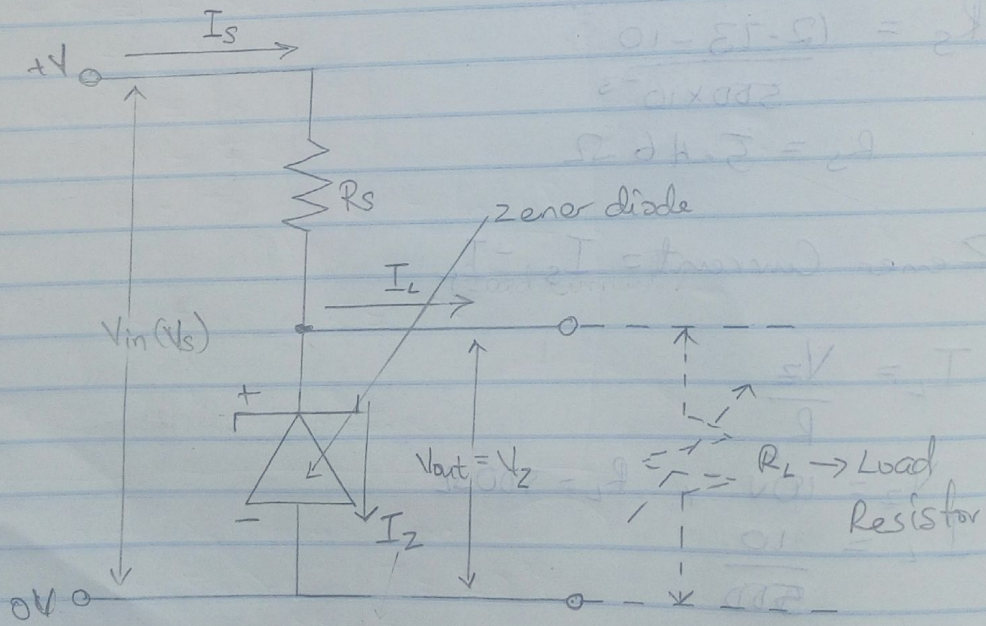
This ability of the zener diode to control itself can be used to stabilise a voltage source against supply or load variations.

i Zener diode symbol.





ZENER DIODE I-V CHARACTERISTICS



ZENER DIODE REGULATOR CIRCUIT

where I_S => Current through the Voltage source
V_S ⇒ Voltage Source
R_S => resistor connected in series with zener diode
I_L => Load Current
I_Z => Zener current
V_Z / V_{out} => Stabilised output voltage

2. $P_z = 5W$

$I_s = 500mA$

Voltage input = 20Vmax

i. minimum value of series resistor $R_s = \frac{V_s - V_z}{I_s}$

$V_s = \frac{2 \times V_{max}}{\pi}$

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

$V_z = ?$

$P_z = I_z V_z$

$V_z = \frac{P_z}{I_s} = \frac{5}{500 \times 10^{-3}}$

$V_z = 10V$

$R_s = \frac{12.73 - 10}{500 \times 10^{-3}}$

$R_s = 5.46\Omega$

ii Zener Current = $I_s - I_L$

$I_L = \frac{V_z}{R_L}$

$V_z = 10V$, $R_L = 500\Omega$

$I_L = \frac{10}{500}$

$I_L = 0.02$

$I_z = 0.5 - 0.02$

$= 0.48$

$= 480mA$