Assignment ENG 212

Basic Electrical Engineering II

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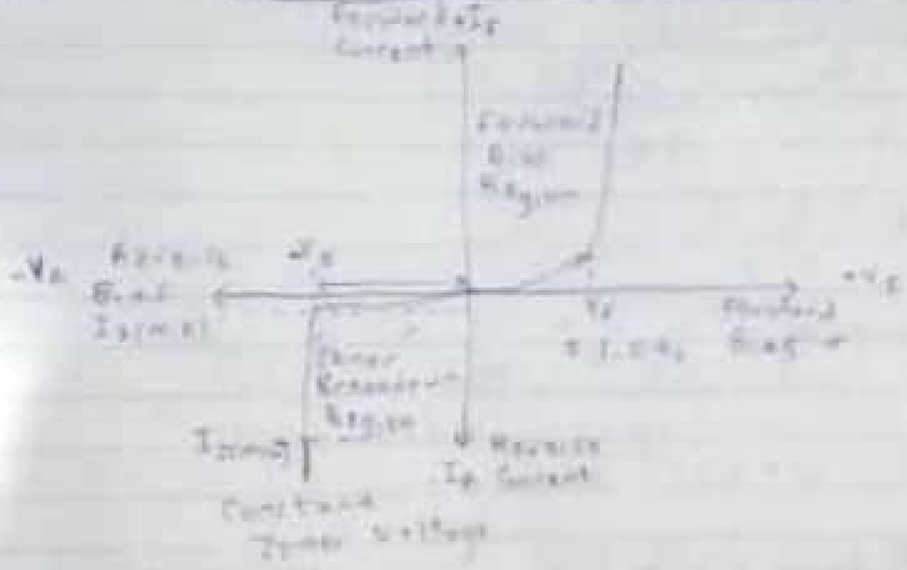
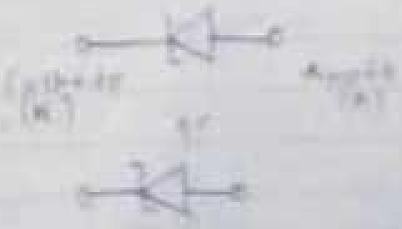
Question 1 (Answer)

The Zener diode is like a general-purpose signal diode consisting of a silicon PN junction. When biased in the forward direction it behaves just like a normal signal diode passing the rated current, but as soon as a reverse voltage applied across the zener diode exceeds the rated voltage of the device the diode's breakdown voltage is reached at which point a process called Avalanche Breakdown occurs in the semiconductor depletion layer and a current starts to flow through the diode to limit this increase in voltage.

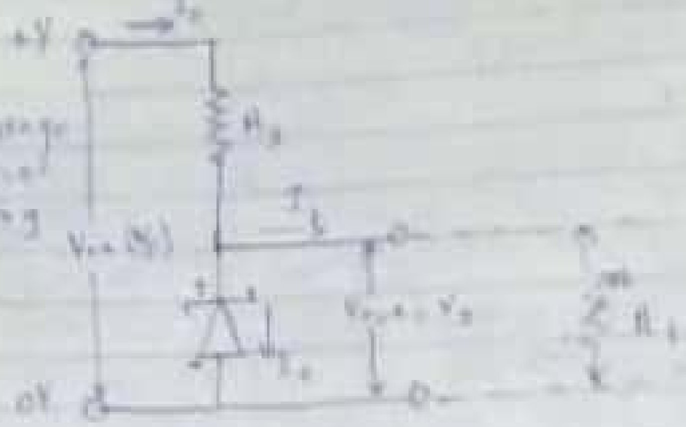
i) Zener Diode I-V Characteristics



Symbol



(ii) Zener Diode Regulator



2) Power of Zener diode = 5W

$I_Z = 500\,mA$

$V_s = 20V_{rms} = \frac{2V_{max}}{\pi}$

$= \frac{2\times20}{\pi}$

$V_s = 12.732V$

$R_s = \frac{V_s - V_Z}{I_Z}$

but V_Z = ?

P = IV

$5/500mA = V_Z = 10V$

$R_s = \frac{12.732 - 10}{500\times10^{-3}} = \frac{2.732}{500\times10^{-3}}$

$\therefore R_s = 5.464\,\Omega$

Since the zener diode is in parallel with the load resistor

$I_T = I_Z + I_L$

but since a load is being introduced

$I_Z = I_T - I_L$

$I_L = V_Z/R_L = \frac{10}{(500\times10^{-3})} = 0.02A \simeq 20mA$

$\therefore I_Z = 500mA - 20mA$

$= 480\,mA$

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