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MATRIC NO: 18/ENG06/012

DEPARTMENT: MECHANICAL ENGINEERING

COURSE: ENG 222 (BASIC ELECTRICAL ENGINEERING II)

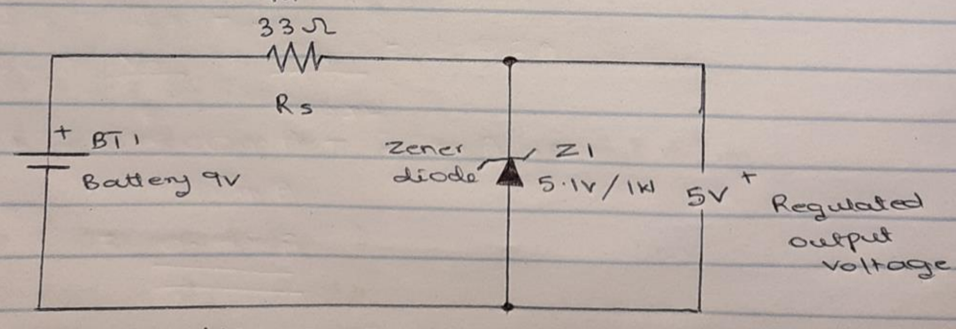
ASSIGNMENT:

1. A Zener diode regulator are widely used as voltage references and as shunt regulators to regulate the voltage across small circuits. When connected in parallel with a variable voltage source so that it is reverse biased, a zener diode conducts when the voltage reaches the diode's reverse breakdown voltage.

A Zener diode regulator works 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 Vout.

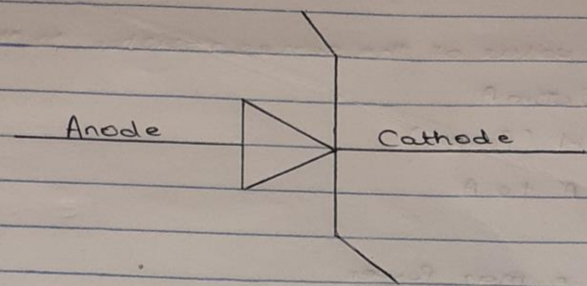
A zener diode is always operated in its reverse biased condition. As such a simple voltage regulator circuit can be designed using a zener diode to maintain a constant DC output voltage across the load in spite of variations in the input voltage or changes in the load current.

Zener diodes are heavily doped than ordinary diodes. They have extra thin depletion region. When we apply a voltage more than the Zener breakdown voltage (can range from 1.2 volts to 200 volts), the depletion region vanishes, and large current starts to flow through the junction.

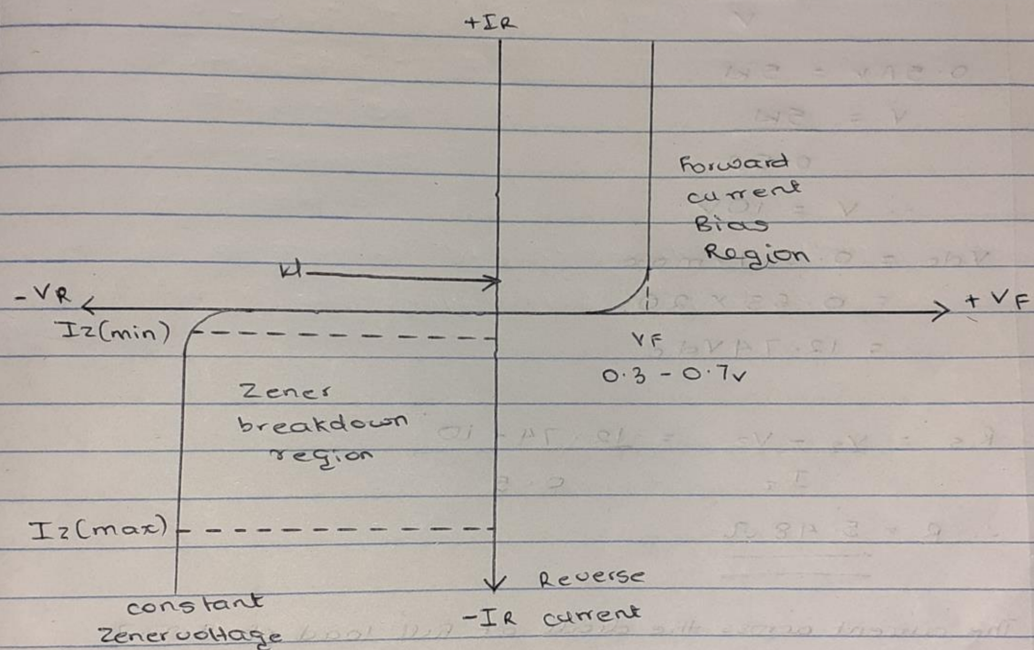


ZENER VOLTAGE REGULATOR CIRCUIT

(i)

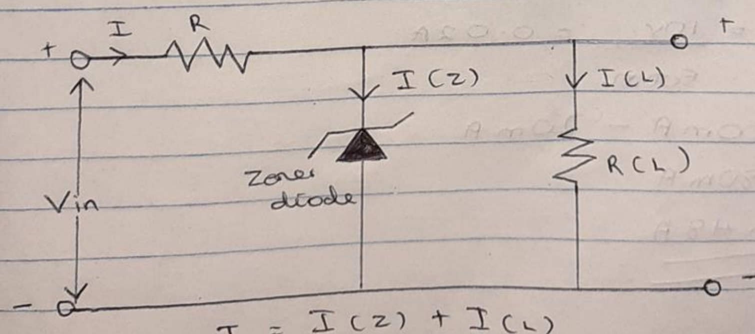


SYMBOL



I-V CHARACTERISTICS CURVE

(ii)



$I = I(Z) + I(L)$

CIRCUIT DIAGRAM

(2) (i) The minimum value of the series resistor to the zener diode

current = 500mA

Watts = 5W (Power)

$I = 500\,mA$ to A

$= 0.5\,A$

$$\text{max current} = \frac{\text{max Power}}{V}$$

$$0.5A = \frac{5W}{V}$$

$0.5AV = 5W$

$$V = \frac{5W}{0.5A}$$

$\therefore V = 10V$

$V_{dc} = 0.637 V_{max}$

$= 0.63 \times 20$

$= 12.74 V_{dc}$

$$R_s = \frac{V_s - V_z}{I_z} = \frac{12.74 - 10}{0.5}$$

$\therefore R = 5.48\,\Omega$

(ii) The current across the diode at full load of 500Ω

Connection in Series

$I_s = I_z + I_L$

$I_z = I_s - I_L$

$$I_L = \frac{V_z}{R} = \frac{10V}{500\Omega} = 0.02A$$

$I_z = 500mA - 20mA$

$= 480mA$

$\therefore = 0.48A$