

12UCHUKWU CHIDERA VICTOR
18/ENGO5/024
MECHATRONICS

ENG 222

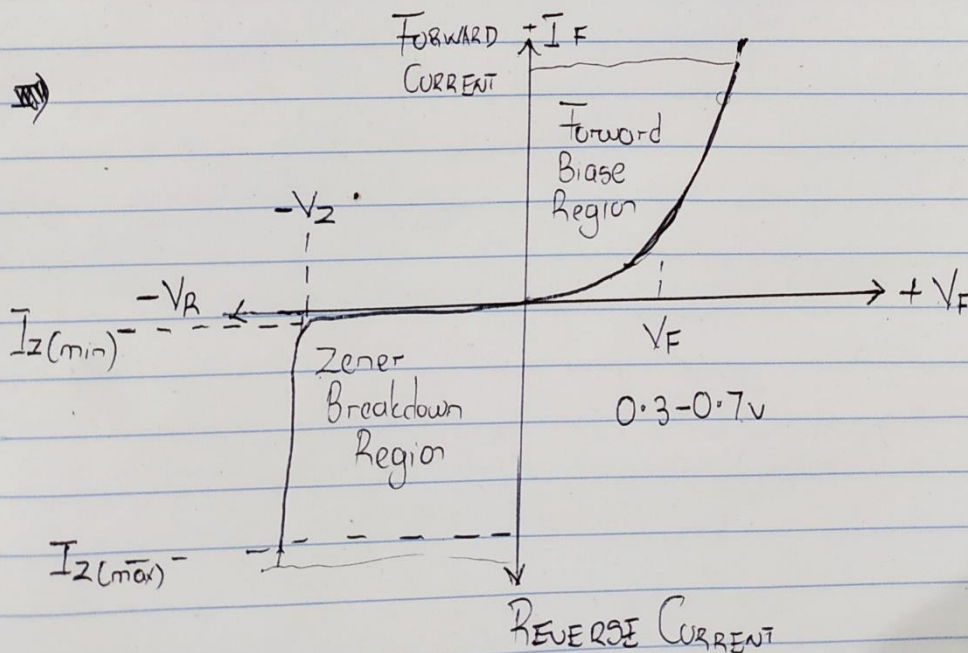
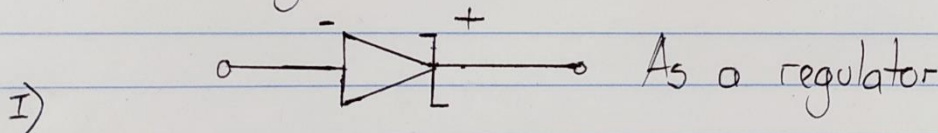
QUESTION ONE

Describe a Zener diode regulator

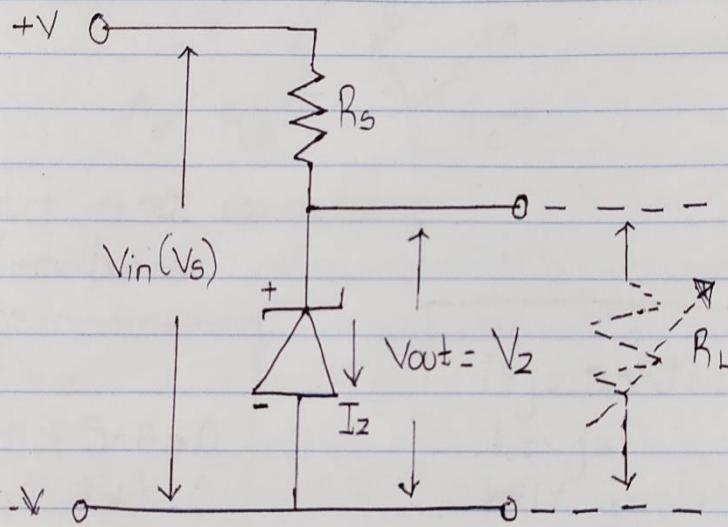
SOL

A ZENER DIODE regulator is a zener diode when connected in reverse bias.

As the reverse voltage increases to the breakdown / zener voltage, a current starts flowing through the diode. The current will increase to a maximum which is determined by the load after which the load current stabilizes and remains constant over a wide range of applied voltage (which is the function of a regulator).



ii)



ZENER DIODE REGULATOR

QUESTION TWO

QUESTION TWO

5W = Max Power

Maximum current = 500mA = 5×10^{-3} A

$V_{in} = 20V_{max}$

$$\text{Maximum Current} = \frac{\text{Watts}}{\text{Voltage } (V_z)}$$

$$\text{Minimum value of series resistor} = \frac{V_s - V_z}{I_z}$$

$V_z = ?$

$$\text{Max Current} = 5 \times 10^{-3} \text{ A} = \frac{5}{V_z}$$

$$\cancel{V_z} V_z = \frac{5}{(500 \times 10^{-3}) \text{ A}} = 10 V_z$$

⇒ For a bridge circuit,

$$V_{dc} = \frac{2V_{max}}{\pi} = \frac{2(20)}{\pi}$$

$$= 12.73 \text{ V}$$

∴ Minimum Value of series resistor to the zener diode

$$= \frac{V_s - V_z}{I_z}$$

$$= \frac{12.73 - 10}{(500 \times 10^{-3})} = \frac{2.73}{0.5}$$

$$= 5.46 \Omega$$

II) Load current at full load of 500Ω

$$I_L = \frac{V_Z}{R_L} = \frac{10}{500}$$
$$= 0.02A$$

\therefore Current across the diode, I_Z

$$I_Z = I_o - I_L$$
$$= 0.5 - 0.02$$
$$= 0.48A$$
$$= \underline{\underline{480mA}}$$