

LAW - ADUE EMMANUEL

19/ENG05/069

MECHATRONICS DEPT

ENG222 ASSIGNMENT

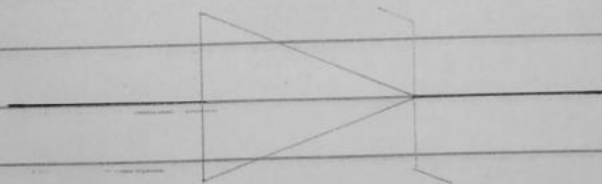
QUESTION ONE (I)

ZENER DIODE REGULATOR :

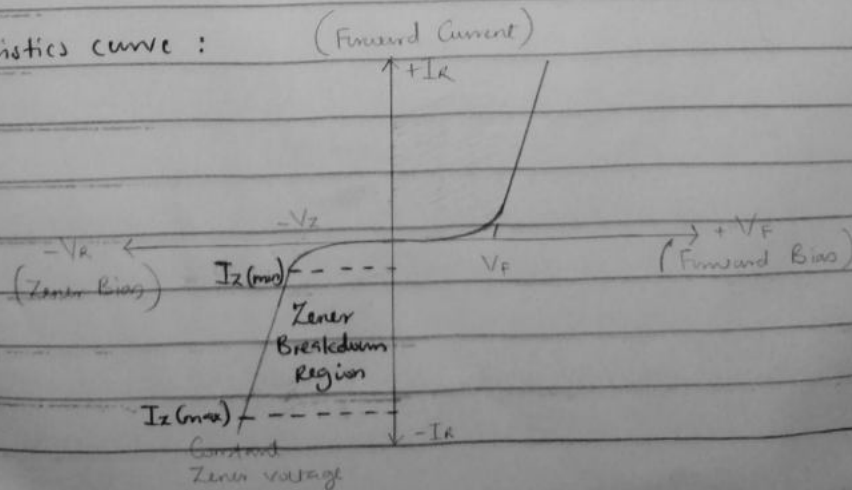
A zener diode is used as a voltage regulator when a resistor is connected in series with the zener diode to limit the current flow through the diode with the voltage source (V_s) being connected across the combination. The stabilised output voltage, V_{out} is taken from across the zener diode.

The zener diode is connected with its cathode terminal connected to the positive rail of the DC supply so it's reverse biased and will be operating in its breakdown condition. A resistor, (R_s) is selected to limit the maximum current flowing in the circuit.

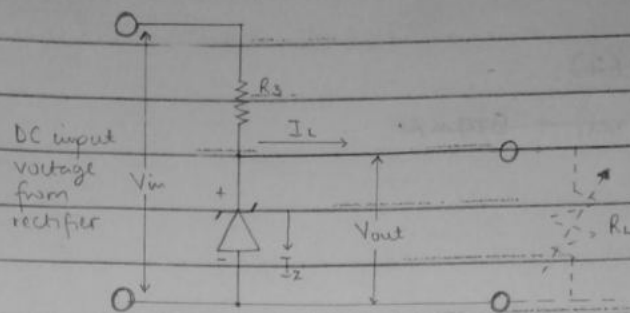
Symbol :



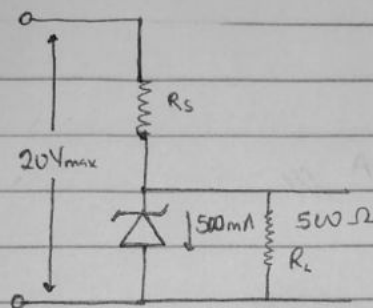
I-V Characteristics curve :



Circuit diagram :



QUESTION TWO (2)



$$V_{dc} = \frac{2V_{max}}{\pi} = \frac{2 \times 20V_{max}}{\pi} = 12.732 V$$

1) Minimum value of series resistor

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

$$= \frac{12.732 - V_z}{500 \times 10^{-3} A}$$

$$\left\{ \begin{array}{l} V_s = 12.732 V \\ V_z = ? \\ I_z = 500 mA = 500 \times 10^{-3} A \end{array} \right.$$

$$P_z = I_z V_z$$

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

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

$$R_s = \frac{12.732 - 10}{500 \times 10^{-3}} = 5.464 \Omega //$$

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

$$I_z = I_s - I_L$$

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

$$I_z = (0.5 - 0.02)A = 0.48A \quad \text{///}$$