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DEPARTMENT: BIOMEDICAL ENGINEERING

2.

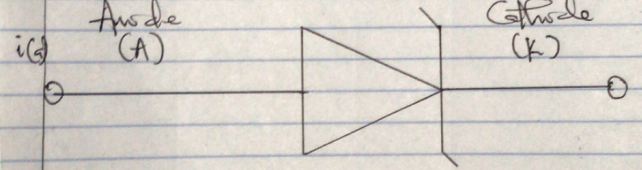
1. Describe a Zener Diode Regulator.

The function of a regulator is to provide constant output voltage to a load connected in parallel with it; in spite of the ripples in the supply voltage or the variation in the load current and the zener diode will continue to regulate the voltage until the diodes current falls below the minimum $I_{Z(min)}$ value in the reverse breakdown region.

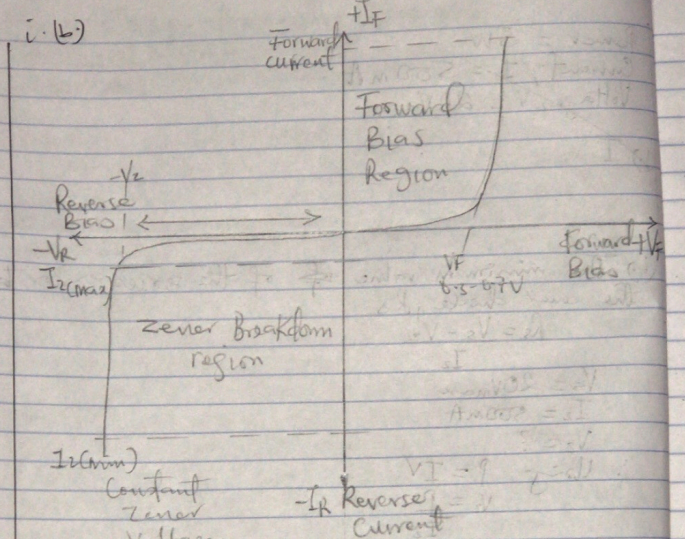
2.

It permits or allows current to flow in the forward direction as normal, but will also allow it to flow in the reverse direction when the voltage is above a certain value (the breakdown voltage diode voltage known as the Zener voltage). The zener is specially made to have a reverse voltage breakdown at a specific voltage.

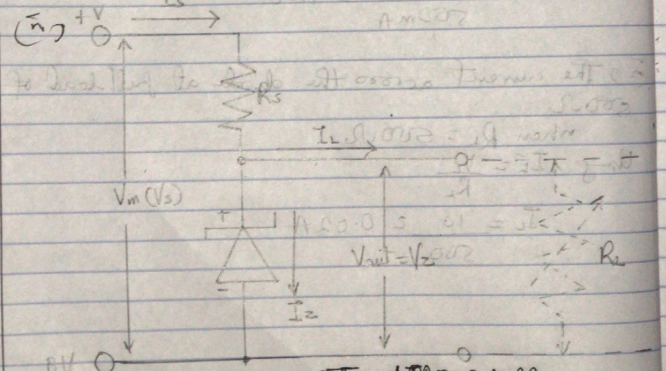
The purpose of a voltage regulator is to maintain a constant voltage across a load regardless of variations in the applied input voltage and variations in the load current. The resistor is selected so that when the input voltage is at $V_{IN(max)}$ and the load current is at $I_{L(max)}$ that the current through the Zener diode is at least $I_{Z(min)}$



i. (b.)



I-V characteristics curve



CIRCUIT DIAGRAM

2a) The minimum value of the series resistor to the zener diode, R_S

$$R_S = \frac{V_S - V_Z}{I_Z}$$

but $V_Z = ?$, $V_S = ?$, $I_Z = 500\,mA$, $P = 5\,watts$

for V_Z, using $P = I_Z V_Z$

$$V_Z = \frac{P}{I_Z}$$

$$V_Z = \frac{5}{500mA} = 10V$$

for V_s, using $V_{dc} = \frac{2V_{max}}{\pi} = 0.637 V_{max}$

$$V_S = 0.637 \times 20 = 12.74V$$

$$\therefore R_S = \frac{12.74 - 10}{500mA}$$

$$R_S = 5.48\,\Omega$$

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

$$I_Z = I_S - I_L$$

but $I_L = ?$

$$\therefore I_L = \frac{V_Z}{R_L} = \frac{10}{500} = 20mA$$

$$\therefore I_Z = 500mA - 20mA$$

$$I_Z = 480mA$$