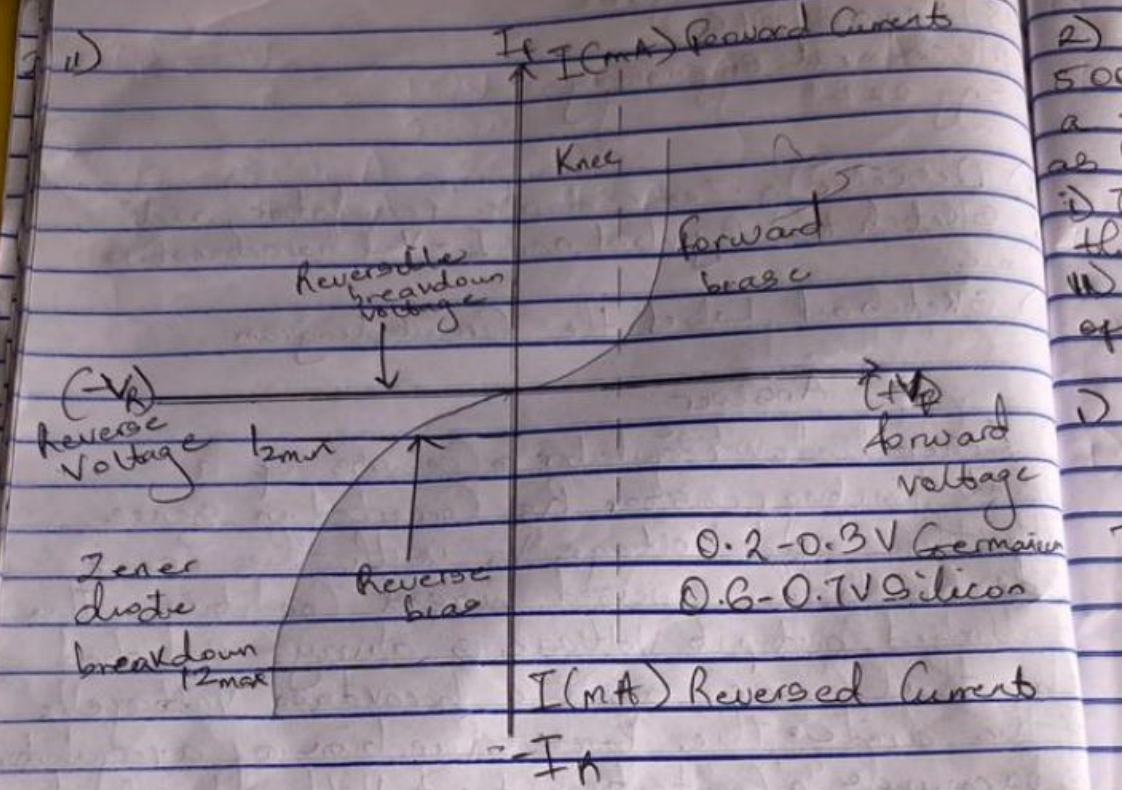
Nwanze Henry chigozie
18/Eng06/1045
Mechanical Engineering
Eng 222

1) Describe a Zener diode regulator and:
i. Sketch the symbol and I-V Characteristics Curve.
ii) Sketch and Label the Circuit diagram

Answer

1) Zener diode voltage regulator Consists of a Current limiting resistor R_S Connected in Series with the Input Voltage V_S with the Zener diode R_L In this reversed biased Condition. The Stabilized output Voltage is always Selected to be the Same as the breakdown Voltage V_z of the diode. The Function of a regulator is to provide a 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. There are two types of regulator Such as Line regulation and load regulation.

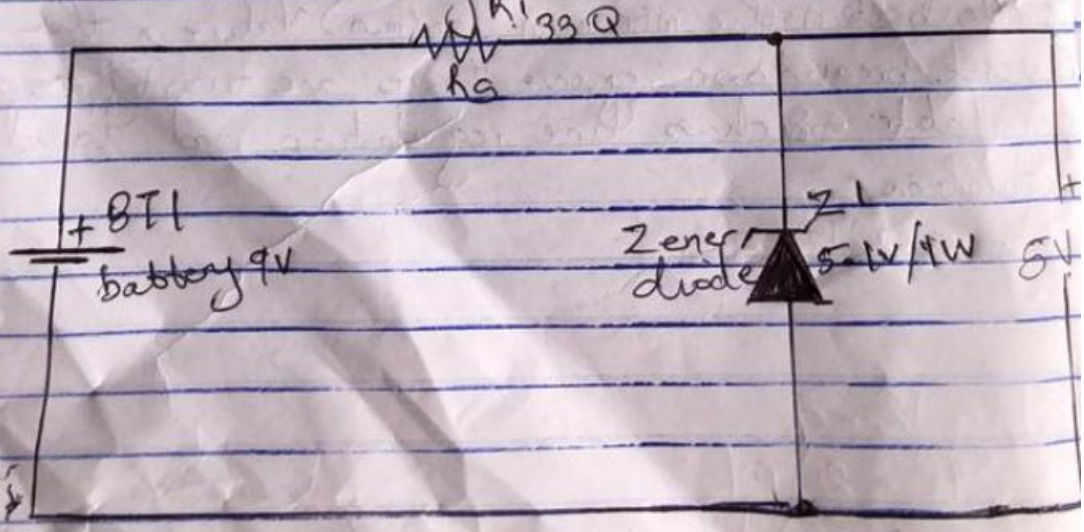
ii)



I-V Characteristic Curve.

iii)

iii) Zener diode regulator circuit



2) A 5W maximum rated Zener diode has 500mA maximum current flowing through it. If a 20V max bridge rectifier circuit is connected as input to the regulator circuit calculate:
i) The minimum value of the series resistor of the Zener diode
ii) The current across the diode at full load of 500Ω

Solution

i) Watts = 5W P_Z
Current = 500mA I_Z
20V max
To convert V_{max} to VDC,
$V_{DC} = \frac{2V_{max}}{\pi}$

$V_S = \frac{2 \times 20}{\pi} = 12.74$ VDC

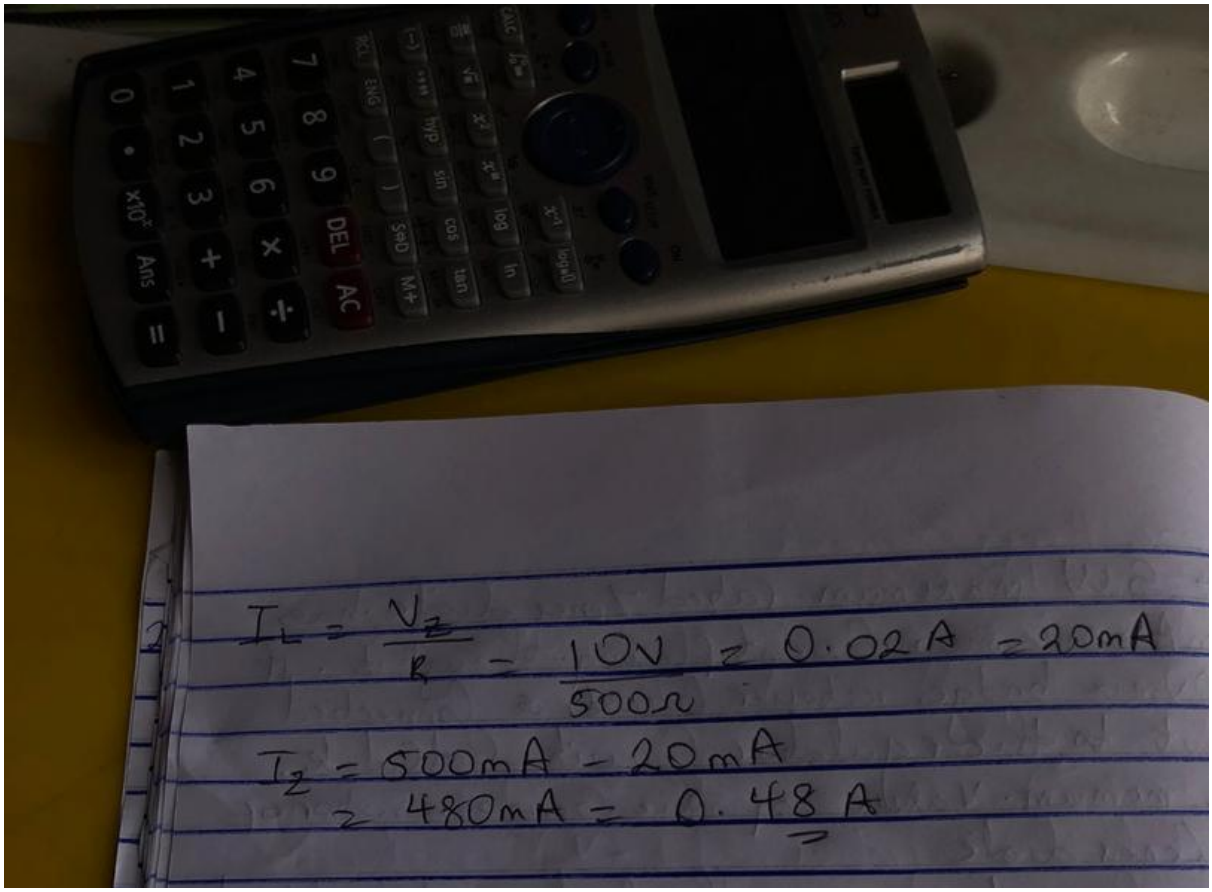
$P = IV$
$\therefore V_Z = \frac{P_Z}{I_Z} = \frac{5}{500 \times 10^{-3}}$ $V_Z = 10V$

Recall that $V_Z + V_R = V_S$
$V_R = V_S - V_Z$
$\frac{2 \times 20}{\pi} - 10$ 2.74V
$= 12.74 - 10 = 2.74V$

$\therefore V = IR$
$R = \frac{V}{I} = \frac{2.74}{500 \times 10^{-3}}$
$R = 5.48\Omega$

Regulated output Voltage.

ii) Since its connected in series, and same current flow
$I_S = I_Z + I_L$
$I_Z = I_S - I_L$


$I_L = \frac{V_Z}{R} = \frac{10V}{500\Omega} = 0.02A = 20mA$
$I_Z = 500mA - 20mA$
$= 480mA = 0.48A$