NAME: OBODO JOSEPH CHIJIOKE

MATRIC NO: 18/ENG09/006

DEPARTMENT: AERONAUTICAL ENGINEERING

COURSE: ENG222

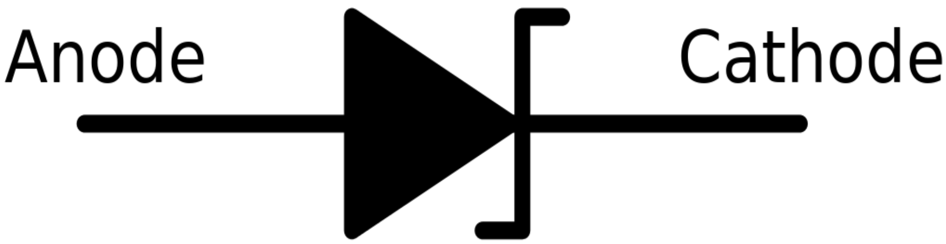
TITLE: ASSIGNMENT

1. The Zener diode regulator is a diode designed specially to perform the role of voltage regulation in circuits and systems. From the pre-established knowledge of P-N Junction diodes, diodes in the forward bias direction allow the flow of current but, in the reverse bias direction block the flow of current. In the reverse bias, the voltage changes rapidly with infinitesimal increase in current until it reaches the breakdown voltage.

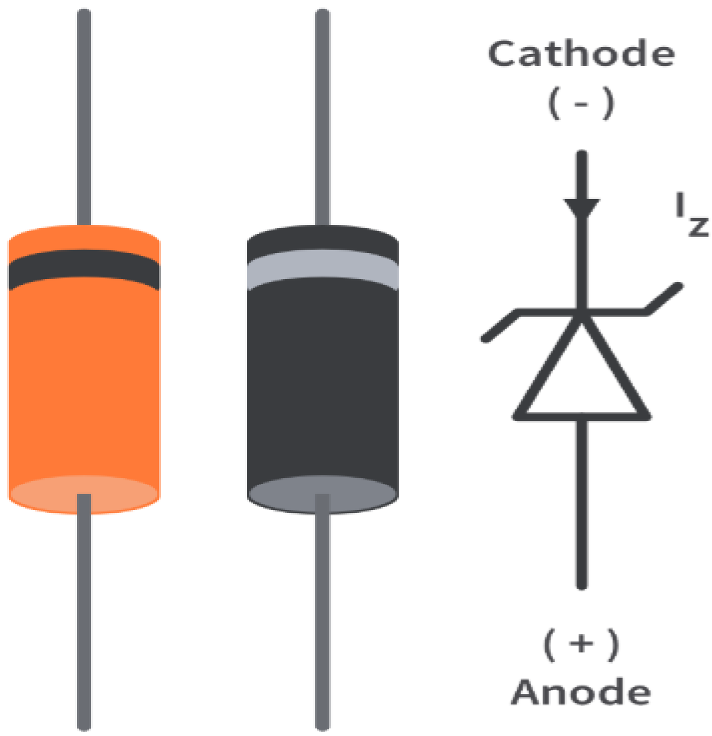
This feature distinguishes the Junction diode from the Zener. Because, the Zener diode in the reverse bias, attains a stable voltage with increase in current which is relatively steady with varying change in current, this voltage is its breakdown voltage.

The process occurs in this manner, when the Zener diode is in forward bias it acts like every signal diode, but when a reverse voltage is opposed on it and it exceeds the voltage of the device, **Avalanche Breakdown** occurs in the diode's depletion layer and current starts to floe through the diode to limit the increase in voltage and its value stabilizes.

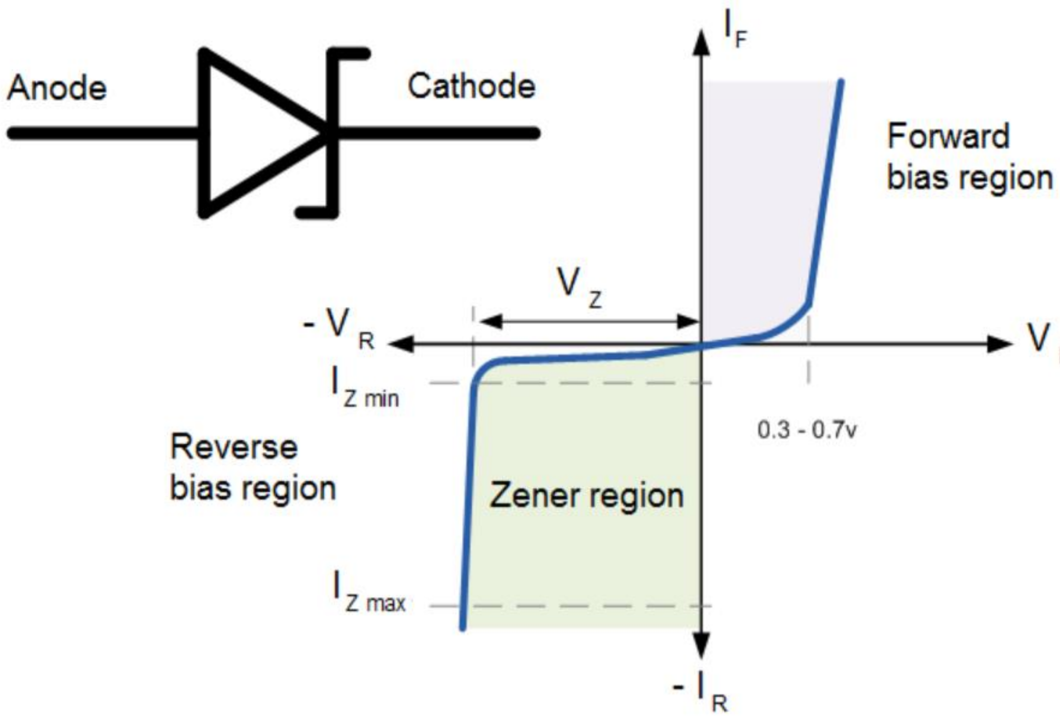
i. The Zener diode is denoted in circuit diagrams with these symbols.



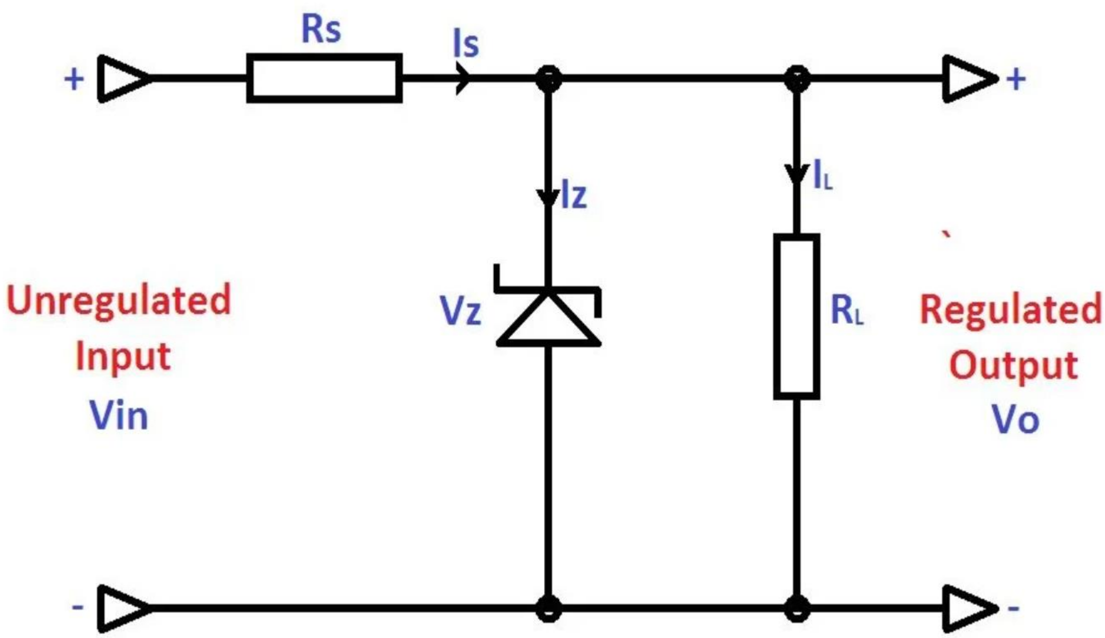
OR



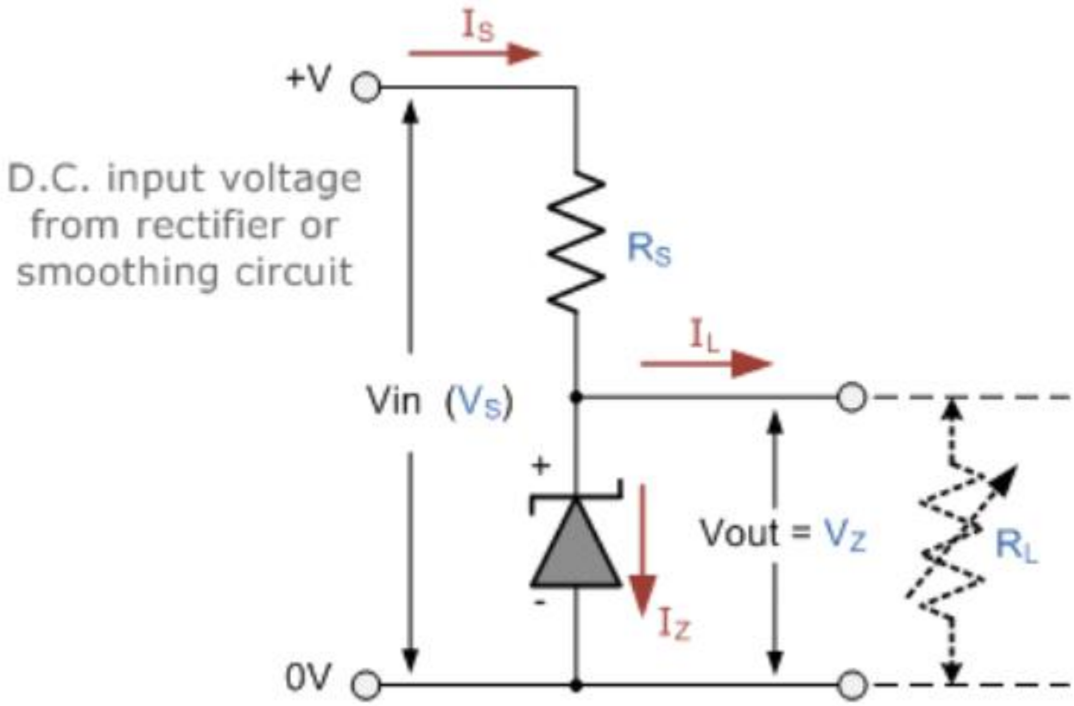
The I-V characteristics curve is also shown in the figure below



ii. The Zener diode circuit diagram is shown below



2. Let the circuit diagram be represented by the figure below



i. Maximum power of Zener diode ($P_{z\,max}$) = 5W
Maximum current through Zener diode ($I_{z\,max}$) = 500mA
$= \frac{500}{1000}$
= 0.5A
Voltage Supply (V_{in}) = $20V_{max}$
Zener Voltage (V_z) = P_z / I_z
= 5 / 0.5
= 10V
$R_z = V_z / I_z$ where R_z => Resistance of Zener diode
R_z = 10 / 0.5
R_z = 20Ω
$V_{in} = V_s + V_z$ where, V_s => Voltage across series

Resistor

$V_s = V_{in} – V_z$

$V_s = 20 – 10$

$V_s = 10V$

At maximum power of Zener diode ($P_{z\,max}$), the current is maximum ($I_{z\,max}$) and equal to the current flowing through the series resistor (I_s)

$I_z = I_s = 0.5A$

Minimum resistance (R_s) = V_s / I_s

$= 10 / 0.5$

$R_s = 20\Omega_{//}$

ii. On addition of Load (R_l) = 500Ω

$I_s = I_z + I_l$ where I_l => Current through the Load

$V_z = V_l$ where V_l => Voltage across the Load

$I_zR_z = I_lR_l$

$I_z = (I_l \times R_l)/R_z$

$I_z = (500 / 20) \times I_l$

$I_z = 25 \text{ x } I_l$

But, $I_z + I_l = I_s$

$I_z + I_l = 10$

$(25 \text{ x } I_l) + I_l = 10$

$26 \text{ x } I_l = 10$

$I_l = 10/26$

$I_l = 0.385A$

$I_z = 25 \times I_l$

$I_z = 25 \times 0.385$

$I_z = 9.615A_{//}$