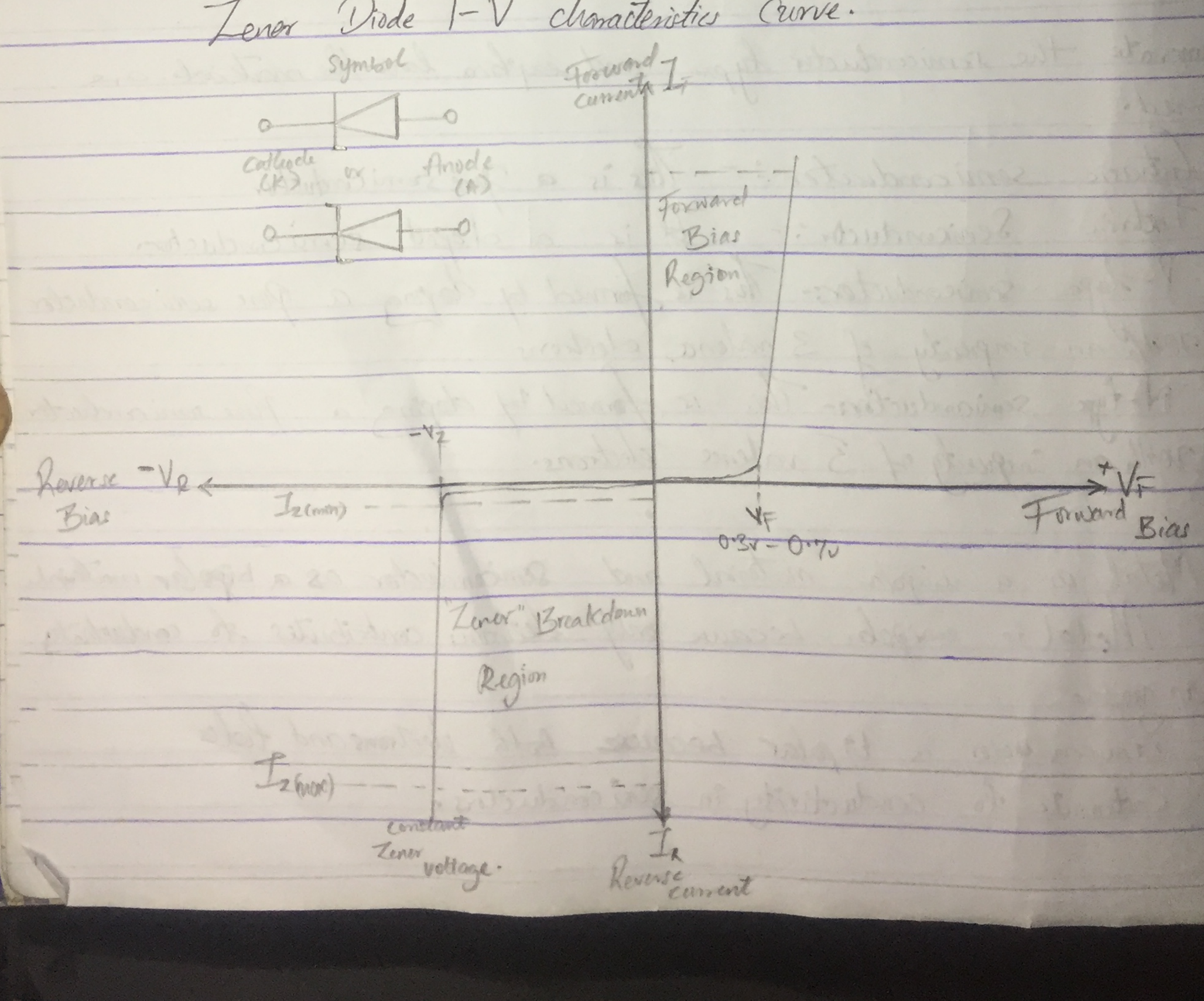
TAIWO DAMILOLA
18/ENGO5/058
MECHATRONICS

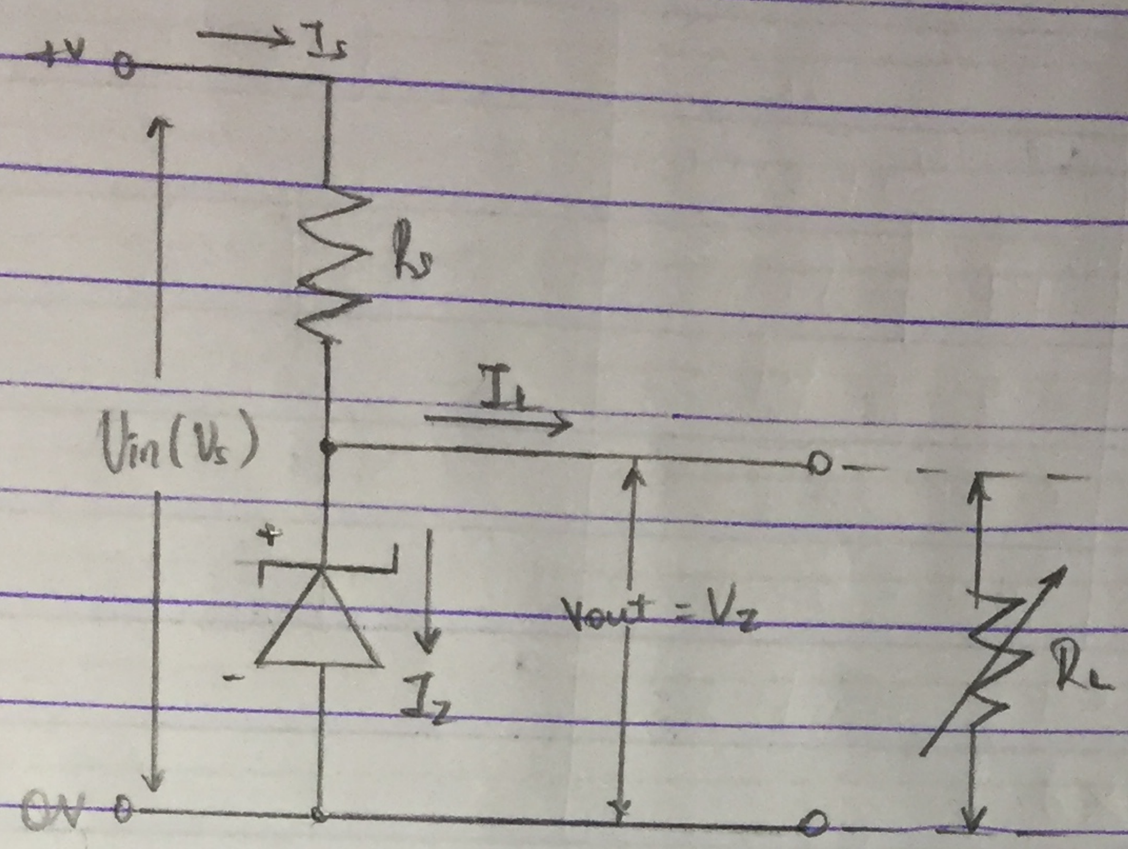
1.) The Zener diode behaves just like a normal general-purpose diode consisting of a silicon PN-junction and when biased in the forward direction, it behaves just like a normal signal diode passing the rated current However, unlike a conventional diode that blocks any flow of current through itself when reversed biased, the zener diode begins to conduct in the reverse direction as soon as the reverse voltage reaches a pre-determined value. This is because when the reverse voltage applied across the Zener diode exceeds the rated voltage of the device.

Avalanche Breakdown occurs in the semiconductor depletion layer and a current starts to flow through the diode to limit its increase in voltage.

Zener Diode I-V characteristics Curve.



Zener Circuit Diagram.



2(i) $P = 5W$, $I_{zmax} = 500mA = 0.5A$

$V_{max} = 20$ $R = ?$ $P = IV$

$$R_s = \frac{V_{in} - V_z}{I_{zmax}}$$

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

$$V = \frac{P}{I_{zmax}} = \frac{5}{0.5} = 10V$$

$$\therefore R_s = \frac{12.732 - 10}{5}$$

$$= 5.46\Omega$$

ii) When load is 500Ω

$$I_{zmin} = I_{zmax} - I_L$$

$$I_L = \frac{V_z}{R_L} = \frac{10}{500}$$

$$= 0.02A$$

$0.02A = 20mA$

$I = 500 - 20$

$= 480mA$