2) Given

I_z (max current) = 500mA = 0.5A

P_z (Max power) = 5W

V_s = 20max

i) max current = $\frac{\text{max power}}{\text{voltage}}$ $\Rightarrow 0.5 = \frac{5W}{V_z}$

$V_z = \frac{5}{0.5} = 10 \text{ volts}$

min resistance = $\frac{V_s - V_z}{I_z}$

$V_{dc} = 0.637 V_{max}$

$= 0.637 \times 20 = 12.74 \text{ vdc}$

∴ minimum resistance = $\frac{12.74 - 10}{0.5} = 5.48\Omega$

ii) $I_L = \frac{V_z}{R_L} \Rightarrow I_L = \frac{10}{500} = 0.02A = 20mA$

$I_z = I_s - I_L = 500 - 20 = 480mA$

∴ Current Across the diode at full load is 480mA

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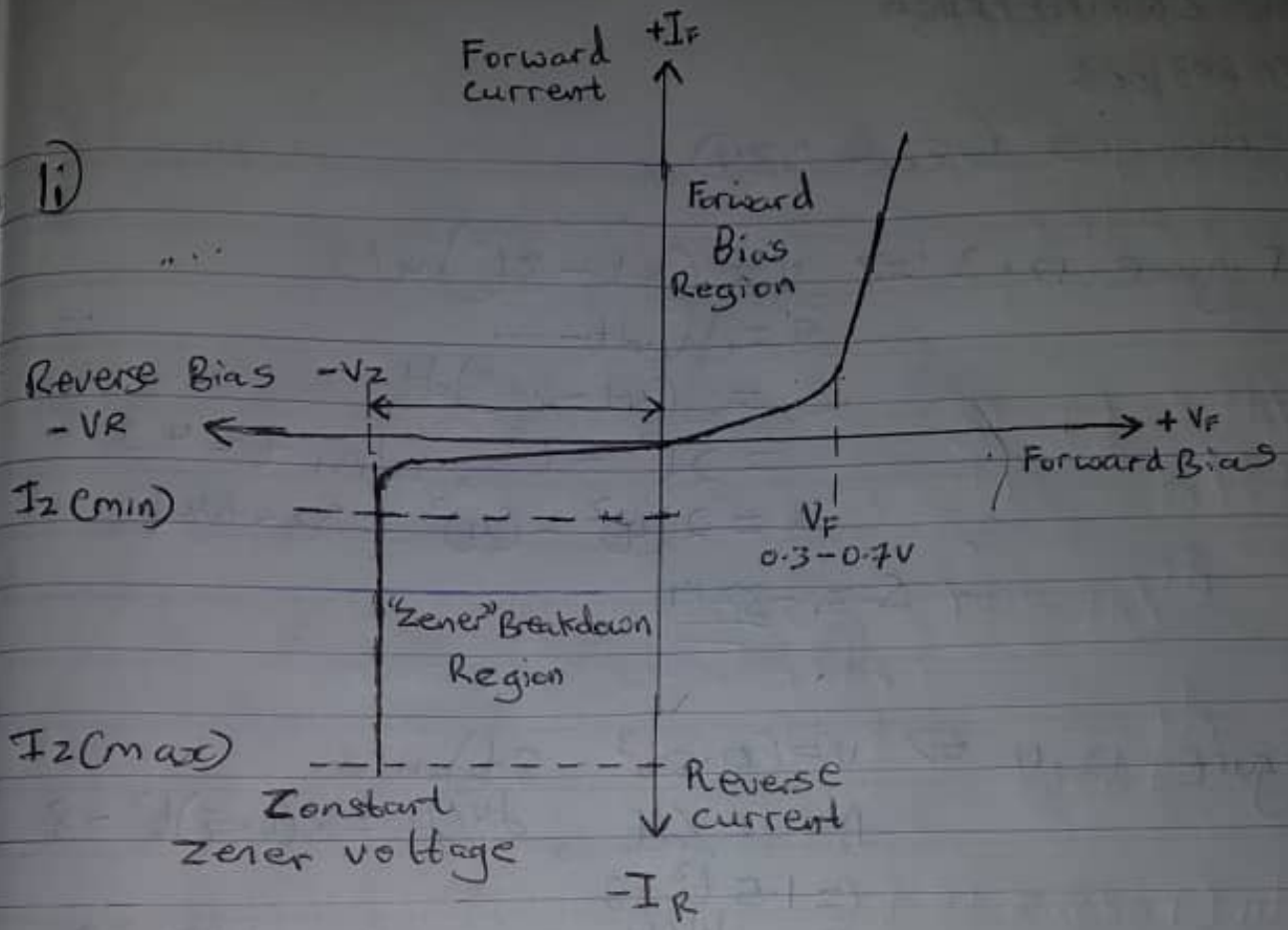
1) The zener diode behaves just like a normal general-purpose diode consisting of a silicon PN junction but is designed to have a low pre-determined Reverse Breakdown Voltage that takes advantage of this high voltage.

Unlike a conventional diode that blocks any flow of current through itself when reversed biased, i.e the cathode becomes more positive than the anode, as soon as the reverse voltage reaches a pre-determined value, the zener diode begins to conduct in the reverse direction because when the reverse voltage applied across the zener diode exceeds the rated voltage of the device, a process called Avalanche Breakdown occurs and a current starts to flow through the diode to limit this increase in voltage.

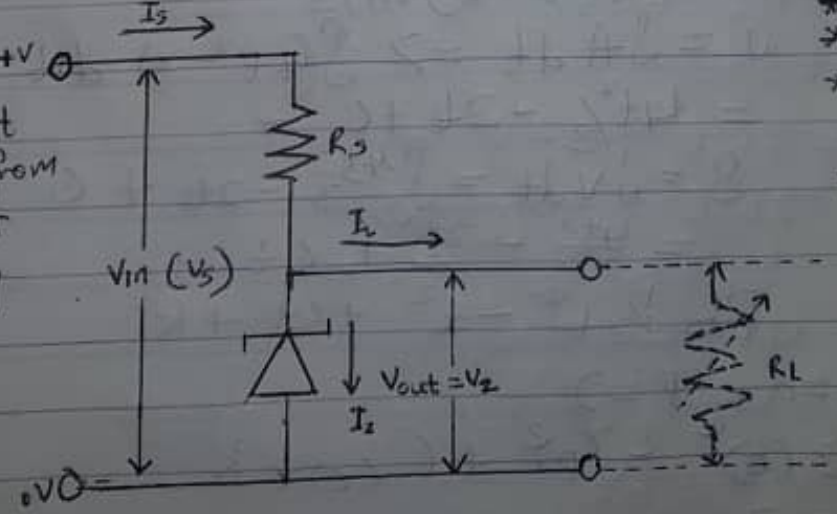
The current now flowing through the zener diode increases dramatically to the max. circuit value (which is limited by a series resistor) and once achieved, the reverse saturation current remains fairly constant over a wide range of reverse voltages. The voltage point at which the voltage across the diode is stable is called zener voltage.

ii)

Zener Diode I-V characteristics



(ii) Zener diode Regulator circuit diagram



Label

* R_S - Resistor
* V_S - voltage source
* V_{out} - stabilised output voltage
* R_L - load resistance
* I_Z - load current across zener diode