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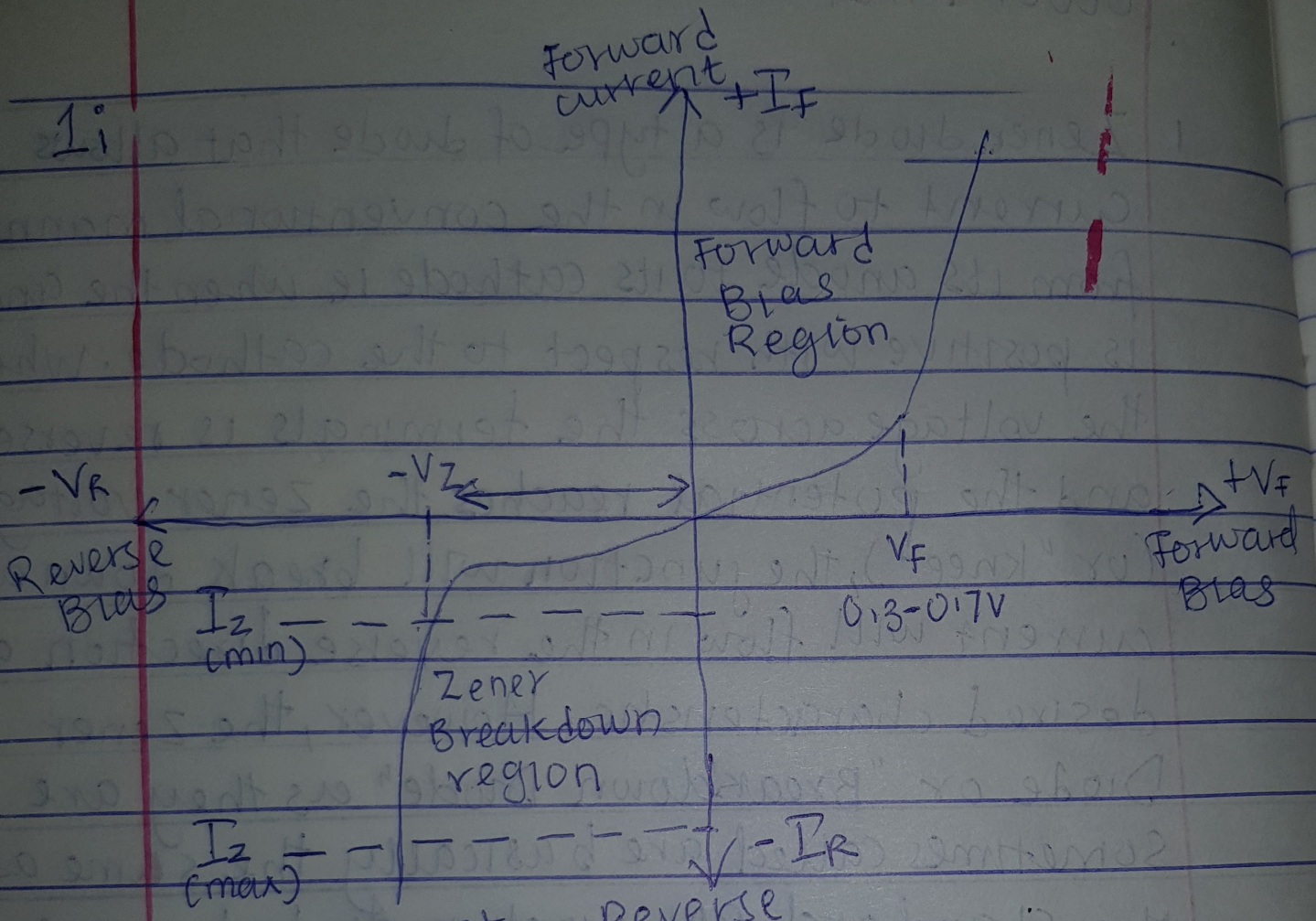
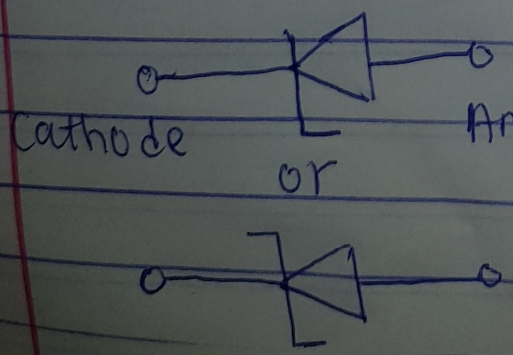
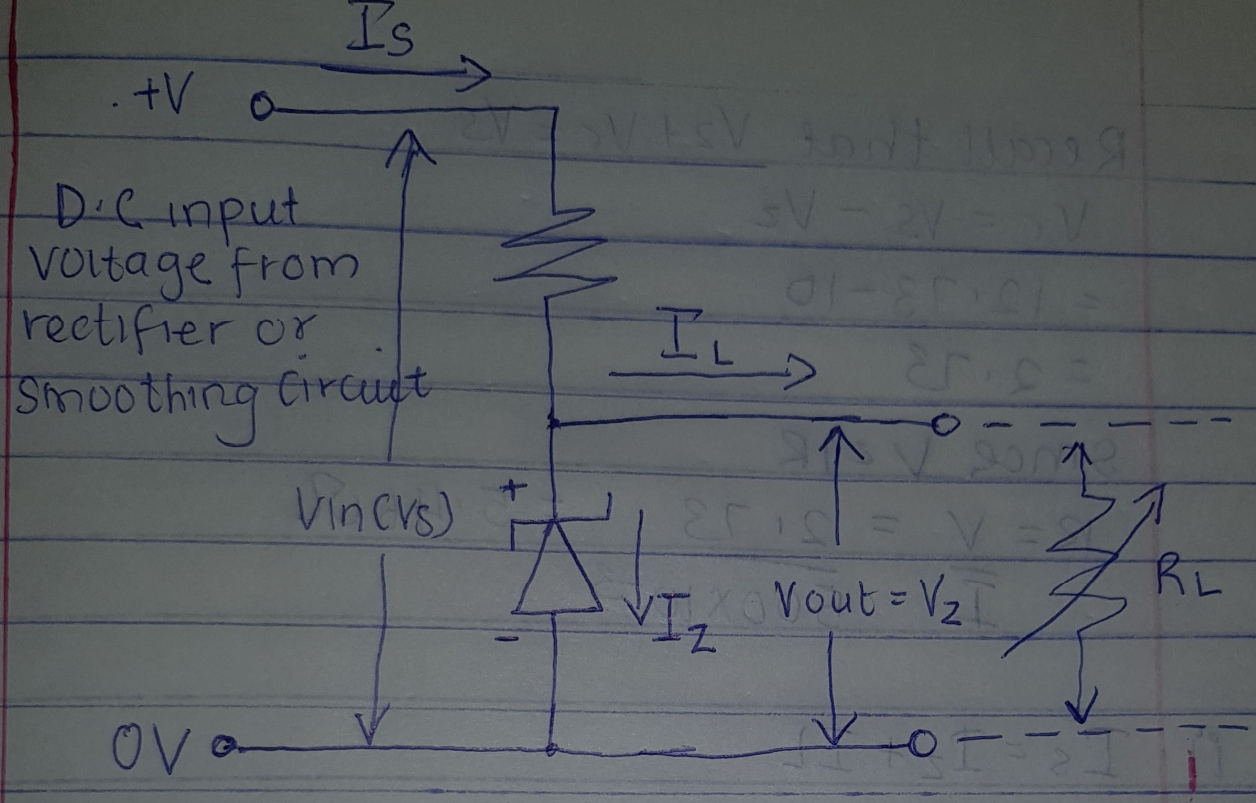
18/ENG04/055
ELECTRICAL/ELECTRONICS ENGINEERING

1 Zener diode is a type of diode that allows current to flow in the conventional manner from its anode to its cathode ie when the anode is positive with respect to the cathode. When the voltage across the terminals is reversed and the potential reaches the Zener voltage (or "knee"), the junction will break down and current will flow in the reverse direction a desired characteristic. However, the Zener Diode or "Breakdown Diode" as they are sometimes called are basically the same as the standard PN junction diode but are specially designed to have a low predetermined reverse breakdown voltage that takes advantage of this high reverse voltage


Forward current
+I_F
Forward Bias Region
$-V_R$
$-V_Z$
$+V_F$
Reverse Bias
V_F
0.3-0.7V
Forward Bias
$I_{Z(min)}$
Zener Breakdown region
$I_{Z(max)}$
$-I_R$
Constant Zener Voltage
Reverse current

Symbol


Cathode
Anode
or



2 i) $P_Z = 5W$

$I_Z = 500mA$

$20V_{max}$

To convert V_{max} to VDC

$$V_s = V_{DC} = \frac{2V_{max}}{\pi}$$

$$V_s = \frac{2 \times 20}{\pi} = 12.73 V_{DC}$$

Recall that $P = IV$

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

Recall that $V_z + V_r = V_S$

$V_r = V_S - V_z$

$= 12.73 - 10$

$= 2.73$

Since $V = IR$

$R = \frac{V}{I} = \frac{2.73}{500 \times 10^{-3}} = 5.46\Omega$

ii) $I_S = I_z + I_L$

$I_z = I_S - I_L$

$I_L = \frac{V_z}{R} = \frac{10V}{500\Omega} = 0.02A = 20mA$

$I_z = 500mA - 20mA$

$= 480mA = 0.48A$