18/ENG07/007
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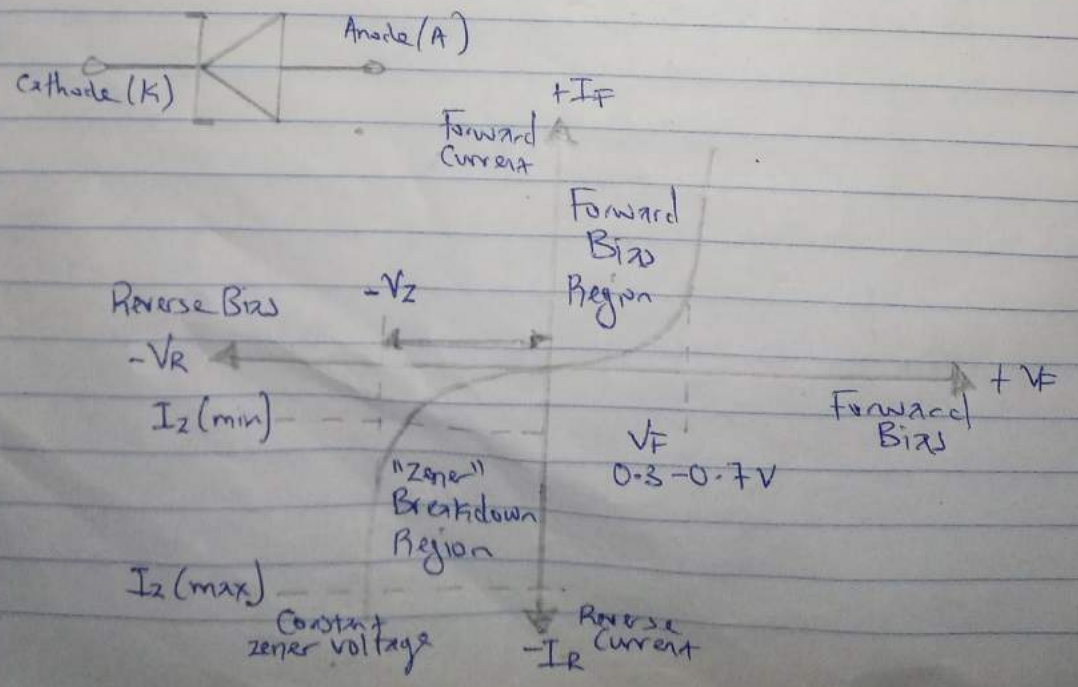
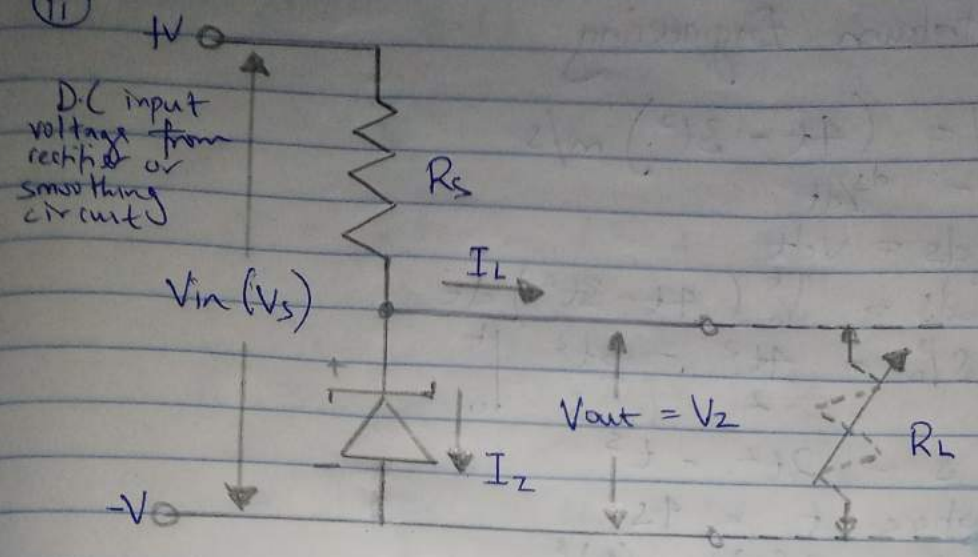
Answers

(1) Zener diodes can be used to produce a stabilised voltage output with low ripple under varying load current conditions. By passing a small current through the diode from a voltage source, via a suitable current limiting resistor (R_S), the zener diode will conduct sufficient current to maintain a voltage drop of V_{out}.
Resistor, R_S is connected in series with the zener diode to limit the flow of current through the diode with the voltage source, V_S being connected across the combination. The stabilised output voltage V_{out} is taken from across the zener diode. The zener diode is connected with it's cathode terminal connected to the positive rail of the DC supply so it is reversed biased and will be operating in it's breakdown condition. The stabilised output voltage is always selected to be the same as the breakdown voltage V_Z of the diode.

(i)



(ii)



(2) (i)

$P_Z = 5W$

$I_Z = 500mA$

$20\ V_{max}$

$V_{dc} = \frac{2V_{max}}{\pi}$

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

$P = IV$

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

$V_Z = 10V$

$V_Z + V_R = V_S$

$V_R = V_S - V_Z$

$= 12.73 - 10$

$= 2.73V$

$\therefore \quad V = IR$

$R = \frac{V}{I}$

$= \frac{2.73}{500 \times 10^{-3}} \qquad \therefore \quad R = 5.46\Omega$

(ii) Since it's in series connection, it will have same current

$$I_S = I_Z + I_L$$

$$I_Z = I_S - I_L$$

$$I_L = \frac{V_Z}{R}$$

$$= \frac{10}{500\Omega} = 0.02A$$

$$= 20mA$$

$$I_Z = 500mA - 20mA$$

$$= 480mA = \underline{\underline{0.48A}}$$