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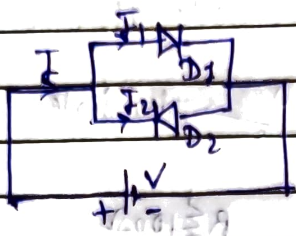
A045

DEL Tutorial no 1 U20CS045

(1) In the circuit below, the current voltage relationship when D_1 and D_2 are identical is given by (assume germanium diodes)



$D_1 \rightarrow FB$

$D_2 \rightarrow RB$

→ std diode current eq^n is:-

$$I = I_0\left(e^{V_D/nV_T} - 1\right) \text{ —— } (1)$$

$$I = I_1 + I_2 \text{ —— } (2)$$

for germanium diode $n = 1$
for silicon diode $n = 2$,
so now $\Rightarrow I = I_0\left(e^{V_D/V_T} - 1\right)$ —— (1a)

→ $I_1 = I_0\left(e^{V_D/V_T} - 1\right)$

$I_2 = I_0$

from above eq^n, $I = I_0\left(e^{V_D/V_T} - 1\right) + I_0$

$$I = I_0 e^{V_D/V_T}$$

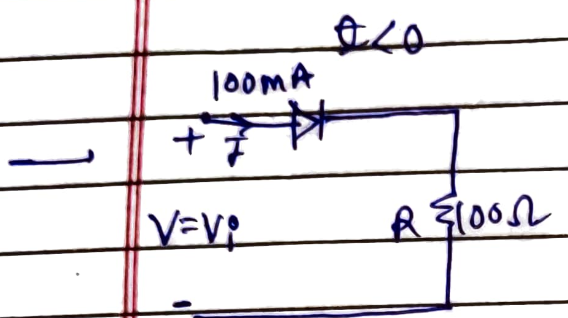
$$\frac{I}{I_0} = e^{V_D/V_T}$$

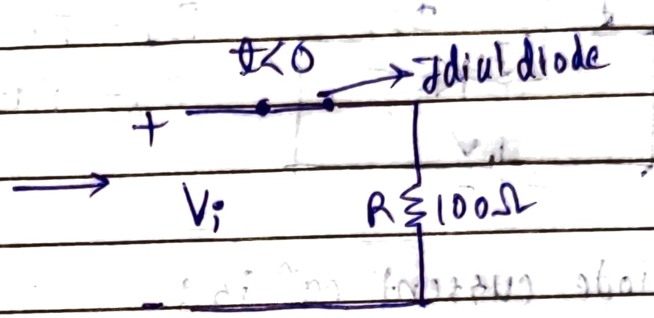
$$\log\left(I/I_0\right) = V/V_T \quad \text{(Taking log both the sides)}$$

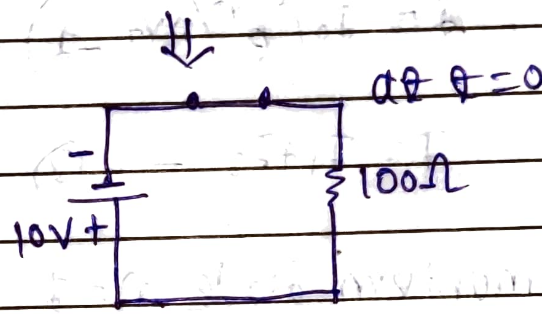
$$V = V_T \ln\left(I/I_0\right)$$

$$\boxed{V = \frac{kT}{q} \ln\left(I/I_0\right)}$$

(2) A pN junction diode with a resistor of 100 Ω, is FB so that a current of 100mA flows. If the voltage across this combination is instantaneously reversed to 10 volts at $t=0$, the reverse current that flows through the diode at $t=0$, is approx





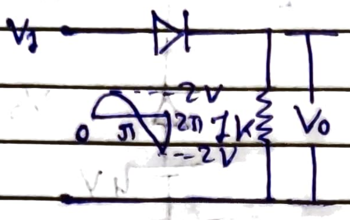


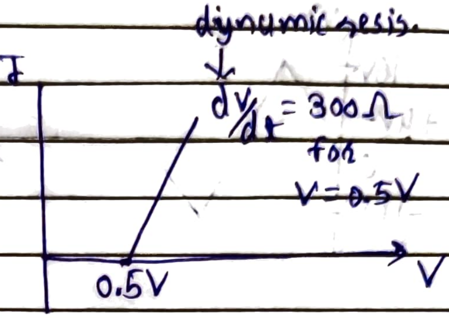
$I = V/R$

$= 10/100$

$= 0.1 \text{ A}$

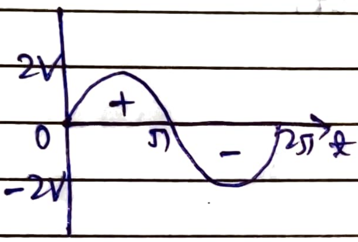
(3) Consider the circuit shown in fig(a). If the diode used here has the V-I characteristic as in fig(b). Then the output waveform V_o is,



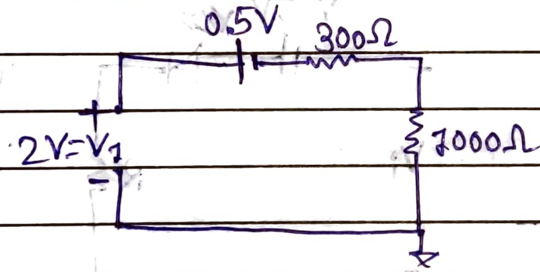


$r_f = 300\,\Omega$

$V_f = 0.5\,V$



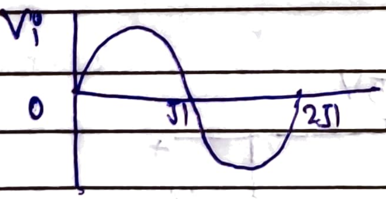
Case:-I

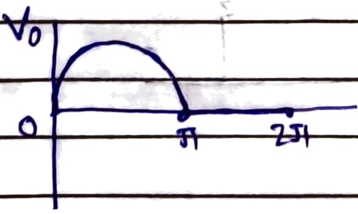


$\Rightarrow V_o = 1.15\,Volt$

Case:-II $V_o = 0$

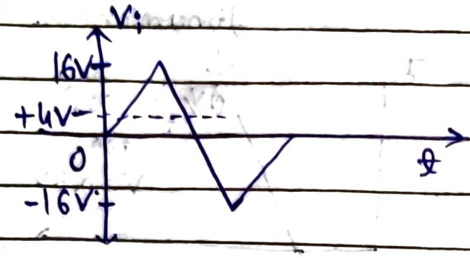
→

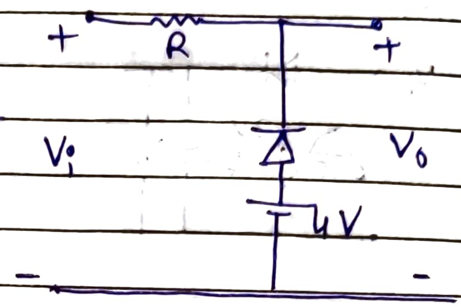




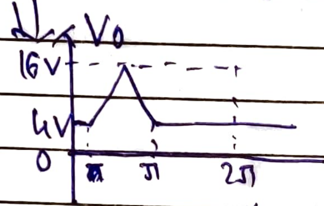
(4) determine output voltage V_o,

Case:1

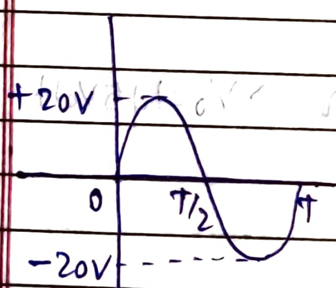


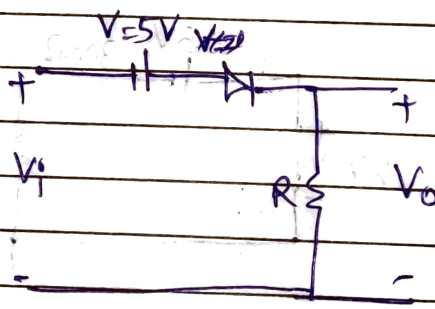


In positive cycle we'll get 16 V as a output.
In negetive half ⇒ 4V as a output,

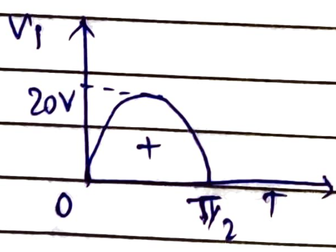


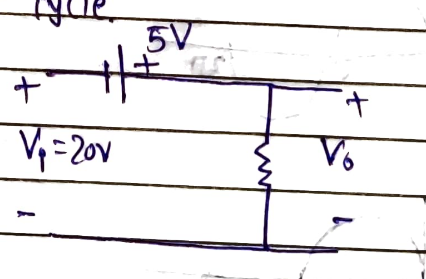
Case:2





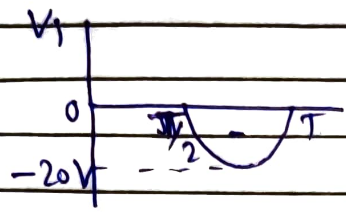
Case:1 for +ve half cycle

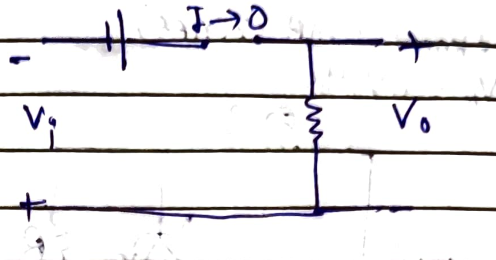




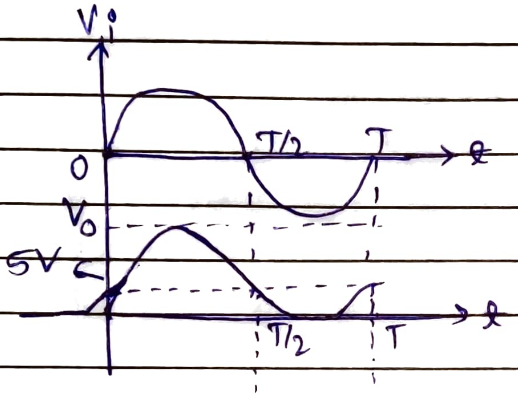
$V_o = V_i + V = 25V$

Case II: for -ve half cycle.





$\boxed{V_0 = 0}$



(5) $R_S = 240\ \Omega$

$V_S = 30V$

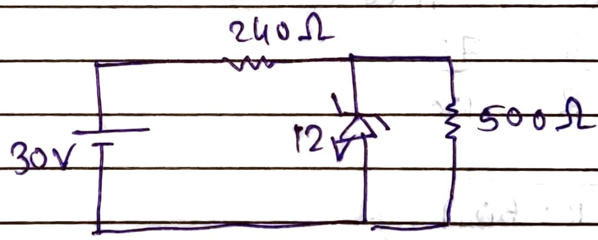
$V_Z = 12V$

$R_L = 500\ \Omega$

$V_{RL} = (?)$

$V_{RS} = (?)$

$I_Z = (?)$



$\boxed{V_{RL} = 12V}$

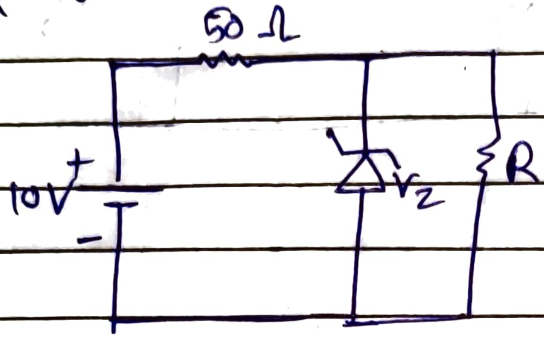
→ $I_Z = \dfrac{30-12}{240} - \dfrac{12}{500} = 0.099\ A$

$\boxed{V_{RS} = 18V}$

(6) $V_z = 6V$, $R_z = 0$

$I_{knee} = 5mA$ (zener)

$V_R = 6$ Volts



$I_z = 5mA$

$$I_z = \frac{10-6}{50} - \frac{6}{R}$$

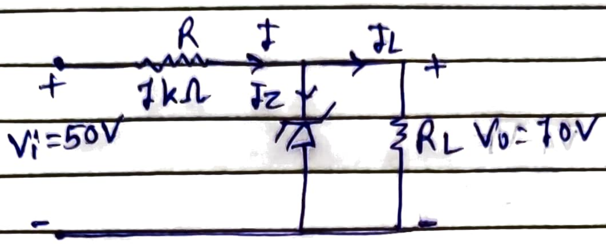
$$\frac{5}{1000} = \frac{4}{50} - \frac{6}{R}$$

$$\frac{6}{R} = \frac{80-5}{1000}$$

$$\frac{6}{R} = \frac{75}{1000}$$

$$\boxed{R = 80\,\Omega}$$

(7)



→ $V_0 = 10V$ hence $V_Z = 10V$

$I = \frac{50-10}{R} = \frac{40}{1000} = 40mA$

Using KCL, $I = I_Z + I_L$

$40 = I_Z + I_L$

→ Range of $I_L \Rightarrow$ 0 to 40mA.

for R_L,

$R_L = V_0/I_L = 10/I_L$

for $I_L = 0 \Rightarrow R_L = \infty$

$I_L = 40 \Rightarrow R_L = 10/40 \times 10^3 = 250\,\Omega$

→ Max power across zener diode $= V_Z (I_Z)_{max}$

→ $V_Z = 10V$, $I_Z + I_L = 40 \Rightarrow (I_L)_{max} = 40mA$

$\therefore$ Max Power $= V_Z (I_Z)_{max}$

$= (10)(40) \times 10^{-3}$

$\boxed{= 0.4 \text{ watt}}$