1 (a)

2 nA is obtained at 10°C

×2 → 4 nA " " " 20°C (+10°C)

×2 → 8 nA " " " 30°C

×2 → 16 nA " " " 40°C

×2 → 32 nA " " " 50°C

(b)

$T \uparrow \quad V_{ON} \uparrow \quad$ rate = 2·5mV/°C

(c)

i. p → n direction → forward biasing

$I_D = I_S e^{\left(\frac{V_D}{nV_T}\right)}$

$\Rightarrow 5 \times 10^{-3} = 6 \times 10^{-9} e^{\frac{V_D}{0.0266}}$

$\Rightarrow V_D = 0.3626\ V$

$I_S = 6\ nA$

$n = 1$

$V_{ON} = 0.2\ V$

$V_{br} = -3\ V$

[V_{br} is a -ve parameter]

$T = 35°C$

$= 308\ K$

$V_T = \frac{KT}{q}$

$= 0.0266\ V$

ii. $I_D = 0 \rightarrow$

we know, I_D becomes zero if

$V_{app}/V_D \leq V_{ON}$

$\Rightarrow V_D \leq 0.2\ V$

iii. $I_D = I_S = 6\ nA$ (n → p) direction → reverse biasing

$-V_{br} < V_D < 0$

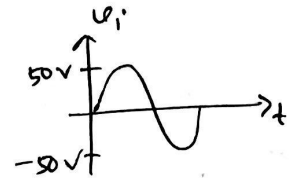
$\Rightarrow -3 < V_D < 0$

21

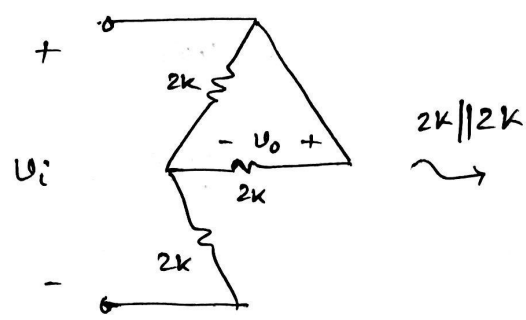
Here, $V_{i,RMS} = \frac{V_{i,max}}{\sqrt{2}}$

$\Rightarrow V_{i,max} = 25\sqrt{2}.\sqrt{2}$

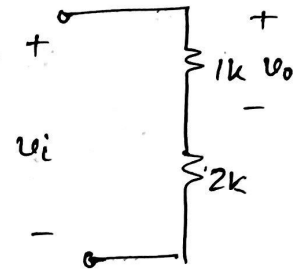
$= 50\ V$



(a) for +ve hc,



$2k \| 2k$



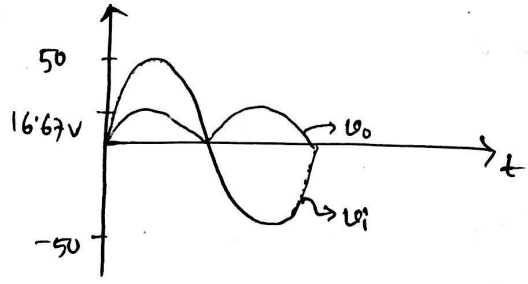
Voltage division rule,

$$v_o = \frac{1k}{1k+2k} v_i$$

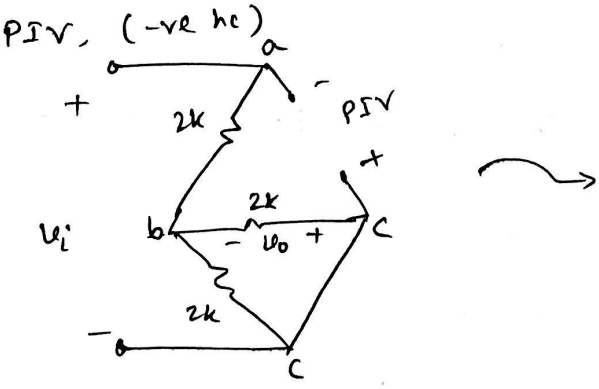
$$\Rightarrow v_o = \frac{v_i}{3}$$

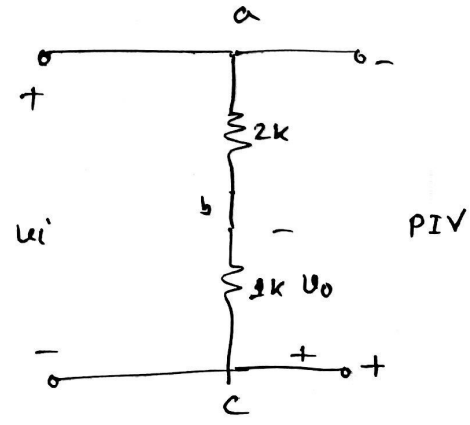
for -ve hc,

$$v_o = -\frac{v_i}{3}$$



(b) for PIV, (-ve hc)





$PIV = -v_i$

$= -v_{i,max} = -(-50)$

$= 50\ V$

(c)

$v_i \longrightarrow$ sine wave $\longrightarrow$ $v_{i,avg} = 0$

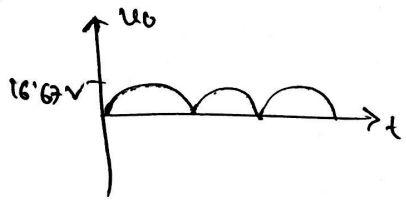
$v_o \longrightarrow$ full-wave $\longrightarrow$ $v_{o,avg} = \frac{2}{\pi} \times v_{o,max}$

$= \frac{2}{3.1416} \times 16.67$

$= 10.61$ V

(e)

(a) Only half wave rectifiers can be considered as clippers since $v_o = 0$ for in any half cycle of half-wave. Since the given circuit represents a full-wave,



v_o Can't be considered

(d)

$|PIV| < |V_{br}|$

$\Rightarrow |V_{br}| > |PIV|$

$\Rightarrow |V_{br}| > 33.33$ V

3] for +ve hc,

$v_o = -5$V $\nearrow$ v_o is taken across diode

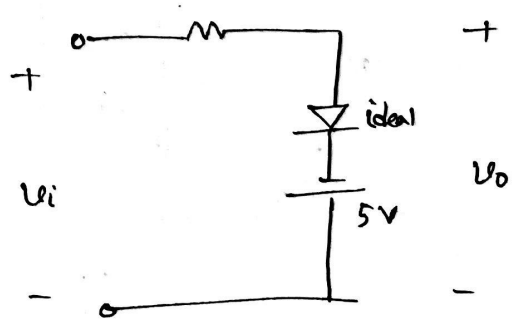
for -ve hc,

$v_o = v_i$

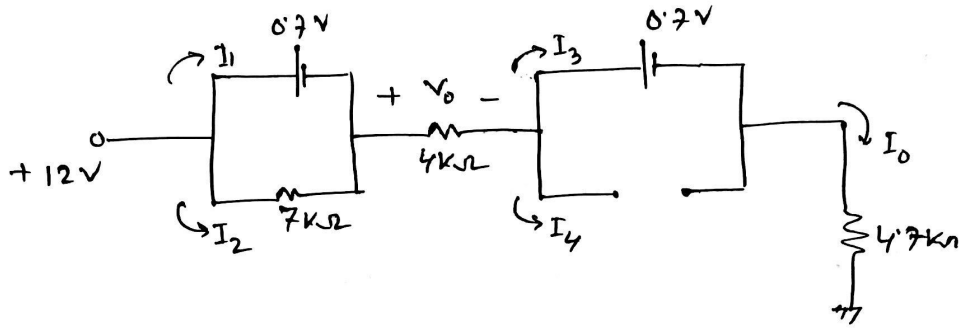
$\swarrow$

diode should be RBed

for -ve hc



4|



Here, $I_4 = 0$ & $I_3 = I_0$

KVL,

$$-12 + 0.7 + 4I_0 + 0.7 + 4.7I_0 = 0$$

$$\Rightarrow I_0 = 1.22 \text{ mA}$$

again, KVL, $-12 + 7I_2 + 4I_0 + 0.7 + 4.7I_0 = 0$ $\Rightarrow I_2 = 0.098$ mA $\hookrightarrow \approx 0.1$ mA

OR,

$$I_2 = \frac{0.7}{7} = 0.1 \text{ mA}$$

So, $I_1 = I_0 - I_2 = 1.12$ mA

Finally,

$I_1 = 1.22$ mA

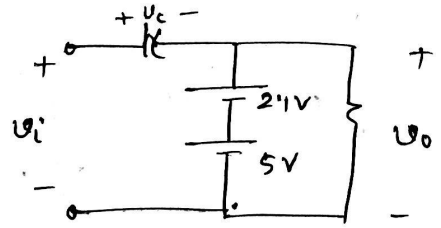
$I_2 = 0.1$ mA

$I_3 = 1.12$ mA

$I_4 = 0$

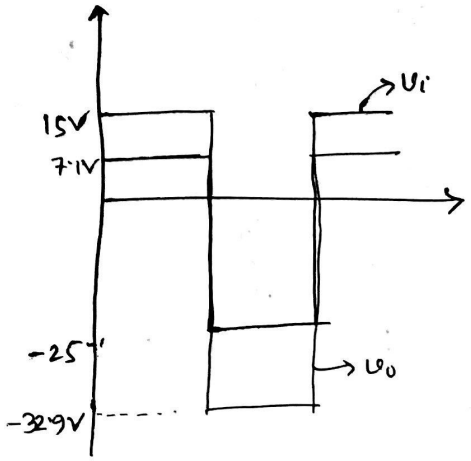
$V_0 = 4I_0 = 4.88$ V

5| for +ve hc,



$v_0 = 2.1 + 5$ | KVL, $v_i = v_c + v_0$

$\Rightarrow v_0 = 7.1$ V | $\Rightarrow v_c = 7.9$ V



for -ve hc,

$-v_i + v_c + v_0 = 0$

$\Rightarrow v_0 = v_i - v_c = -25 - 7.9$

$\Rightarrow v_0 = -32.9$ V

$$v_0 = \begin{cases} 7.1\text{V} & \text{;+ve hc} \\ -32.9\text{ V} & \text{; -ve hc} \end{cases}$$