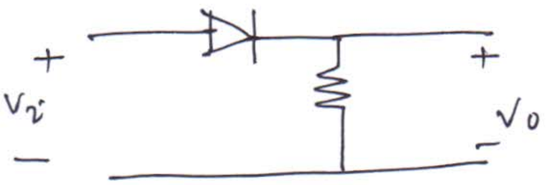
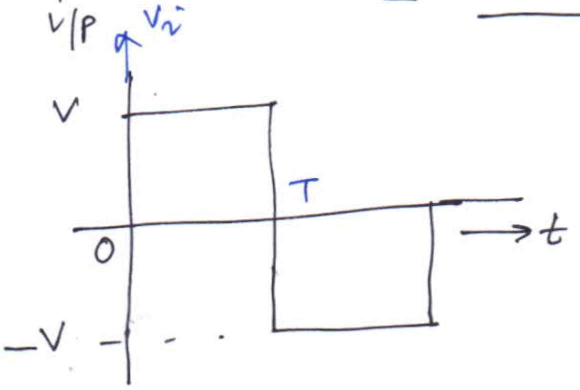
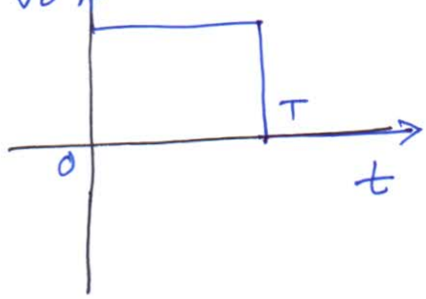
CLIPPERS

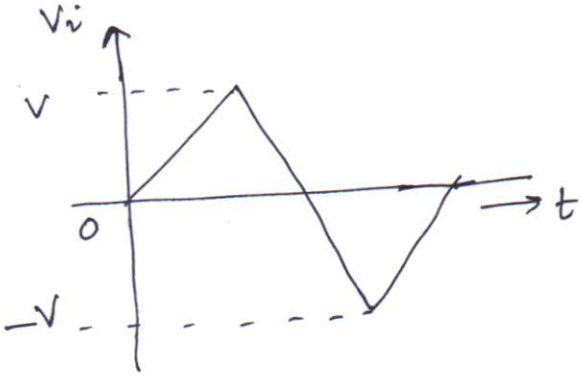
"CLIP" OFF PORTION OF THE I/P SIGNAL WITHOUT DISTORTING REMAINING PART OF THE AC WAVEFORM.

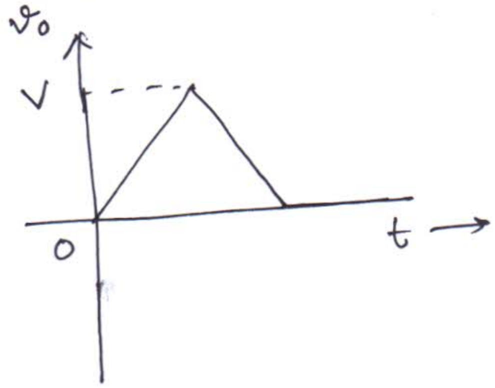
Series.

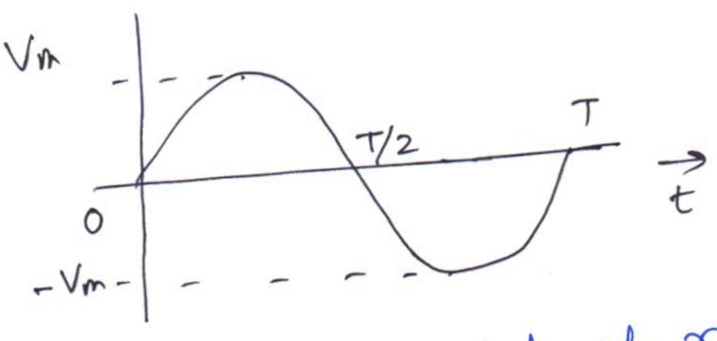


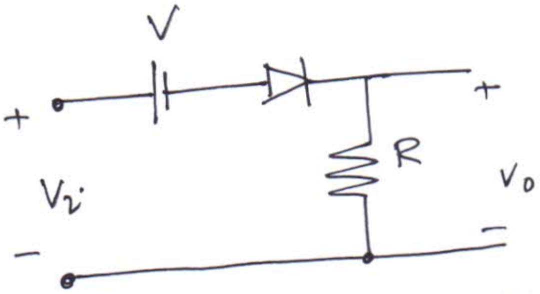








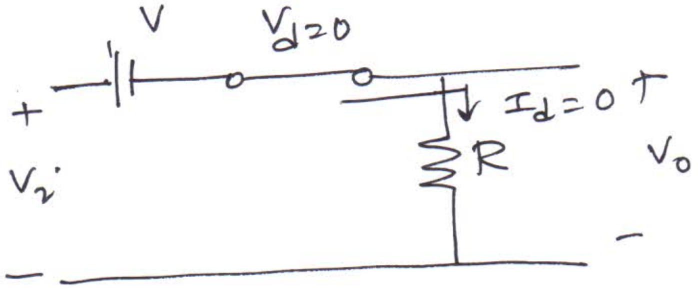




- Make a sketch of response of N/W based on direction of diode and applied voltage
- Determine applied voltage (transition voltage) that causes a change in state of Diode.

For the ideal diode transition occurs at $i_d = 0$, $V_d = 0$

- Apply this condition to the network.



$V_o = I_R \cdot R = I_d \cdot R = 0$

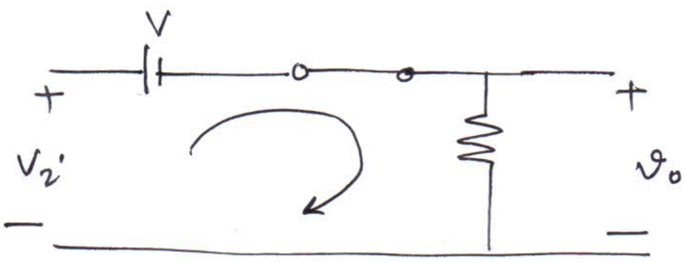
$V_o = 0$

$V_i = V$

So level of $V_i = V$ will cause a change/transition in state.

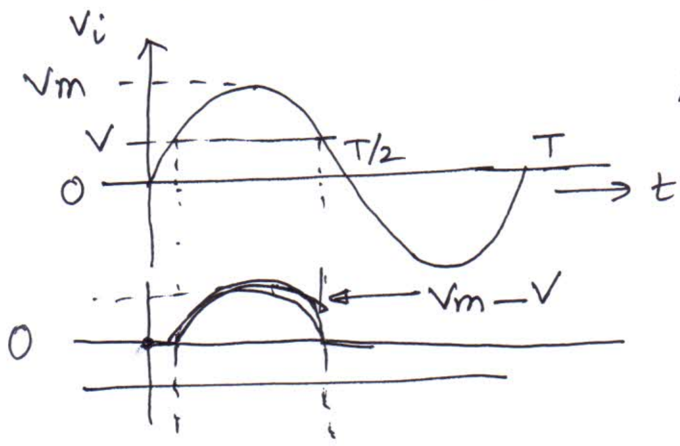
- Thus for an i/p voltage greater than V, diode is in short-ckt state, while for i/p less than 'V' volt, it is in open ckt or OFF state.

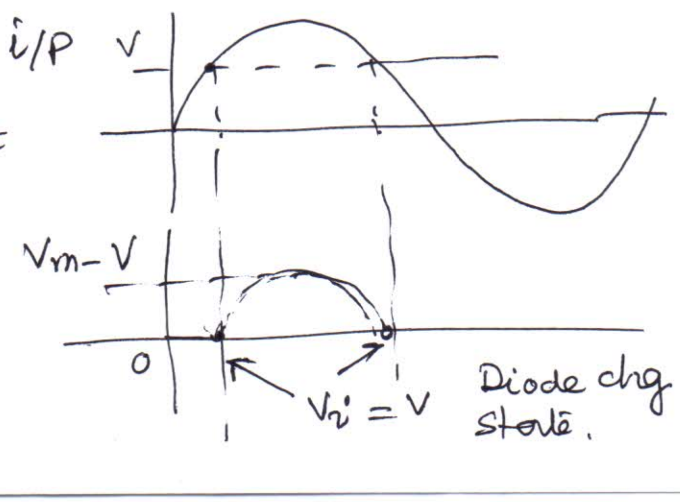
- When the diode is in short ckt state, the o/p voltage V_o can be determined by KVL



$-V_i + V + V_o = 0$

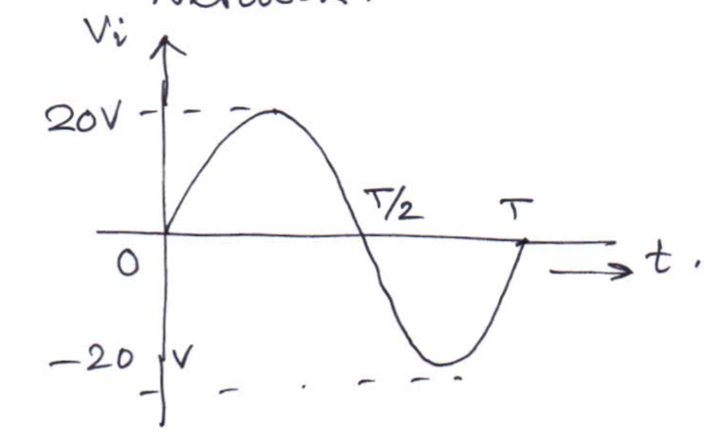
or $v_o = v_i - V$

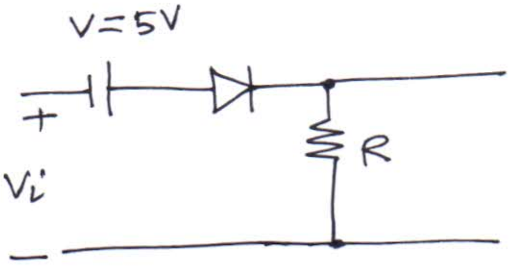




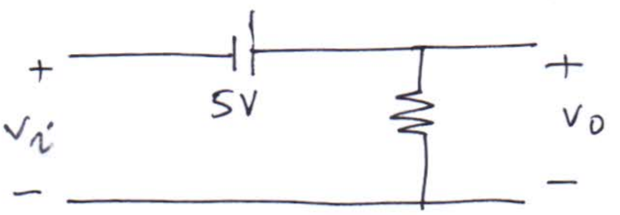
Ex:

Determine the o/p waveform of the Network.





Diode will be ON for +ve V_i



$-V_i - 5 + V_o = 0$

or $\boxed{V_o = V_i + 5}$

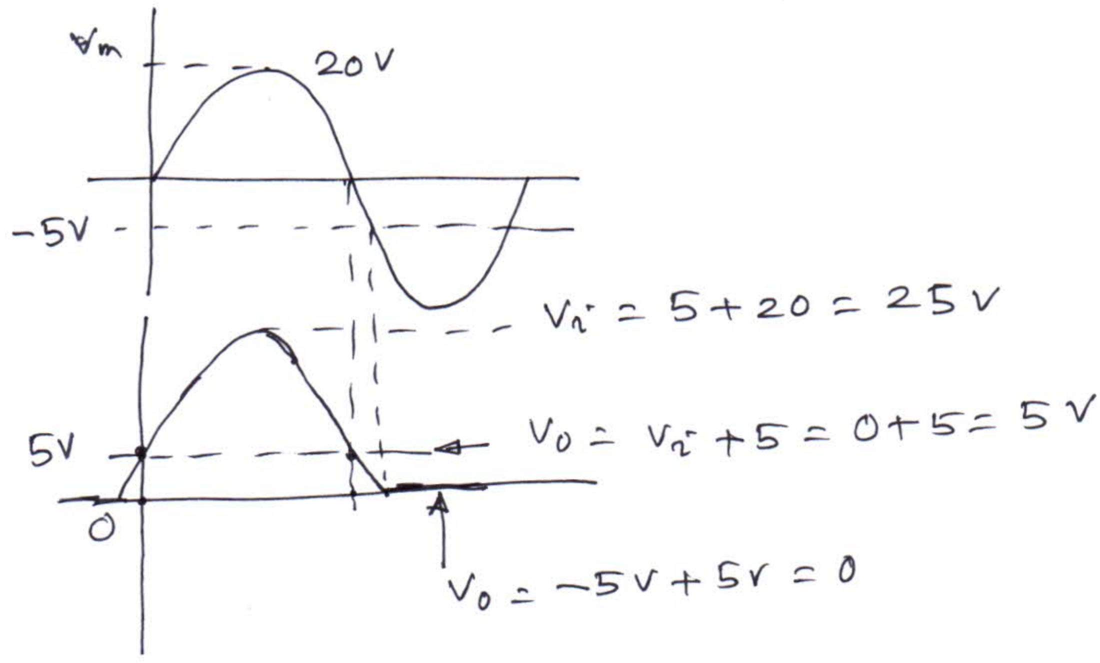
For transition level,

$v_d = 0, \; i_d = 0$

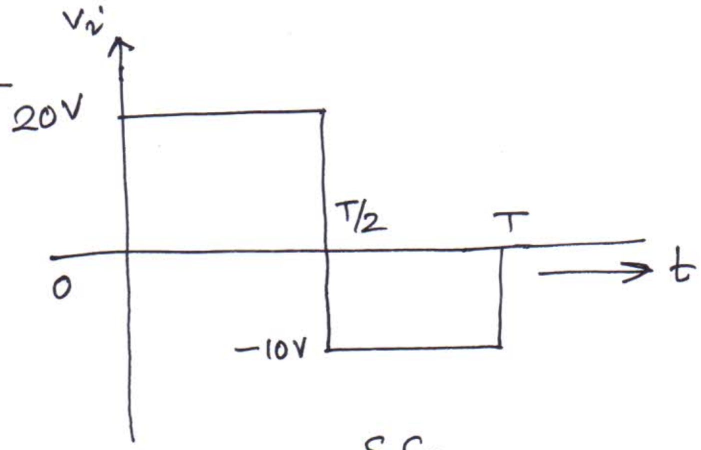
$-V_i - 5 = 0$

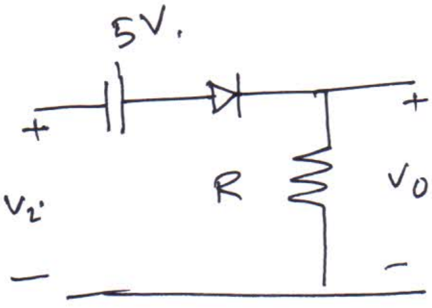
$V_i = -5\,V$

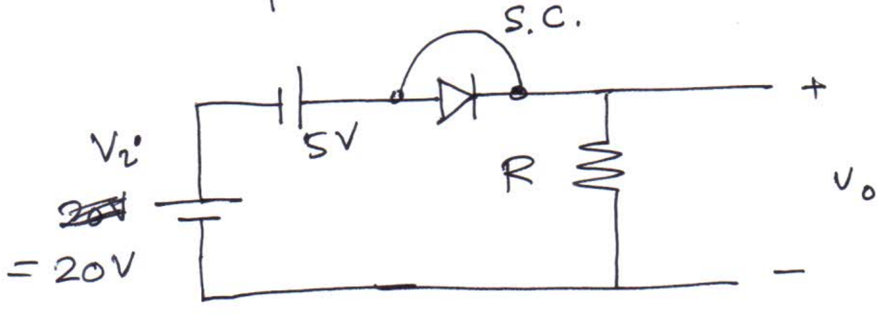
For V_i more negative than $-5V$, Diode is OFF
more +ve " $-5V$ Diode ON



Ex:





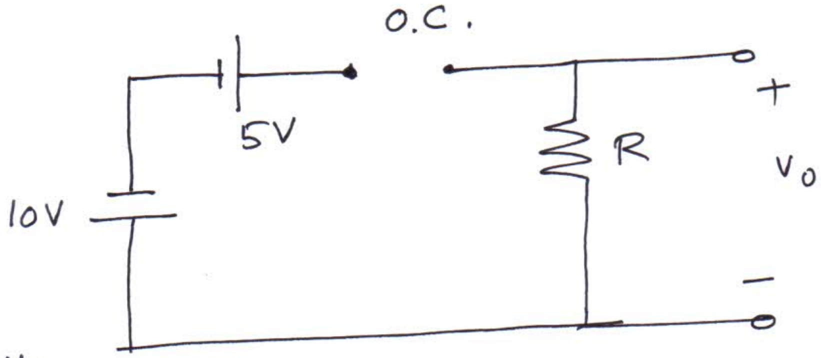


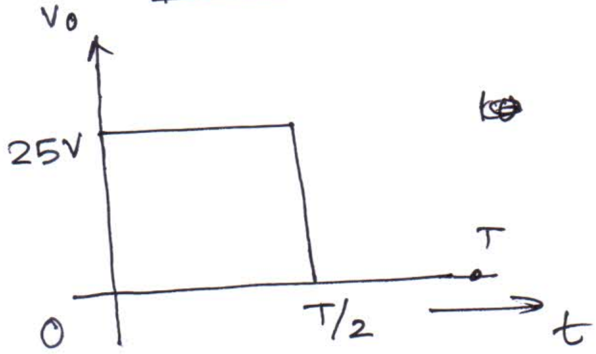
For $v_i = 20V$ $(0 \rightarrow T/2)$, Diode is S.C.

$v_o = 25V.$

For $V_i = -10V$, Diode is OFF / O.ckt.

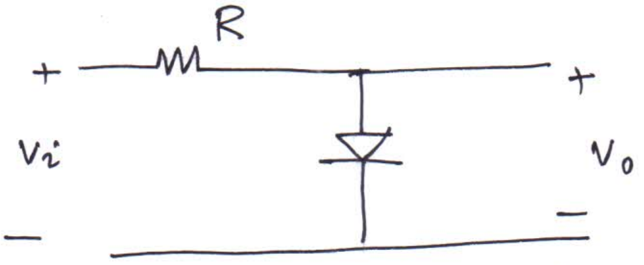
$v_o = 0V.$



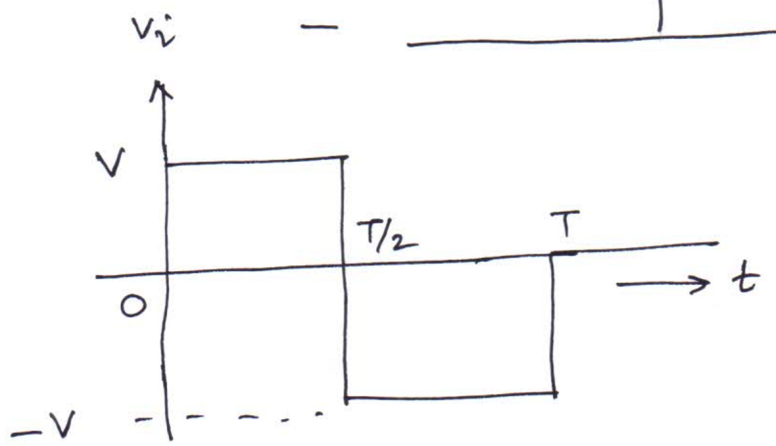


$V_o = 0V.$

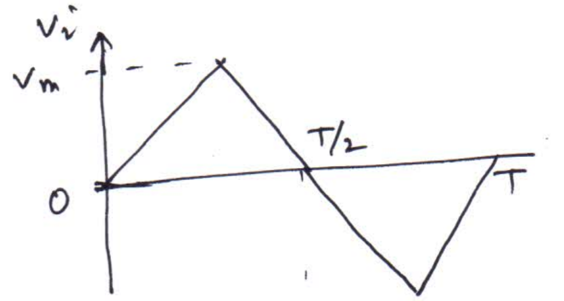
Parallel



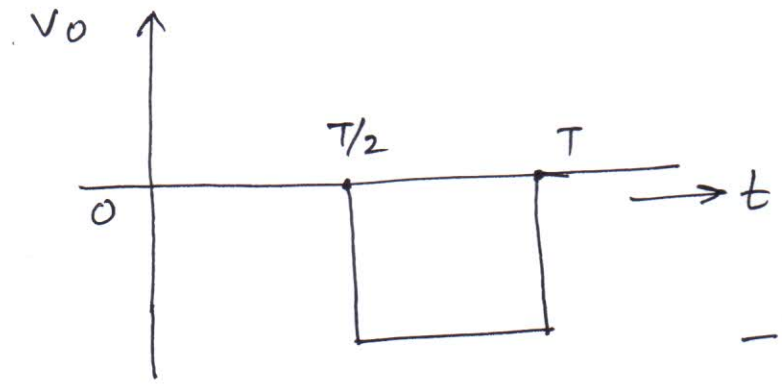
R
+
+
V_i
V_o
−
−



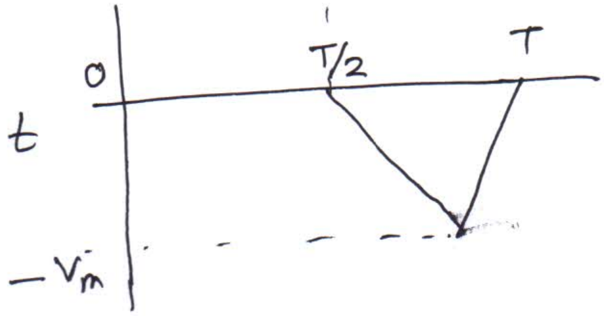
V_i
V
T/2
T
t
0
−V



V_i
V_m
T/2
0
T

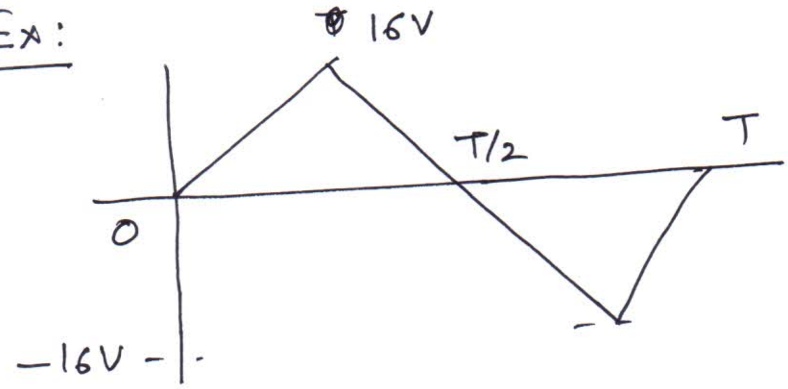


V_o
T/2
T
0
t

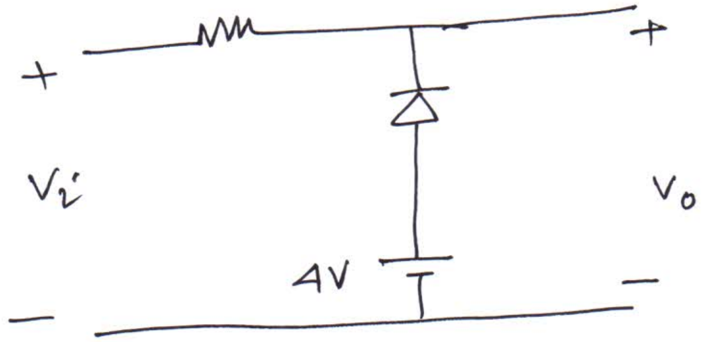


0
T/2
T
$-V_m$

Ex:



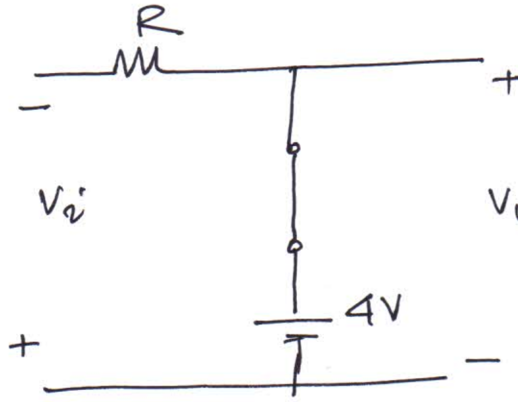
16V
T/2
T
0
−16V



+
+
V_i
V_o
4V
−
−

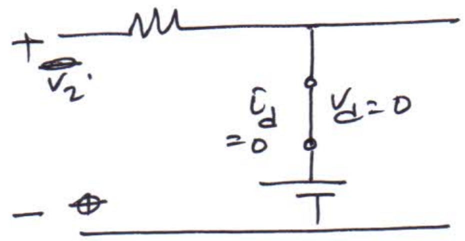
Diode will be ON for −ve region of i/p.

Network appears as



$V_o = 4\,V.$

transition state
$V_d = 0$, $i_d = 0$

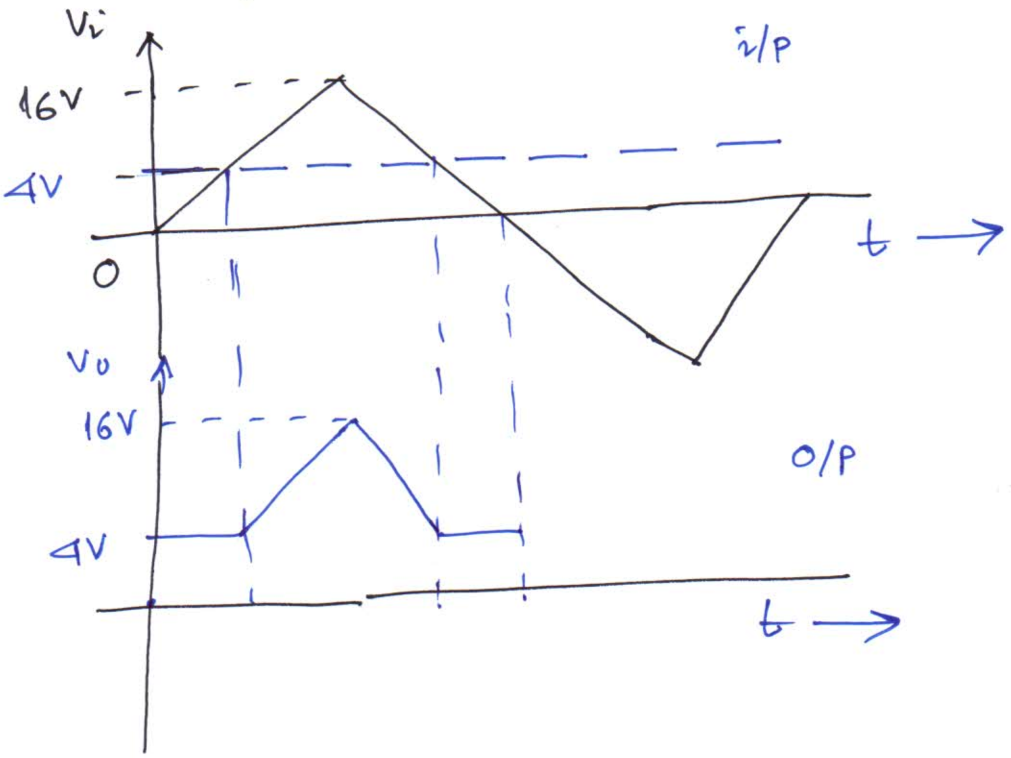


$-V_i + 4 = 0$

$V_i = 4\,V.$

i/p $V_i > 4V$ Diode goes OFF

$V_i < 4V$ Diode is ON.



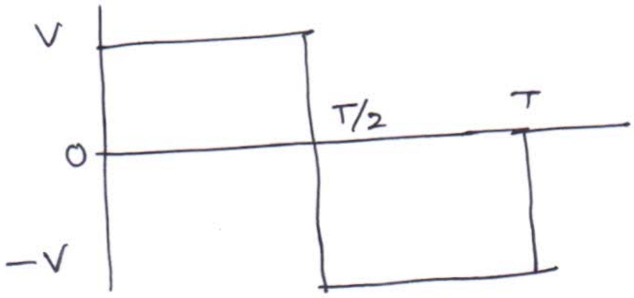
CLAMPERS

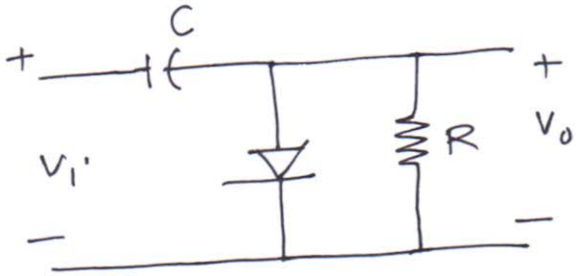
The clamping network will 'clamp' a signal to a different d.c. level.

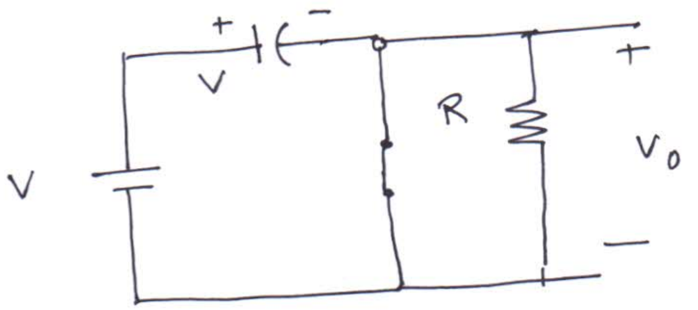
The Network will have a capacitor, diode, resistor.

It can have an independent d.c. supply to introduce additional shift.

R & C chosen such that $\tau = RC$ is large enough to ensure that the voltage across the capacitor does not discharge significantly during the interval when diode is non-conducting.



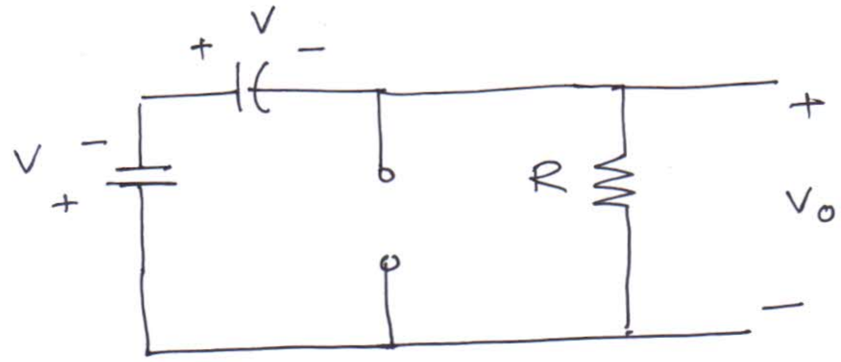




$V_o = 0\ V$

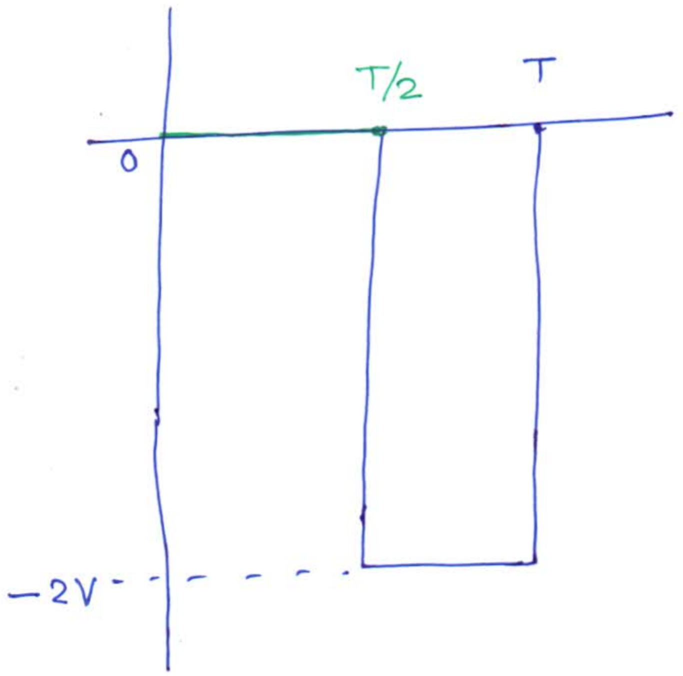
during $0 \rightarrow T/2$

C charges to V quickly



$V_o = -2V.$

O/p <u>wave form.</u>



$V_o = -2V.$

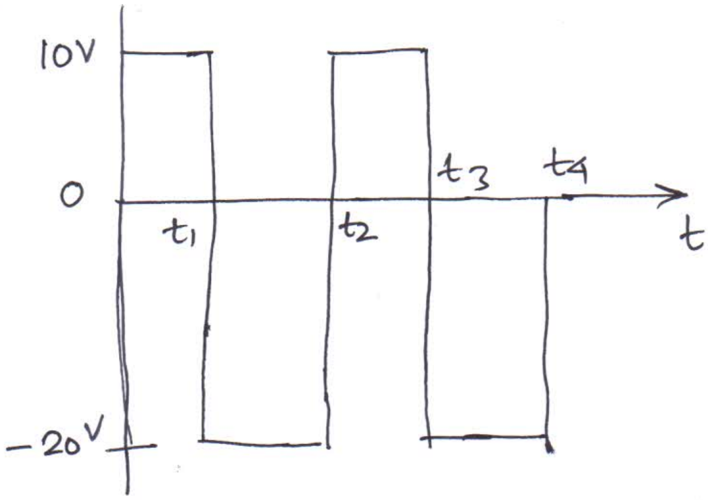
RC product is sufficiently large to establish a discharge period of 5τ much greater than $T/2 \to T$,
capacitor holds onto all its charge and therefore, voltage ($V = Q/C$) during this period.

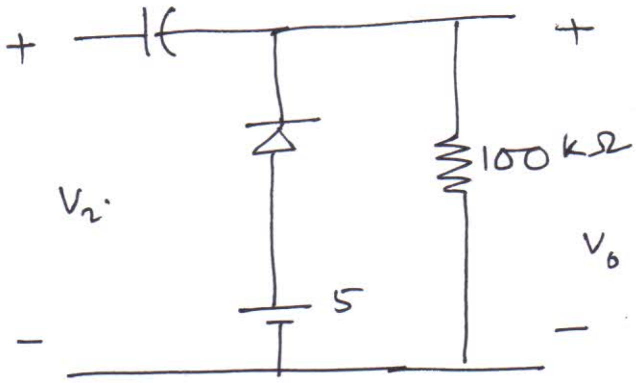
$+V + V + V_o = 0$

or. $V_o = -2V.$

Total swing of O/p
= Total swing of i/p

Ex:





$f = 1000\ Hz$.

Step-1 $\qquad 0 - t_1 = 0.5\ ms$.

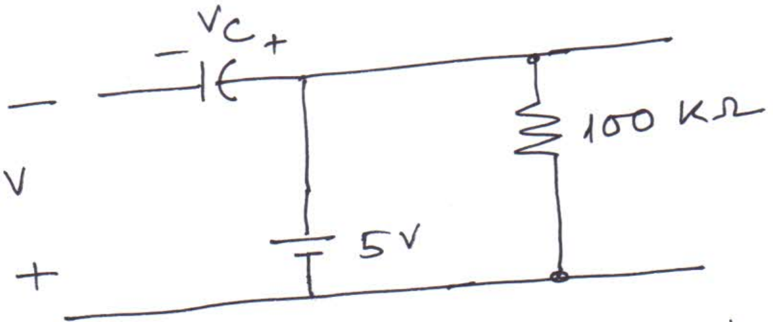
$f = 1000\ Hz \qquad$ period $= 1\ ms$.

- Start the analysis by considering that part of i/p signal which will fwd bias the diode

So we start '$t_1 \rightarrow t_2$'

- During the period when diode is 'ON' capacitor will charge up instantaneously.
- During the period when diode is 'OFF' capacitor holds on its voltage level.

$t_1 \rightarrow t_2$



$V_0 = 5V$

$20 - V_C + 5 = 0$

$V_C = 25\ V$

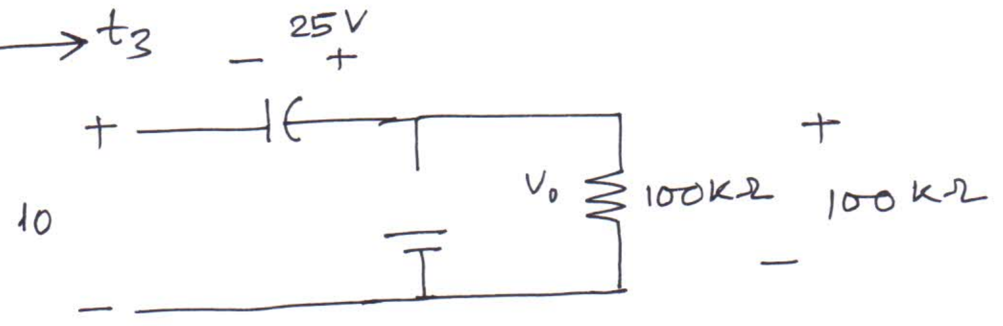
Capacitor charges upto 25 V.

$V_0 = 5V$

$t_1 \rightarrow t_2$

#4

$t_2 \longrightarrow t_3$



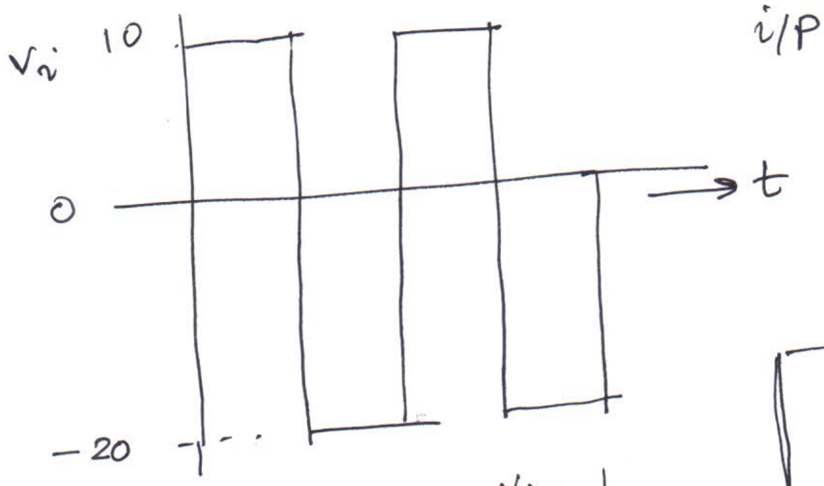
$-10 - 25 + V_0 = 0$ or $V_0 = 35\,V$ $\quad t_2 - t_3,\ V_0 = 35V$

Time const for the discharging n/w

$\tau = RC = 100 \times 10^{3} \times 0.1 \times 10^{-6} = 10\,ms$

$R = 100\,k\Omega \quad C = 0.1\,\mu F$

total discharge time $= 5\tau = 50\,ms.$

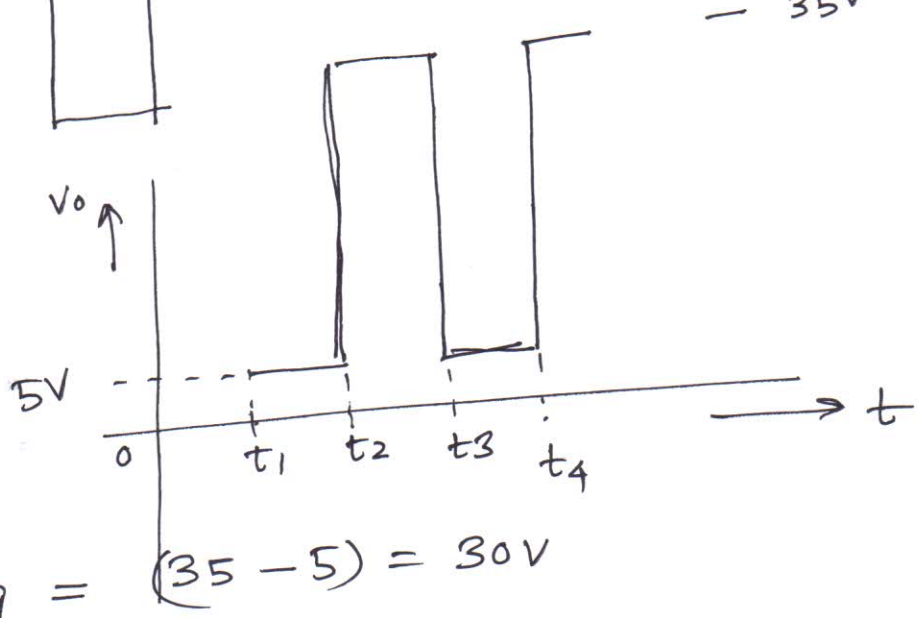


i/p

max i/p swing

$= 10 - (-20)$

$= 30V$



max swing $= (35 - 5) = 30V$