MID Term Assignment

Summer 2021

Sub : Electronic Devices

Sec : R

Name : Jannatul Ferdous Umama

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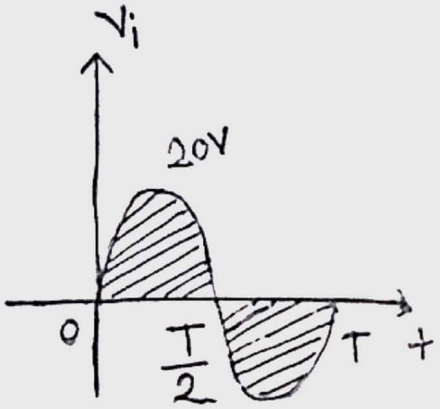
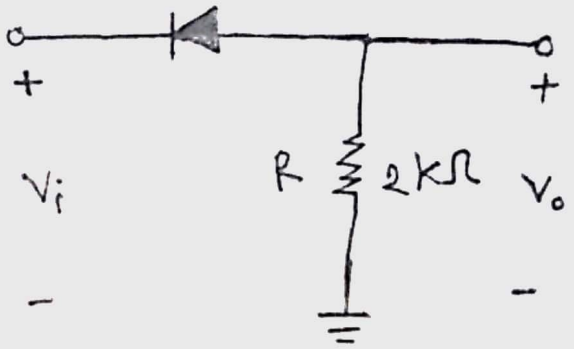
Mid Term Assignment

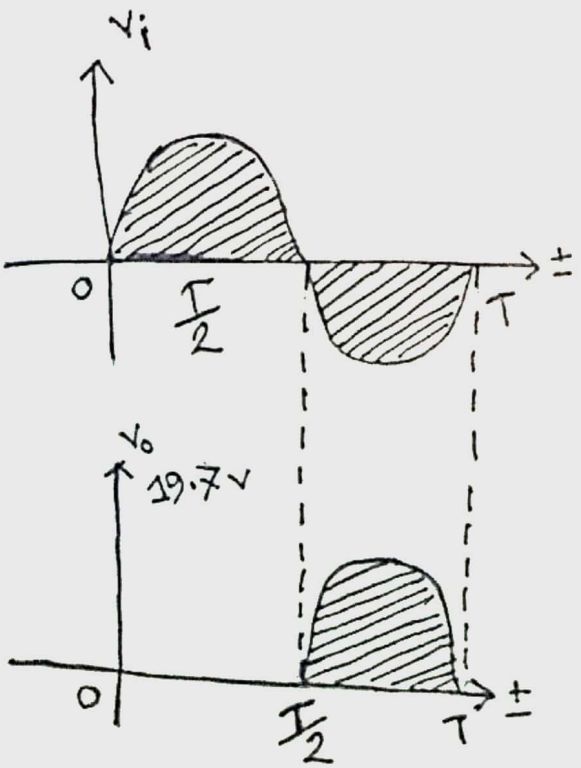
1. (i) Sketch the output v_o for the given network as shown in figure 2 (Consider the diode as Ge)

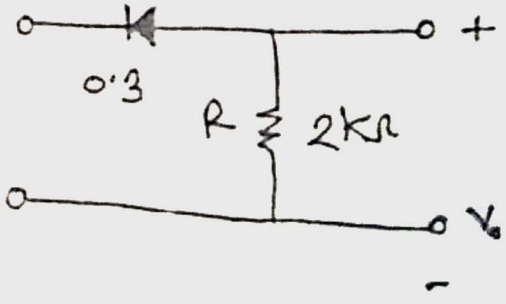
(ii) Repeat part (i) if the diode is replaced by a silicon (Si) diode.





(i)





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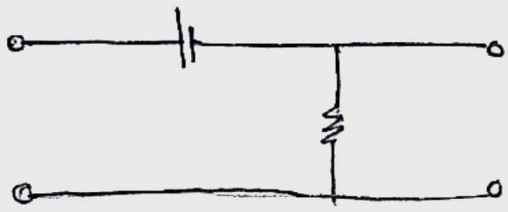
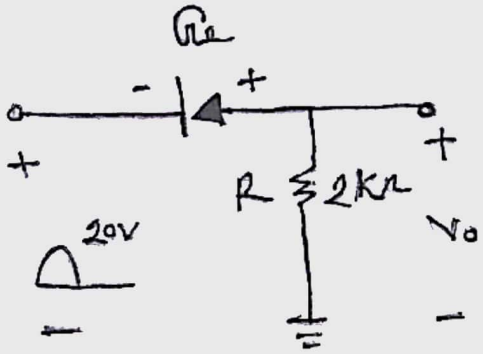
positive Cycle :

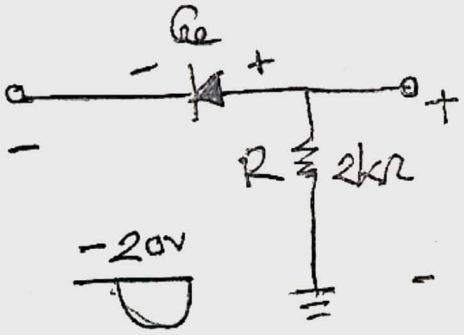
For the positive cycle, the Diode is in Reverse Bias. So, the Diode will act as an open circuit. So, $I = 0A$.





$I_o = 0mA$
$V_o = 0V$

Negative cycle :



Here, the Diode is in Forward Bias.

Applying KVL,

$+20V - 0.3V + V_o = 0$

$\therefore V_o = 19.7V$

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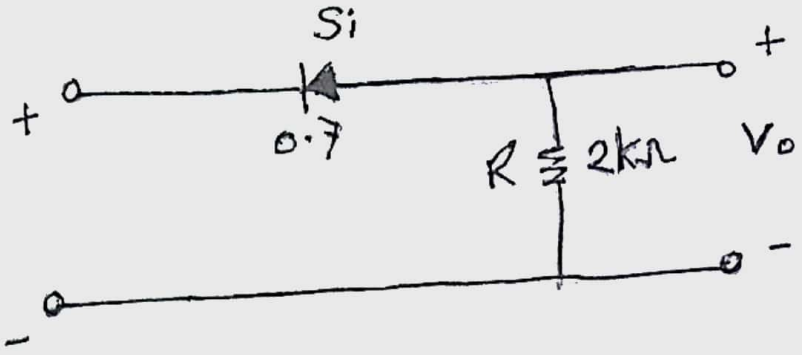
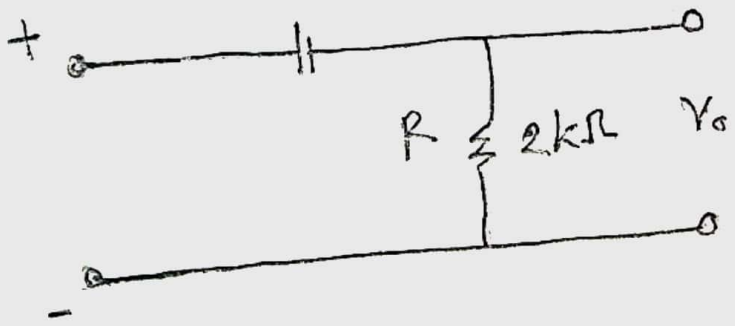
(ii) If the diode is replaced by a Silicon (Si) diode, the circuit will be.



Positive cycle :

For the positive cycle, the Diode is in Reverse Bias, So, current will not flow and it will act as an open circuit.

$\therefore I = 0A$
$V_o = 0V$



$I_o = 0mA$
$V_o = 0V$

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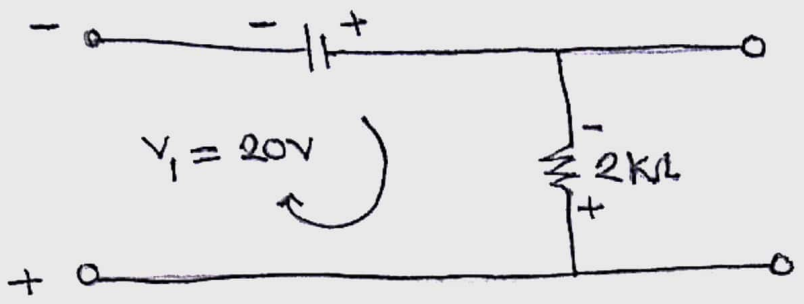
Negative Cycle :



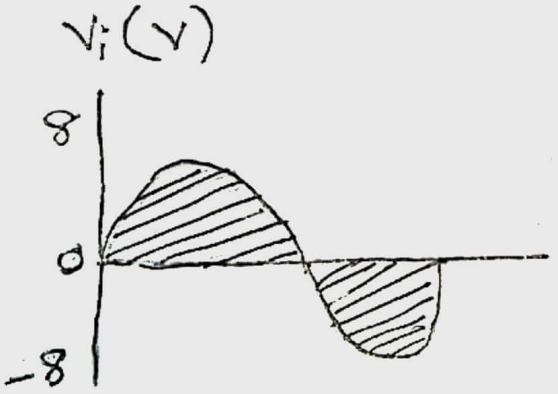
Apply KVL :

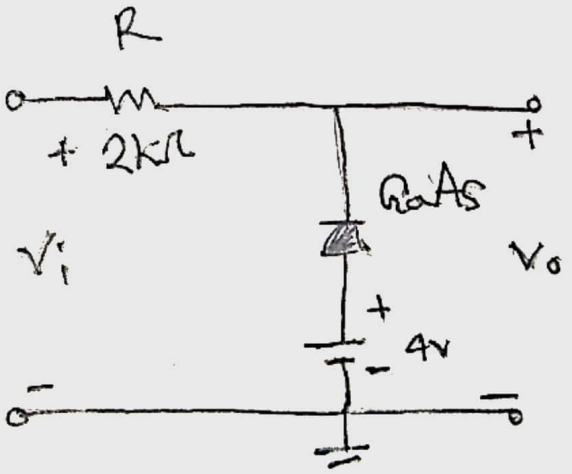
$$20 - 0.7 - V_o = 0$$

$$\Rightarrow V_o = (20 - 0.7)V$$

$$\therefore V_o = 19.3V.$$

2. Determine V_o for the following clipper network. Given, the threshold voltage of GaAs is 1.2V.





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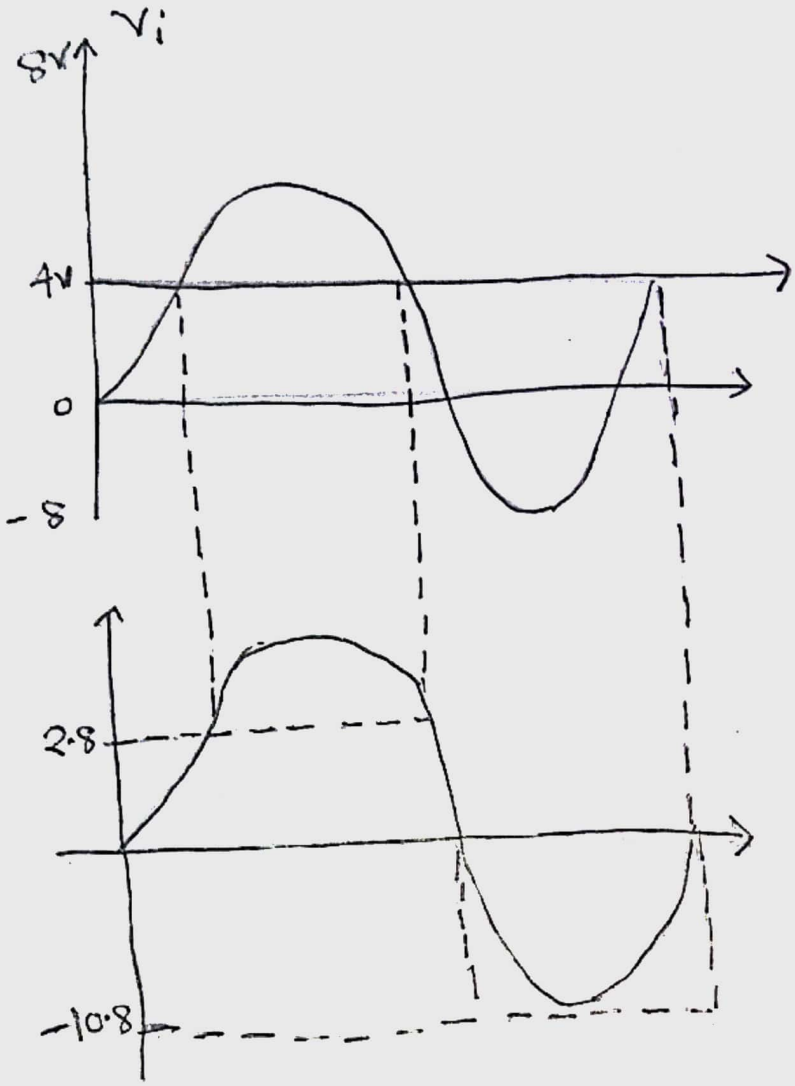

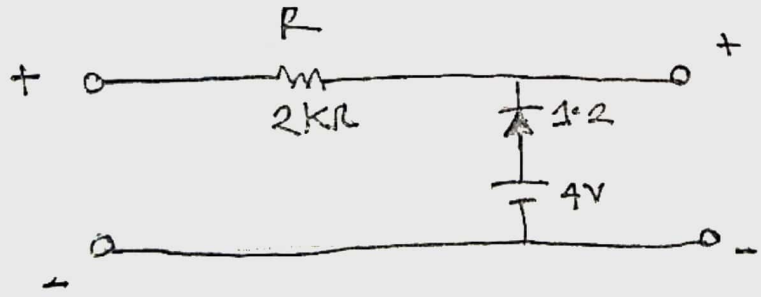

Positive Cycle : For 0 to 4 volt Diode will forword Bias with Battery. For 5 to 8v Diode will reverse Bias.

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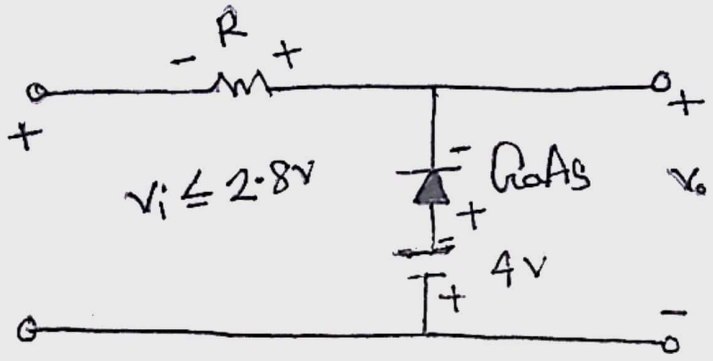
$V_i = 0V$, $V_o = 2.8$ volt

$V_i = 4V$, $V_o = 2.8$ volt

$V_i = 5V$, $V_o = 5$ volt

$V_i = 8V$, $V_o = 8$ volt.

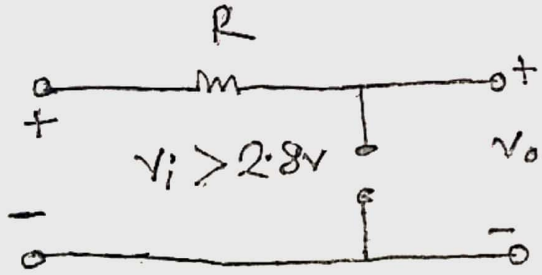


Using KVL,

if, $V_i \leq (4 - 1.2)V$

$\Rightarrow V_i \leq 2.8V$

$\therefore$ Diode is On



if $V_i > 2.8$

$\therefore$ V dc is off. So, Diode is off.

When Diode is On,

Applying KVL :

$$-4V + 1.2V + V_o = 0$$

$$\therefore V_o = 2.8V$$

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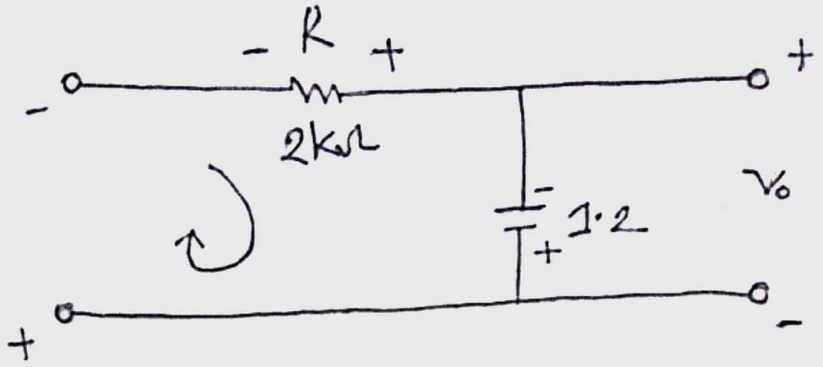
when diode is off

$V_o = V_i$

Negative Cycle :

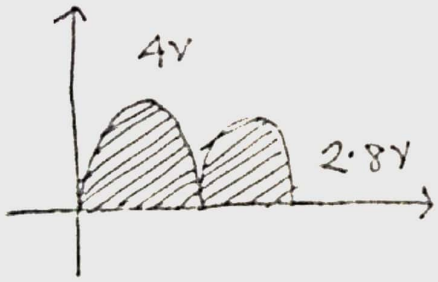


Apply KVL :

$-8V - 4V + 1.2V + V_o = 0$

$\therefore V_o = 2.8V$

Output :



Here it is V_o for the following clipper network.

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3. Apply the knowledge gained from diode theories to construct a circuit which satisfies the following conditions and sketch the output voltage of the constructed circuit. Please explain how your circuit works and state your reasoning for your choice of circuit.

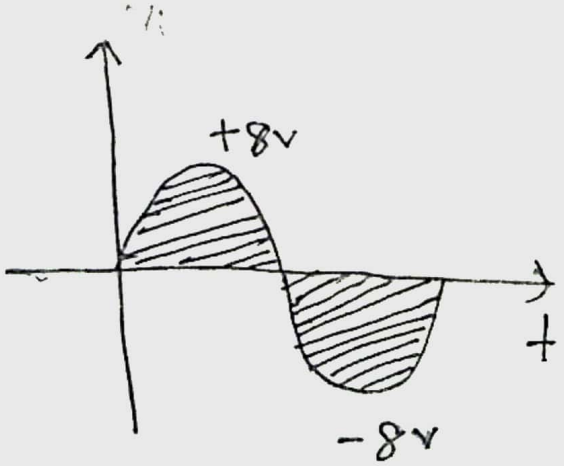
Design Criteria:

1) Only regular diodes (choose between Ge, Si, GaAs) and resistors can be used to construct the network.

2) During positive half cycle, output $V_o = (V_i - 1.2V)$

3) During negative half cycle, output $V_o = 0V$

4) Diode Peak inverse voltage $= V_x$.



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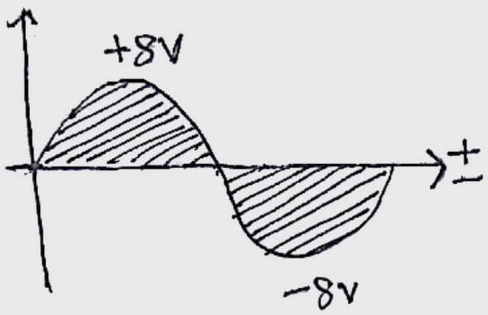
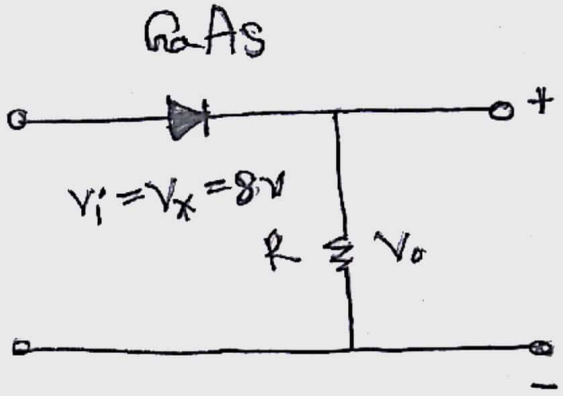
1) Here,

$V_z = 8V$





For constructing the circuit here Gallium Arsenide (GaAs) diode and a register R is used

2) During positive half cycle →

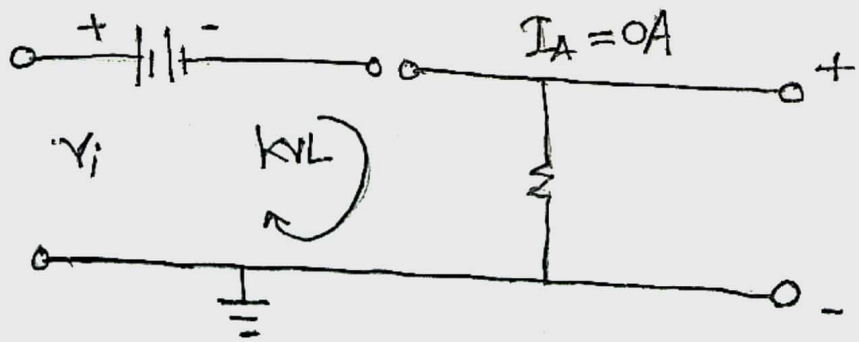
output, $V_o = (V_i - 1.2V)$

$= (8 - 1.2V)$

$= 6.8V$

3) During Negative half cycle →

Output, $V_o = 0V$



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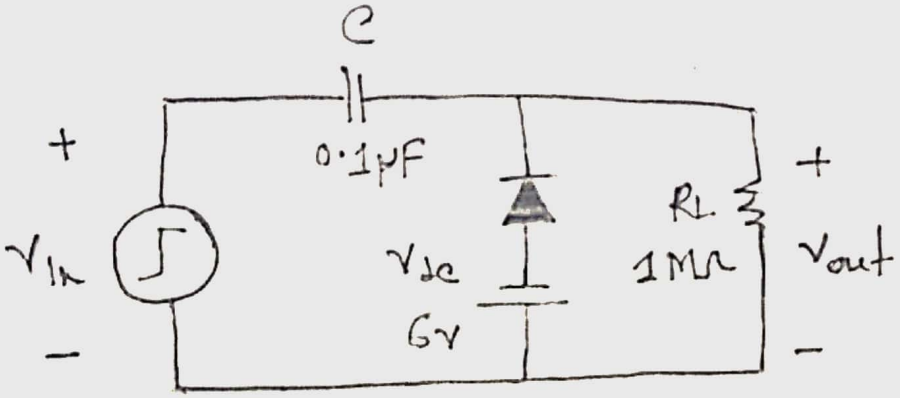
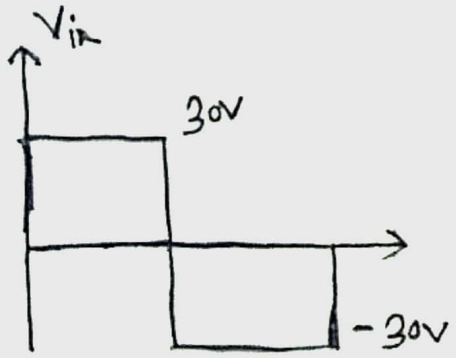
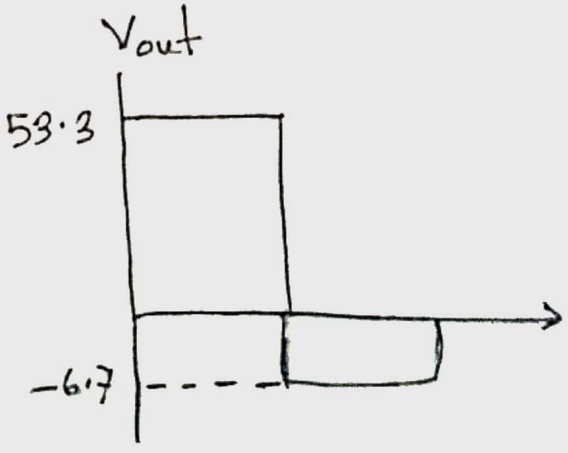
4) $V_o = I_o R$
$= 0 \times R$
$= 0V$

(4) Show necessary calculation to find the wave shape of the output voltage, Vout. Draw the wave shape of Vout with proper labeling. Assume the input is a square wave with $V_{rms} = 30V$ and 1 kHz frequency. Consider the diode as an ideal one.



Ans :





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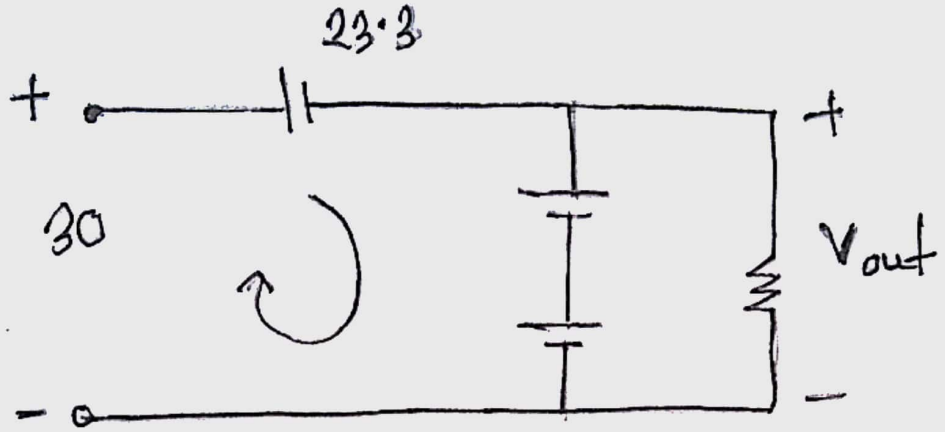
Positive Cycle :



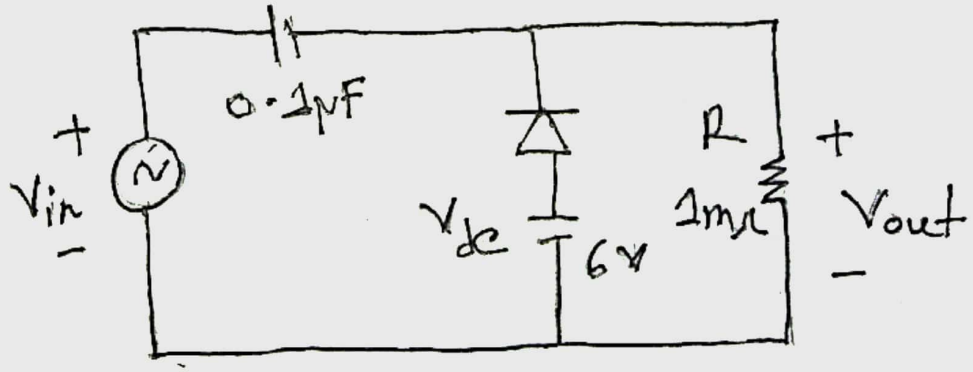
Apply KVL :

$$-30 - 23.3 + V_o = 0$$

$$\therefore V_o = 53.3V$$

for verified :

$$53.3 - (-6.7) = 60$$



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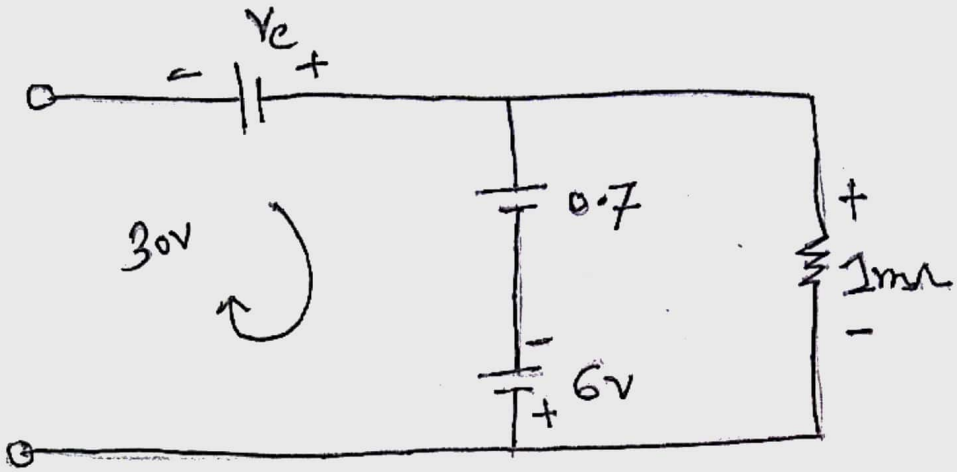
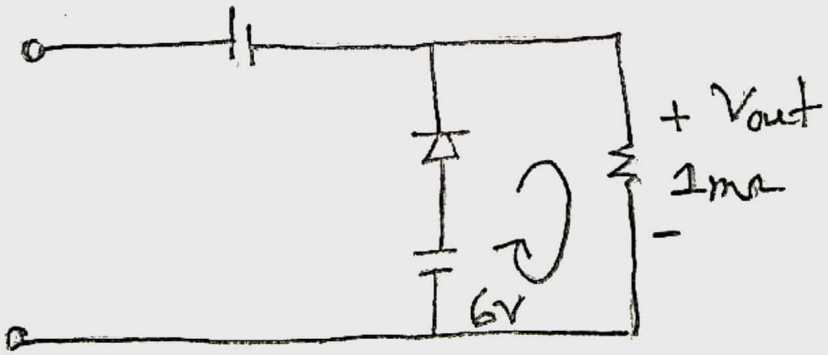
Negative cycle :



Apply KVL :

$$30 - V_c - 0.7 - 6 = 0$$

$$\therefore V_c = 23.3V$$



Apply KVL :

$$6 + 0.7 + V_o = 0$$

$$\therefore V_o = -6.7V.$$