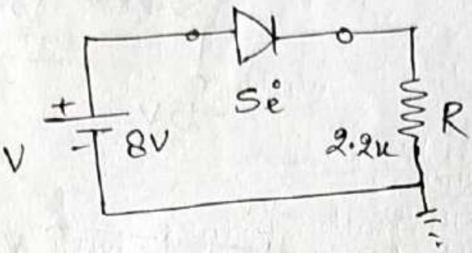
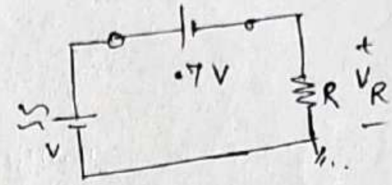
Series diode Configuration-

Determine V_o, I_D & V_D.

(I)



$\cong$



$V_D = 0.7V$

$V_R = 8 - \cdot 7V = 7.3V$

$I_D = I_R = \frac{V_R}{R} = \frac{7.3V}{2.2K\Omega} = 3.32mA$

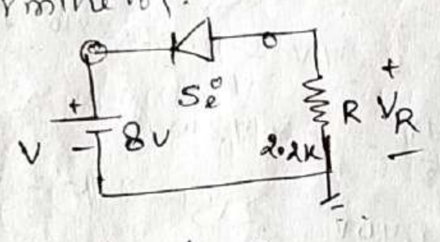
$V_R = V - \cdot 7V$

$I_D = I_R = \frac{V_R}{R}$

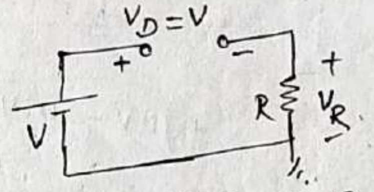
$V_D = V_\gamma$

Determine V_o?

(II)



$\cong$



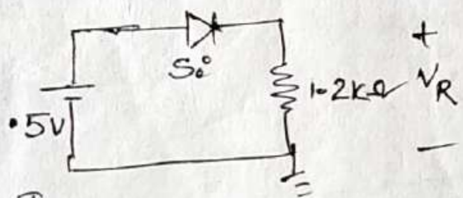
$V_R = I_R \cdot R = I_D \cdot R = 0 \cdot R = 0V$

$V - V_D - V_R = 0$

$V_D = V = 8V$

Determine V_R.

(III)

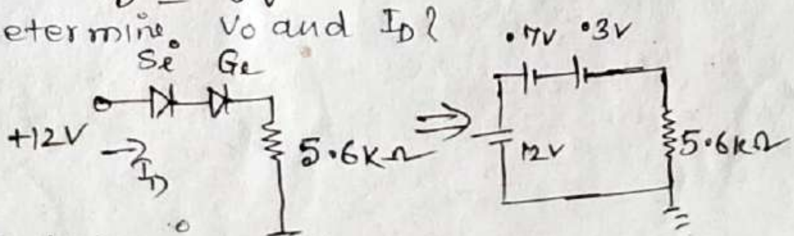


$I_D = 0A$, $V_R = 0V$

$V_D = \cdot 5V$

Determine V_o and I_D?

(IV)



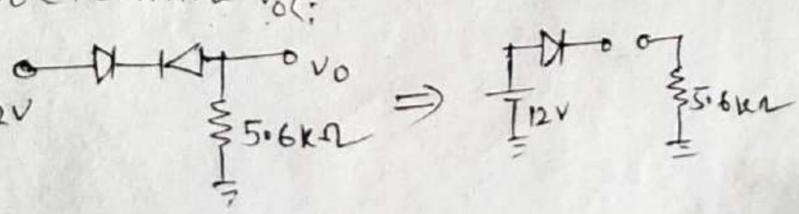
$V_o = 12V - (\cdot 7V + \cdot 3V)$

$= 11V$

$I_D = I_R = \frac{V_R}{R} = \frac{11V}{5.6K\Omega} = 1.96m$

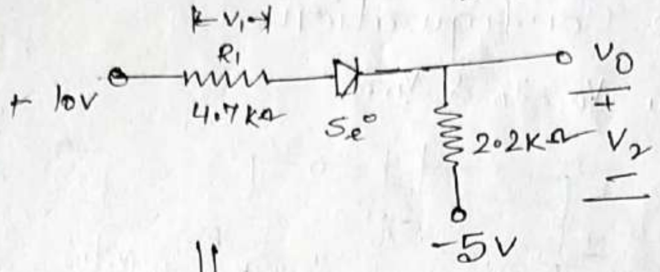
Determine V_o?

(V)



$V_o = 0V$

(VI) Determine I, V_1, V_2 and V_o for the network.



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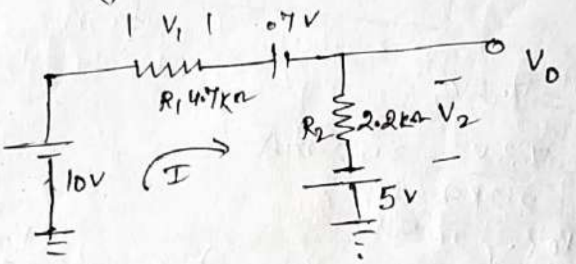


$$+10V - 4.7\times10^3 \times I - .7V - I \times 2.2\times10^3 + 5V = 0$$

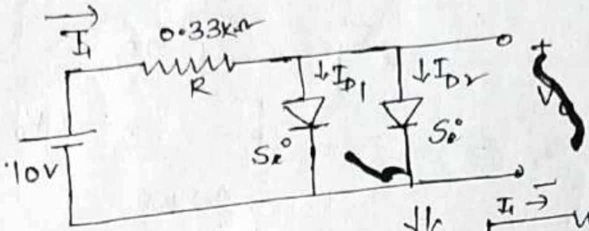
or $I = \dfrac{15V - .7V}{6.9\times10^3} = 2.072\,mA$

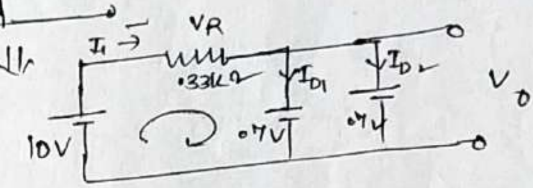
$V_1 = I \cdot R_1 = 9.74V$, $V_2 = I R_2 = 4.56\,V$

$-5V + 4.56 - V_0 = 0$ or $V_0 = -0.44V$

Parallel and series - parallel configurations.

1. Determine V_o, I_1, I_{D1} and I_{D2} for the network.





Both diode is ON.

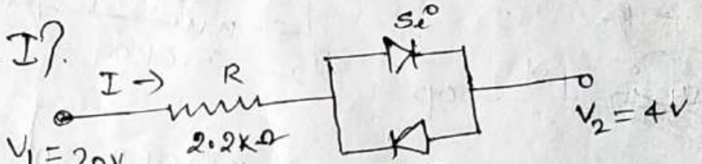
$\underline{V_o = 0.7V}$.

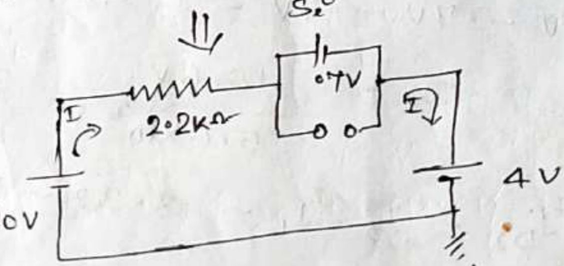
$$10V - I_1 \times .33 \times 10^3 - .7V = 0$$

$$\text{or} \quad I_1 = \frac{9.3V}{330\Omega} = 28.18\,mA$$

$$\therefore \quad I_{D1} = I_{D2} = \frac{I_1}{2} = \frac{28.18}{2} = 14.09\,mA$$

2. Determine I?



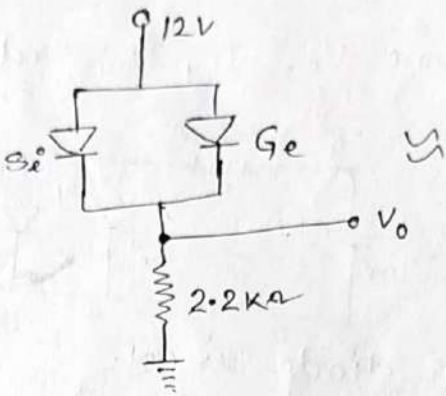


Applying KVL in closed loop.

$$+20V - I \times 2.2 \times 10^3 - .7V - 4V = 0$$

$$\text{or} \quad I = \frac{20V - 4V - .7V}{2.2 \times 10^3} = 6.95\,mA$$

(3) Determine V_o for the network.



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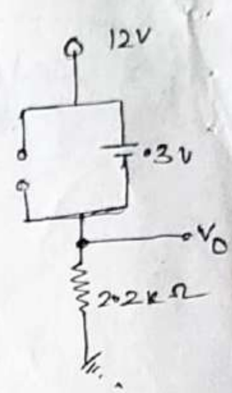
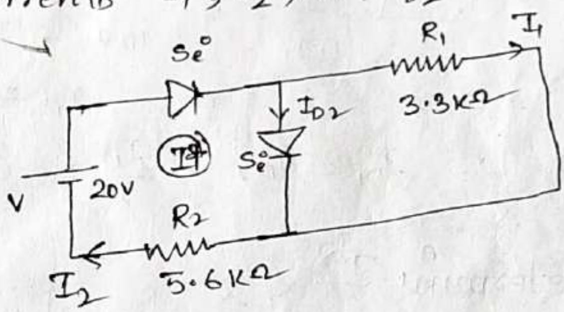


$$V_o = 11.3V$$

(4) Determine the currents I_1, I_2, and I_{D2} for the network



$$I_1 = \frac{.7V}{3.3K\Omega} = 0.212\,mA$$

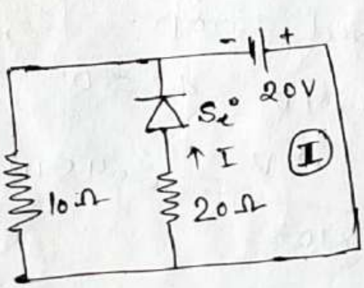
Applying KVL in I^{st} Loop we have

$$20V - .7V - .7V - I_2 \times 5.6K\Omega = 0$$

or $$I_2 = \frac{18.6V}{5.6\times10^3} = 3.32\,mA$$

$$I_{D2} = I_2 - I_1 = 3.32 - .212 = 3.108\,mA$$

(5.)

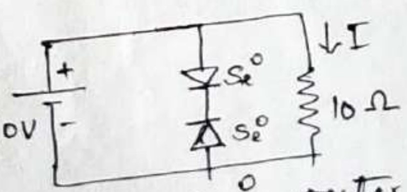


Applying KVL in the Loop. I.

$$20V - I\times 20\Omega - .7V = 0$$

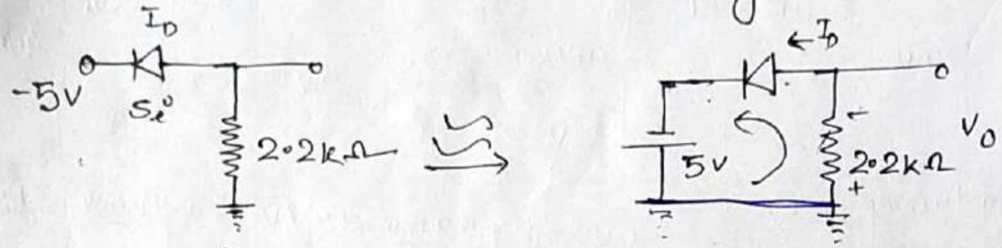
or $$\frac{19.3V}{20\Omega} = I = .965A$$

(6)



with applied voltage upper diode will conduct while lower diode will not conduct, hence path is open. Applying KVL in outer loop we have $I = \frac{10V}{10\Omega} = 1A$

(7) Determine V_0 and I_D for following network



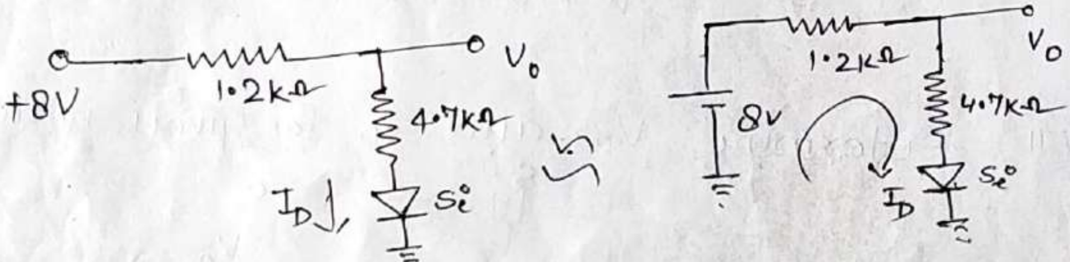
Applying KVL in Loop, we get $-5V + .7V + I \times 2.2k\Omega = 0$

or $I = \frac{+4.3V}{2.2 \times 10^3} = 1.95\,mA$

~~direction~~

$V_0 = -4.29V$

(8)

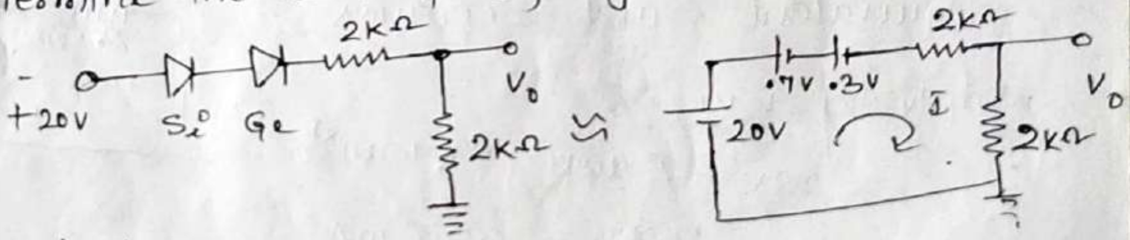


Applying KVL in Loop — $+8V - I_D \times 1.2k\Omega - 4.7k\Omega \times I_D - .7V = 0$

or $I_D = \frac{8V - .7V}{(4.7+1.2)k\Omega} = \frac{7.3V}{5.9\,k\Omega} = 1.23\,mA$

$V_0 = V_{4.7k\Omega} + .7V = 5.78\,V + .7V = 6.48\,V$

(9) Determine the level of V_0 for given network.



Applying KVL

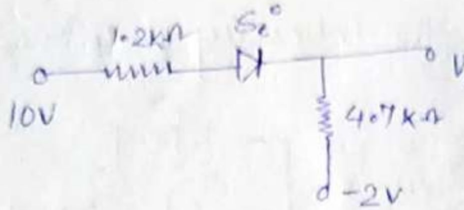
$20V - .7V - .3V - I \times 2k\Omega - I \times 2k\Omega = 0$

$I = \frac{20V - 1.0V}{4k\Omega} = \frac{19V}{4k\Omega} = 4.75\,mA$

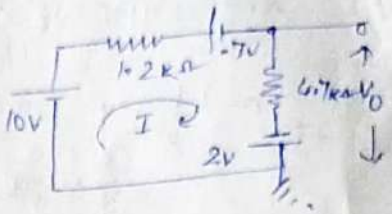
$V_0 = 4.75\,mA \times 2k\Omega$

$= 9.50\ V$

(10)



$\Rightarrow$



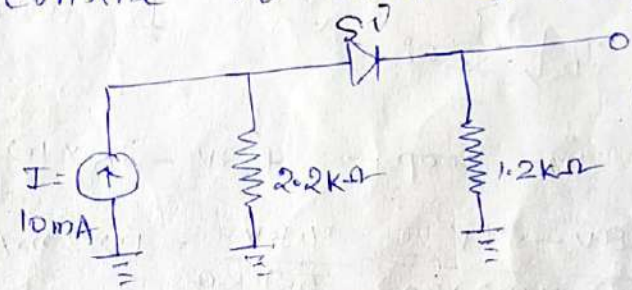
Applying KVL, $10V - I \times 1.2k\Omega - .7V - 4.7k\Omega \times I + 2V = 0$

$$\frac{11.3V}{5.9k\Omega} = I = 1.91\,mA$$

$$V_{4.7k\Omega} = 4.7 \times 10^{3} \times 1.91 \times 10^{-3} = 8.977\ V$$

$$V_0 = -2V + 8.97\ V = 6.97\ V$$

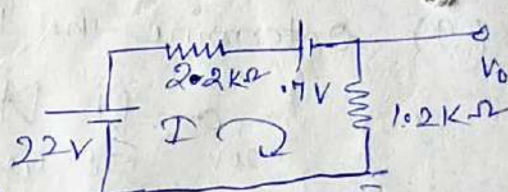
(11) Determine V_0 and I_D for given network



Converting current source into voltag source we have

$$V_i = 10\,mA \times 2.2k\Omega = 22V$$

Equivalent ckt becomes



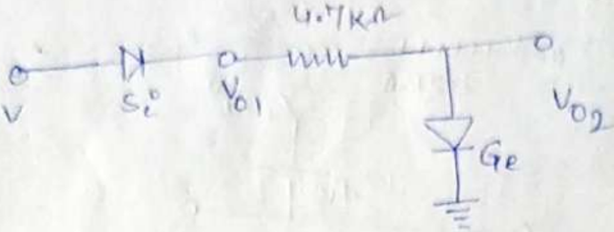
Applying KVL

$$22V - I \times 2.2k\Omega - .7V - 1.2k\Omega \times I = 0$$

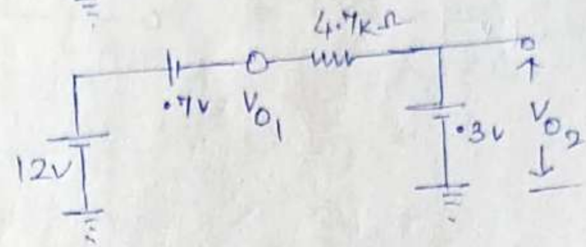
or $I = \frac{21.7V}{3.4k\Omega} = 6.35\ mA$

$$V_0 = 6.35\,mA \times 1.2k\Omega = 7.72\ V$$

(12) Determine V_{o1} and V_{o2} for given network



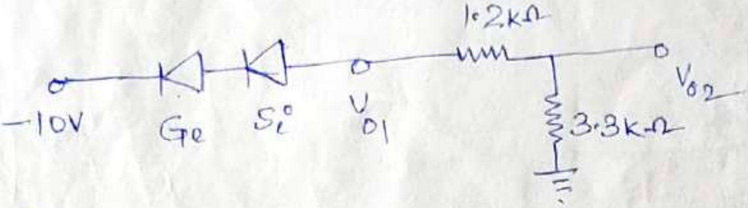
Equivalent circuit is



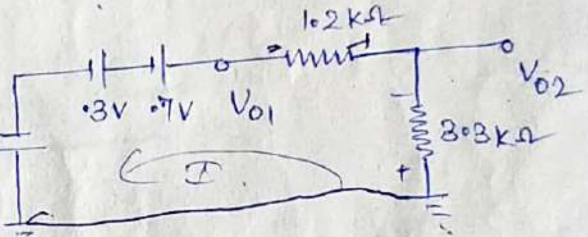
$12V - .7V = V_{o1} = 11.3V$

$V_{o2} = 0.3\,V$

(13)



Equivalent ckt is



KVL

$-10V + .3V + .7V = V_{o1}$

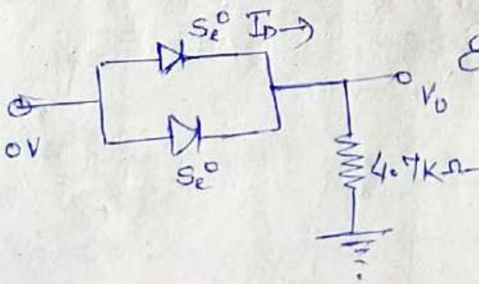
or $V_{o1} = -9V$

KVL in entire Loop results $-10V + .3V + .7V + (1.2K + 3.3K)I = 0$

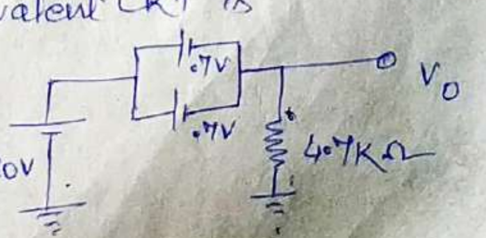
$$\frac{9V}{4.5\,K\Omega} = I = 2\,mA$$

$$V_{o2} = V_{3.3K\Omega} = -3.3K\Omega \times 2mA = -6.6V$$

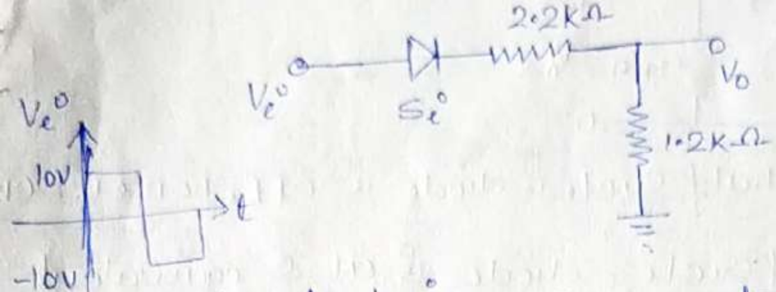
(14) Determine V_o and I_D for the network.



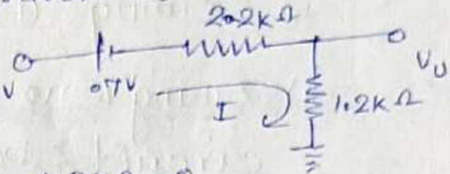
Equivalent ckt is



(15) Determine V_0 for given network.



During (+)ve half cycle diode is F.B and equivalent ckt may be drawn as



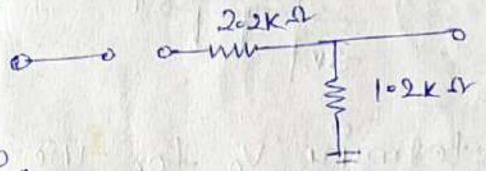
(1.) Applying KVL we get—

$$10V - .7V - I \times 2.2K\Omega - I \times 1.2K\Omega = 0$$

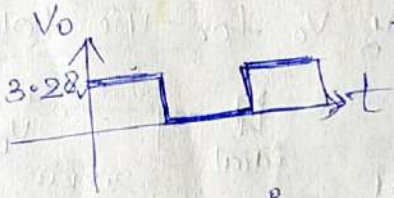
or $$\frac{9.3V}{3.4K\Omega} = I = 2.73\,mA$$

$$V_0 = 1.2K\Omega \times 2.73\,mA = 3.276\ V$$

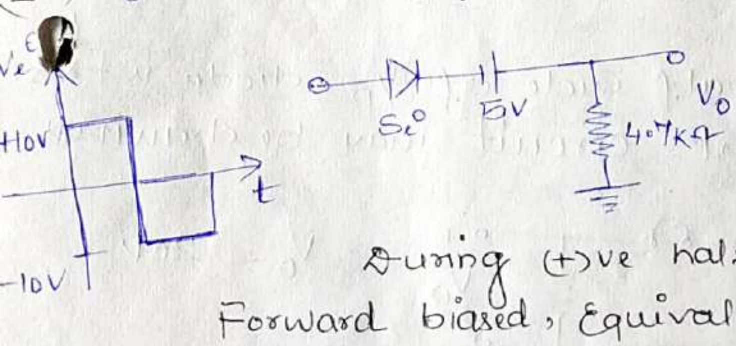
During (−)ve half cycle, diode is R.B. equivalent circuit reduces as.



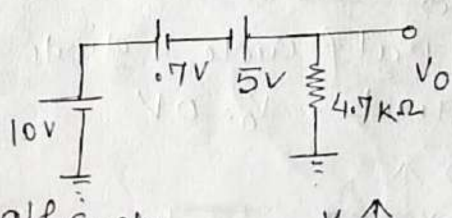
$I = 0$ $V_0 = 0\ V$



(16) Determine V_0 for following network.



During (+)ve half cycle of Input diode is Forward biased, Equivalent ckt may be drawn as



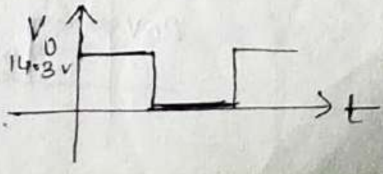
Applying KVL in the circuit we get—

$$+10V - .7V + 5V = V_0$$

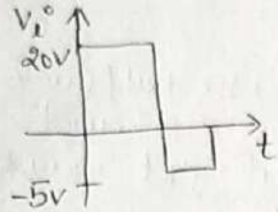
$$V_0 = 14.3\ V$$

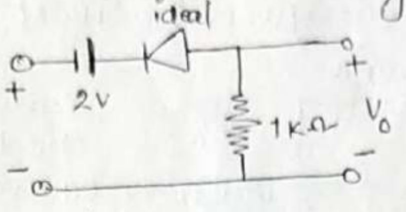
During (−) ve half cycle diode is off

$V_0 = 0V$



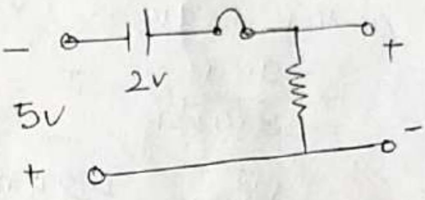
(17) Determine V_o for following network.





i. During (+)ve half cycle, diode is OFF, hence $V_o = 0V$

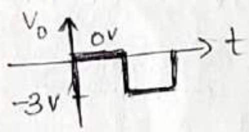
ii) During (−)ve half cycle diode is ON & equivalent circuit becomes



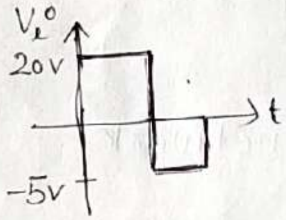
Applying KVL we get

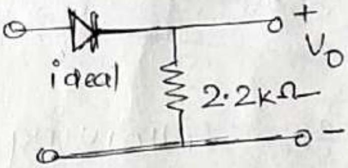
$$-5V + 2V = V_o$$

$$-3V = V_o$$

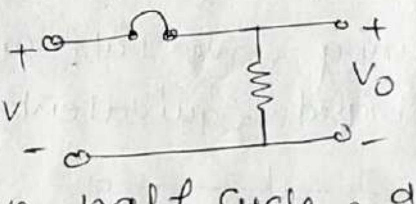


(18) Determine V_o for the following network.



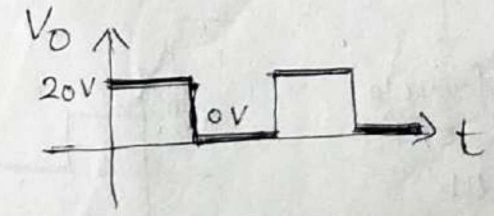


1. During (+)ve half cycle of I/p, diode is F.B. and equivalent circuit may be drawn as

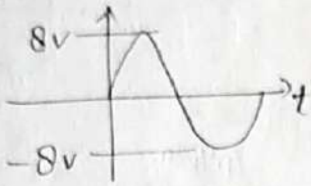


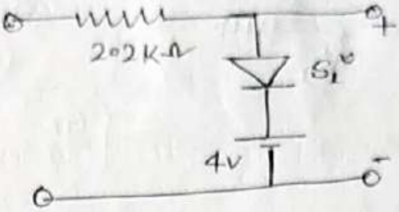
$V_o = 20V$

2. During (−) ve half cycle, diode becomes reverse biased and $V_o = 0V$



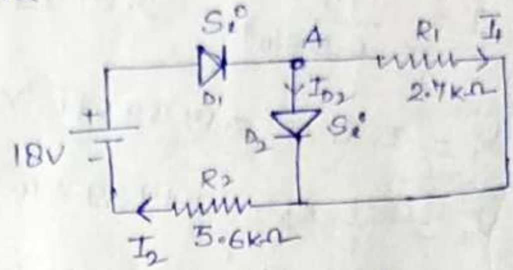
(19) Determine V_o for given network.





Series and Parallel Diode Configuration -

1. Determine the currents I_1, I_2 and I_{D_2} for the following network.

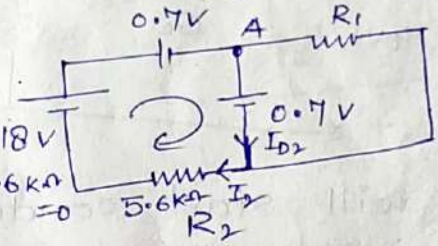


Due to 18V supply, both diode D_1 and D_2 are forward biased and conducting. The voltage drops across D_1 and D_2 are 0.7V

Voltage drop across A = 0.7 V which is same across R_1.

$$I_1 = \frac{V_A}{R_1} = \frac{0.7V}{2.7\times10^3} = 0.259\,mA$$

Applying KVL in input loop.

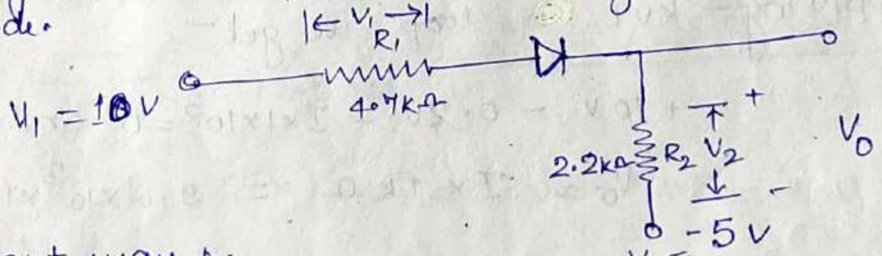


$18V - 0.7V - 0.7V - I_2 \times 5.6k\Omega = 0$

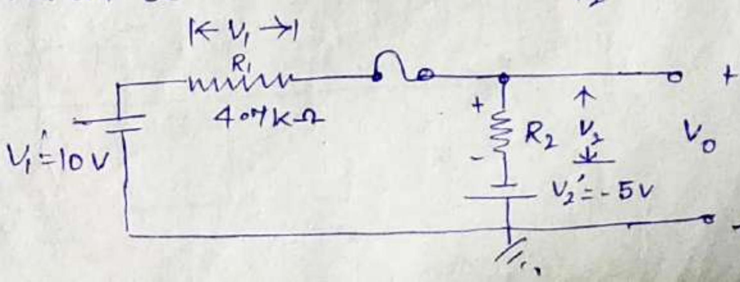
or $\quad I_2 = 2.96\,mA$

$$I_{D_2} = I_2 - I_1 = (2.96 - 0.259)\,mA$$
$$I_{D_2} = 2.701\,mA$$

2. Determine I, V_1, V_2 and V_o for the series d.c. configuration of the following network assuming ideal diode.



Modified ckt. may be



Applying KVL in f.B. condition

$$10V - I \times 4.7 \times 10^3 - I \times 2.2 \times 10^3 + 5V = 0$$

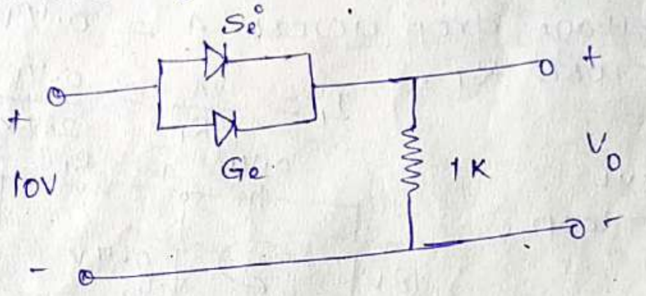
$$\text{or} \quad I = \frac{15}{6.9 \times 10^3} = 2.1739 \, mA$$

$$V_1 = I.R_1 = 2.1739 \times 10^{-3} \times 4.7 \times 10^3 = 10.2173 \, V$$

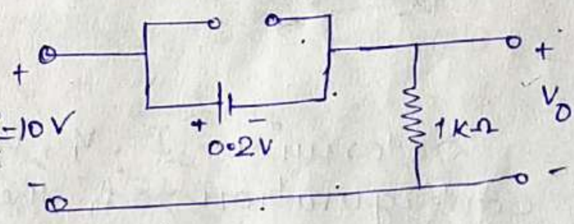
$$V_2 = I.R_2 = 2.1739 \times 10^{-3} \times 2.2 \times 10^3 = 4.7825 \, V$$

$$V_0 = V_2 - V_2' = -0.2174$$

3. Determine V_0 and I for following network.



Ge diode will start conducting first (due to low cut-in-voltage). The Ckt. reduces as

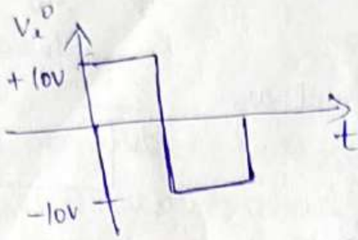


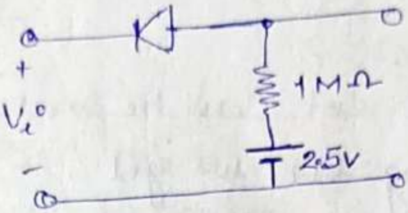
Applying KVL in loop we get —

$$+10V - 0.2V - I \times 1 \times 10^3 = 0 \quad \text{or } I = 9.8 \, mA$$

$$V_0 = I \times 1k\Omega = 9.8 \times 10^{-3} \times 1 \times 10^3 = 9.8V$$

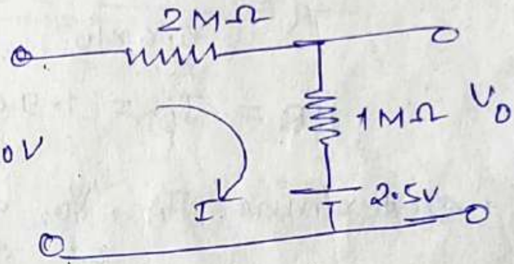
4. A symmetrical 5 KHz square wave varying between +10V and −10V is impressed upon the network shown below. Assuming $R_f = 0\Omega$, $R_r = 2M\Omega$ and $V_\gamma = 0V$, sketch and calculate output voltage.





During (+)ve half cycle when $V_i > 2.5V$, the Diode is reverse biased with reverse resistance $R_r = 2M\Omega$.

The ckt reduces as



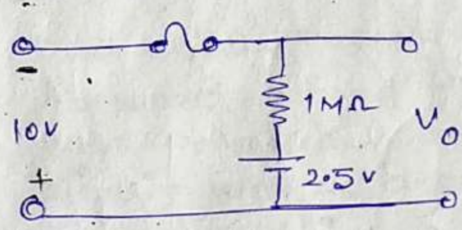
Applying KVL we get—

$$+10V - I\times 2\times 10^6 - I\times 1\times 10^6 - 2.5V = 0$$

or $I = \frac{10-2.5}{3\times 10^6} = 2.5\mu A$

$$V_0 = I\times 1\times 10^6 + 2.5V = 5V$$

During (−) half cycle; the diode becomes forward biased, and circuit reduces as

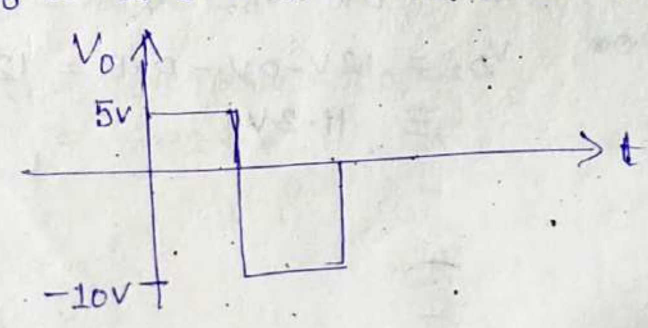


Applying KVL we have

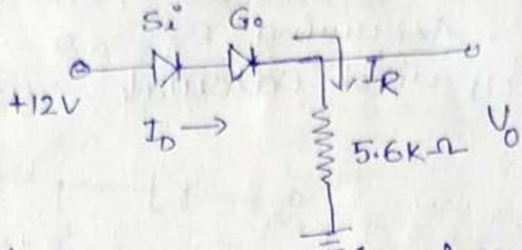
$$-10V + 1\times 10^6\times I - 2.5V = 0$$

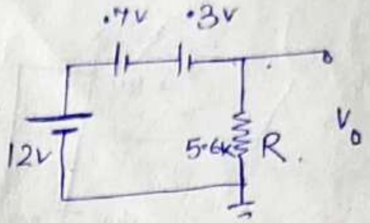
or $I = \frac{10+2.5}{1\times 10^6} = 12.5\mu A$

$$V_0 = 2.5 - I\times 1\times 10^6 = 2.5 - 12.5 = -10V$$



5 Determine V_0 and I_D for the following series ckt.





The ckt can be redesigned as

Applying KVL we get

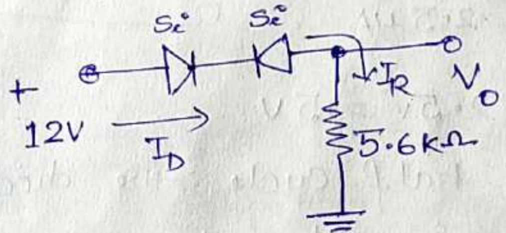
$$+12V - .7V - .3V = V_0$$

or $V_0 = 11V$ $\qquad \therefore V_0 = I_R \cdot R = I_R \cdot 5.6 \times 10^3$

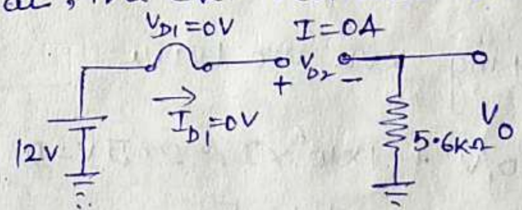
$$\therefore I_R = \frac{V_0}{5.6 \times 10^3} = \frac{11V}{5.6 \times 10^3} = 1.96mA$$

$$\therefore I_R = I_D = 1.96mA.$$

6 Determine I_D, V_{D_2} and V_0 for the following ckt.



With applied potential, the ckt reduces to.



Applying KVL in the ckt.

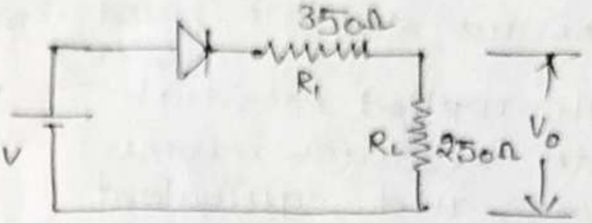
$$12V - 0V - V_{D_2} - V_0 = 0$$

or $12V - 0V - V_{D_2} - I_R \cdot R = 0$

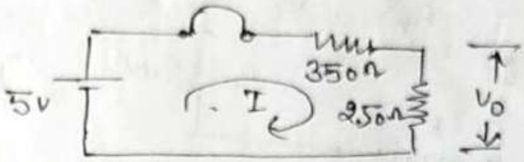
or $V_{D_2} = 12V - 0V - 0 \cdot R = 12V$

$\cong 11.3V$.

Example :- In the following network, determine the current and output voltage. Assume ideal diode.



With applied voltage (5V) diode becomes forward biased, and equivalent ckt. becomes

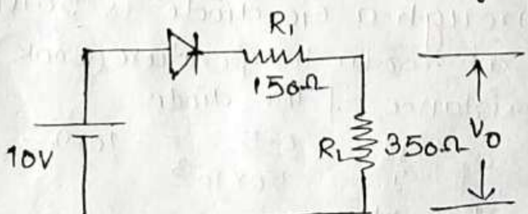


$$+5V - I \times 350\Omega - I \times 250\Omega = 0$$

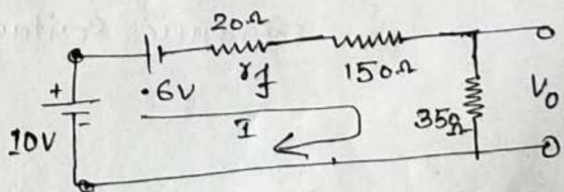
$$\text{or} \quad I = \frac{5V}{600\Omega} = 8.33\,mA$$

$$V_0 = I \times 250\Omega = 8.33 \times 10^{-3} \times 250\Omega$$
$$= 2.083\,V$$

Example :- In the following network, determine the current flow through the diode and output voltage assume $V_\gamma = 0.6V$ and $r_f = 20\Omega$.



The diode becomes forward biased with given potential. Equivalent circuit may be drawn as.

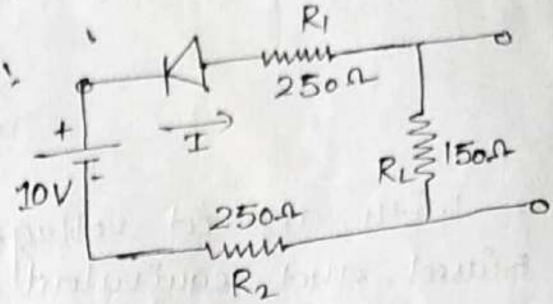


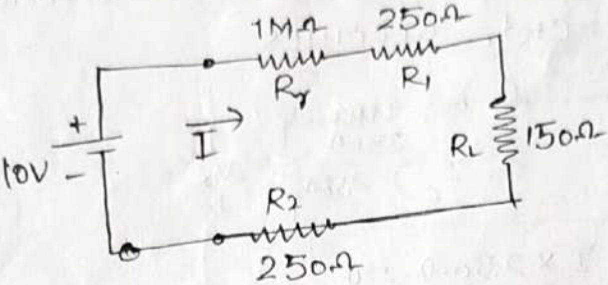
$$I = \frac{10 - 0.6}{20 + 150 + 350}\,A = 18.076\,mA$$

$$V_0 = I \cdot R_L = 18.076 \times 10^{-3} \times 350\Omega$$
$$V_0 = 6.326\,V$$

Example :- Determine the current flow through the diode, the voltage across the diode and output voltage. Assume of diode and $R_r = 1\,M\Omega$.

With applied Potential diode becomes reverse biased, and equivalent may be





$$I = \frac{10V}{R_r + R_1 + R_L + R_2}$$

$$= \frac{10V}{1\times10^6 + 250 + 150 + 250} A$$

$$I = 9.99\,\mu A$$

The voltage across the diode

$$V_D = 10V - I(R_1 + R_2 + R_L) = 10 - 9.99\times10^{-6}\times650V$$
$$= 9.99V$$

Or $V_D = I \times R_r = 9.99\times10^{-6} \times 1\times10^6 = 9.99V.$

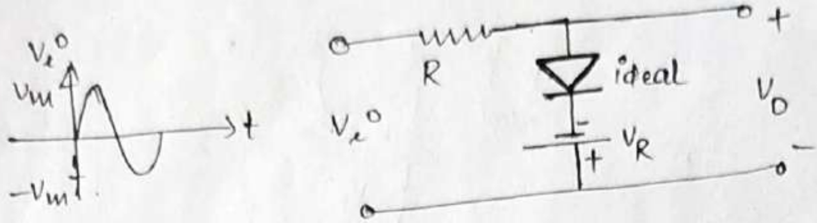
The output voltage $V_0 = I \cdot R_L = 9.99\times10^{-6}\times150\Omega$
$$= 1.499\,mV$$

Example :- The current through a Ge diode is 50mA for a forward voltage of 0.5V at room temperature (300K). Calculate the static and dynamic resistance of the diode

Static Resistance $R_f = \frac{V}{I} = \frac{0.5}{50\times10^{-3}} = 10\,\Omega$

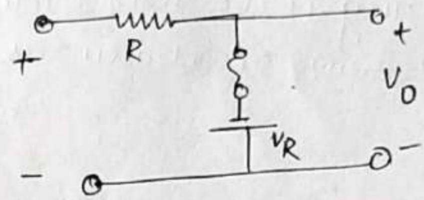
Dynamic Resitance $r_f = \frac{\eta V_T}{I} = \frac{1\times.026}{50\times10^{-3}} = 0.52\,\Omega$

Example: Determine V_o for following network.

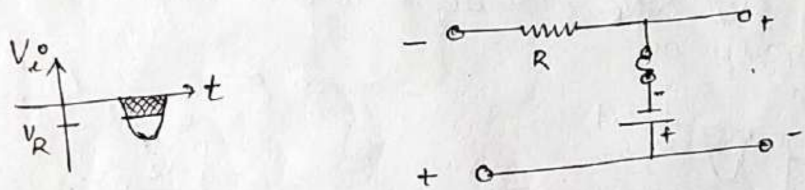


1. During (+)ve half cycle ; diode is Forward biased. Equivalent circuit may be

$V_o = -V_R$.

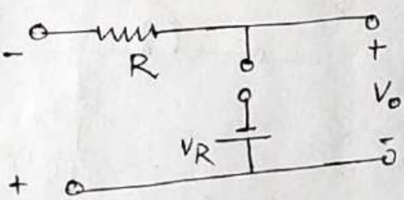


2.(a) During (−)ve half cycle. when $V_i > V_R$, diode becomes Forward biased. Equivalent circuit will be



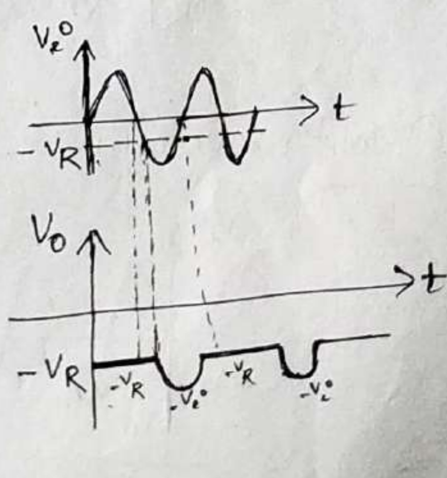
$V_o = -V_R$.

(b) when $V_i < V_R$, diode becomes reverse biased and equivalent ckt may be drawn as.

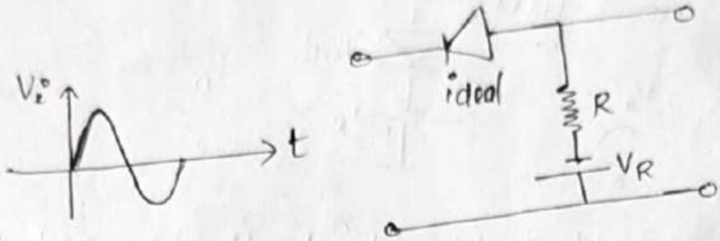


$V_o = -V_i$

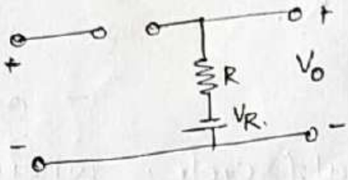
Output waveform -



Example:- Determine V_0 for following network:



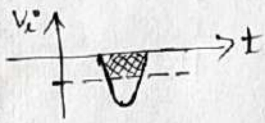
1. During (+)ve half cycle, diode is reverse biased. Equivalent ckt may be drawn as

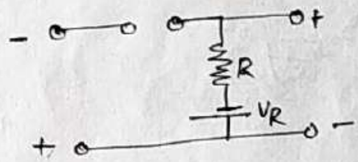


$V_0 = -V_R$

2. During (−)ve half cycle:

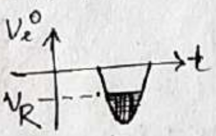
(a) when $V_i > V_R$, diode is reverse biased & equivalent ckt may be drawn as

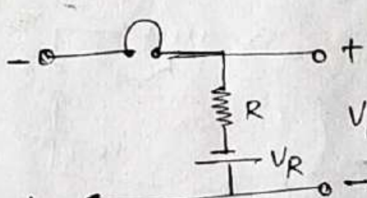




$V_0 = -V_R$

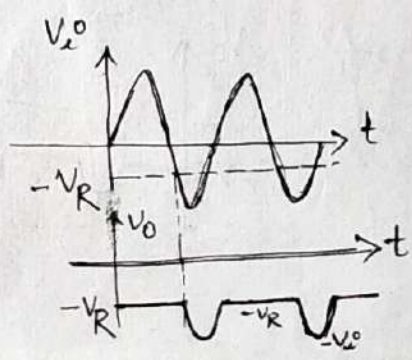
(b) when $V_i < V_R$, the diode is forward bias & equivalent ckt will be



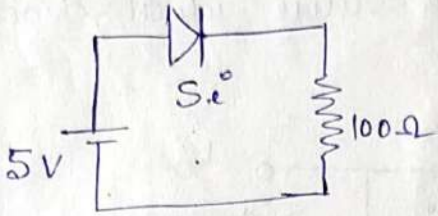


$V_0 = -V_i$

Output waveform:



Ex. 1. Determine current in following ckt.



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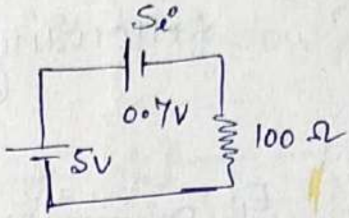
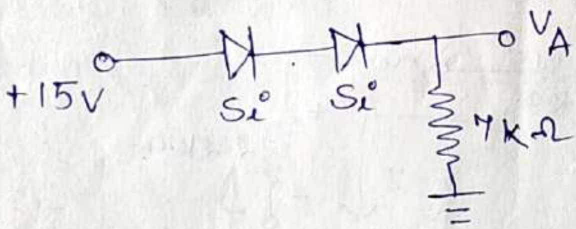


$$I = \frac{5 - 0.7V}{100} = 0.043A = 43mA$$

Ex 2. Find the voltage V_A in following ckt.



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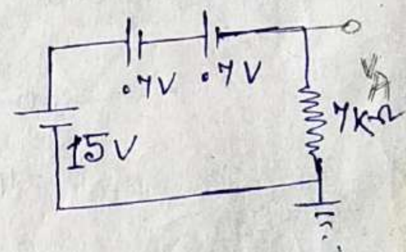
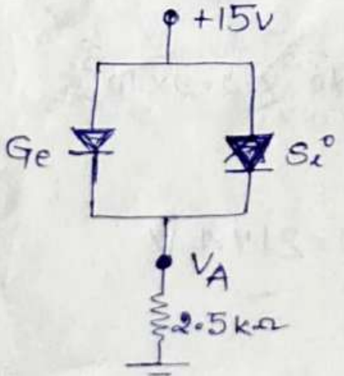


current through the circuit

$$I = \frac{15 - (1.4\,V)}{7 \times 10^3} = 1.943\ mA$$

V_A = voltage drop across 7 KΩ $= 1.943 \times 10^{-3} \times 7 \times 10^3$
$= 13.6\ V$

Ex. 3. Determine the voltage V_A in following ckt.



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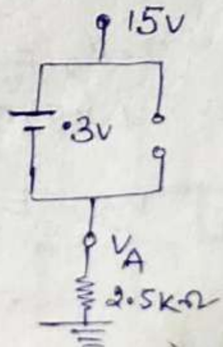
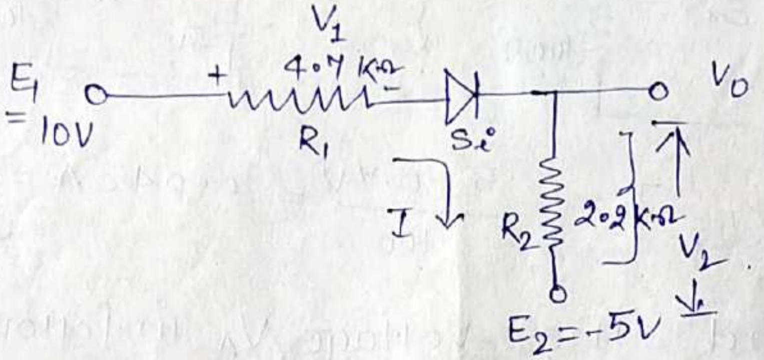
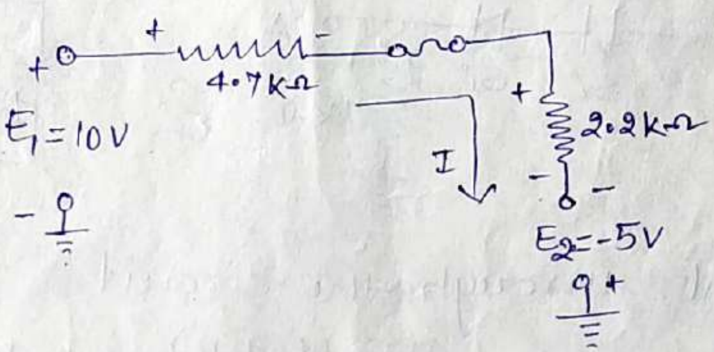


$V_A = (15 - 0.3)V$
$= 14.7\ V$

Ex. 4. Determine I, V_1, V_2 and V_0 for the following ckt. Assume ideal diode.



Equivalent circuit is



KVL in loop gives

$$10 - 4.7\times10^{3}\times I - 2.2\times10^{3}\times I + 5 = 0$$

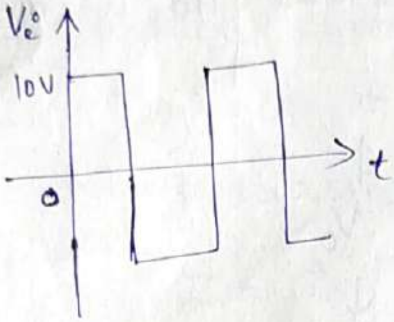
or $$I = \frac{15}{6.9\times10^{3}} = 2.1739\,mA$$

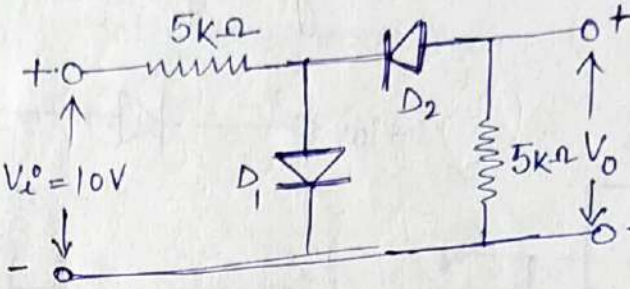
$$V_1 = I\cdot R_1 = 2.1739\times10^{-3}\times4.7\times10^{3}$$
$$= 10.2173\,V$$

$$V_2 = I\cdot R_2 = 2.1739\times10^{-3}\times2.2\times10^{3}$$
$$= 4.7825\,V$$

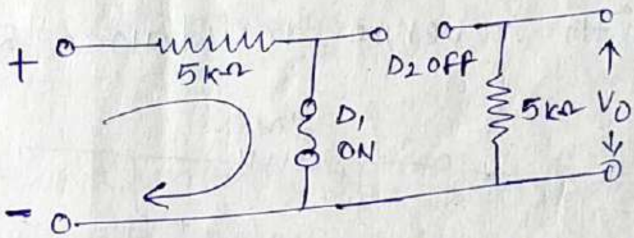
$$V_0 = V_2 - E_2 \doteq -0.2174\,V.$$

Ex. 5 ⟹ Determine and sketch the output voltage & waveform for circuit given below, assuming ideal diodes.



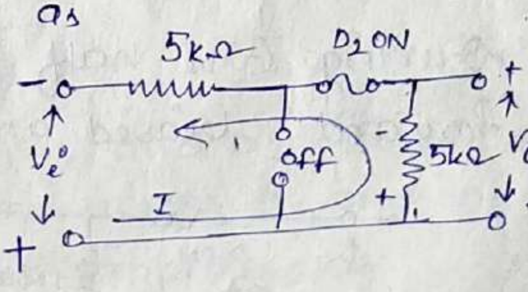


During positive half cycle Diode D_1 is forward biased and D_2 is reverse biased. The circuit appears as



Thus no current can flow through outer 5kΩ resistance as D_2 is open hence $V_0 = 0\,V$

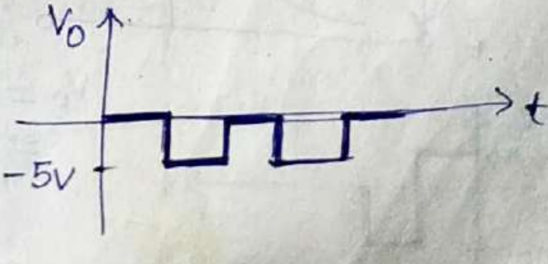
When negative half cycle ($V_i = -10V$) is applied, diode D_2 is forward biased while D_1 is reverse biased. The ckt. appears as



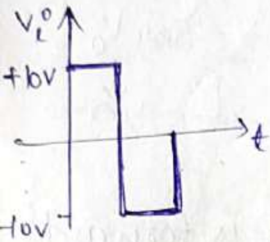
$$I = \frac{V_i}{(5+5)\times 10^3} = \frac{10}{10\times 10^3}$$

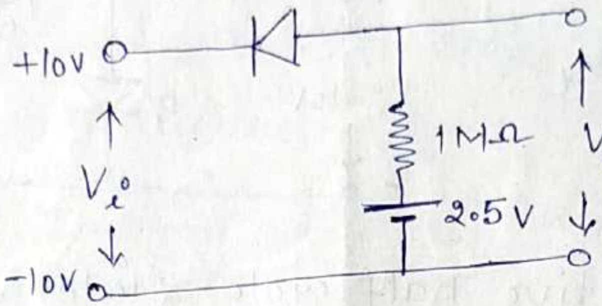
$$= 1\,mA$$

$$V_0 = -5\times 10^3 \times 1 = -5V$$

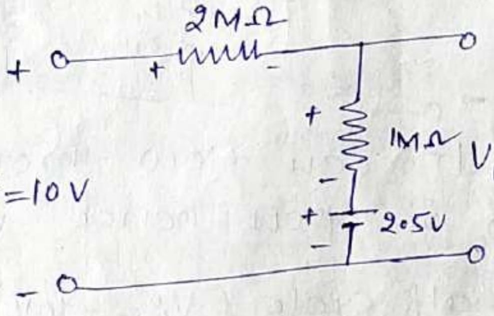


Ex. → Sketch and determine the output voltage waveform of following network, assuming $R_f = 0\,\Omega$, $R_r = 2\,M\Omega$ and $V_\gamma = 0V$.





When $V_i > 2.5V$ the diode is reverse biased with reverse resistance $R_r = 2M\Omega$. The ckt. appears as



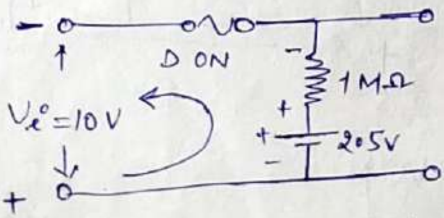
Applying KVL to the loop we get—

$$10V - 2\times10^6 \times I - 1\times10^6 I - 2.5 = 0$$

or $I = \frac{10-2.5}{3\times10^6} = 2.5\mu A$

$$V_o = I\times1\times10^6 + 2.5 = 5V$$

During (-)ve half cycle ($V_i = -10V$) the diode becomes forward biased and circuit appears as

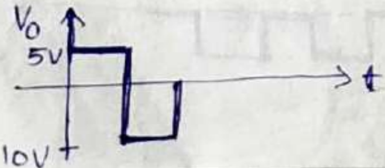


Applying KVL we get—

$$-10 + 1\times10^6 \times I - 2.5V = 0$$

or $I = 12.5\,\mu A$

$$V_o = 2.5 - I\times1\times10^6 = 2.5 - 12.5\times10^{-6}\times10^{6}$$
$$= -10V$$



Ex. A germanium diode carries a current of 1 mA at room temperature when a forward bias of 0.15V is applied. Calculate the reverse saturation current at room temperature.

$$I = 1\,mA,\quad T = 27^\circ C = 300^\circ K \qquad V = 0.15V$$

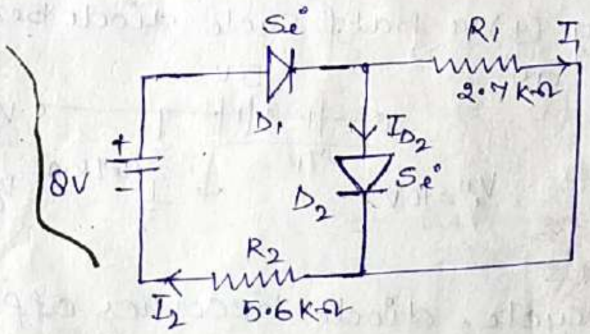
For germanium $\eta = 1$

$$I = I_0\left[e^{\frac{V}{\eta V_T}} - 1\right]$$ where $V_T = 26\,mV$ at room temperature.

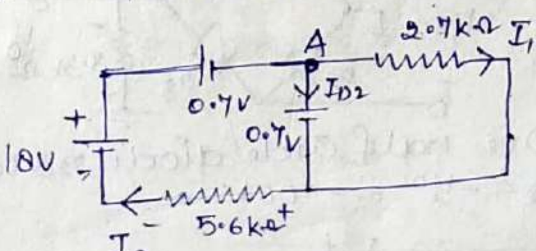
$$1\times10^{-3} = I_0\left[e^{\frac{0.15}{26\times10^{-3}}} - 1\right]$$

Or $\boxed{I_0 = 3.1319\ \mu A}$

Ex. Determine the currents I_1, I_2 and I_{D2} for the network shown below.



Due to 18 V supply, both D_1 and D_2 diodes are forward biased. The drop across D_1 and D_2 are 0.7V. The equivalent ckt. appears as



Voltage at node A = 0.7 V
= drop across R_1

$$\therefore \quad I_1 = \frac{0.7}{2.7\times10^3} = 0.259\,mA$$

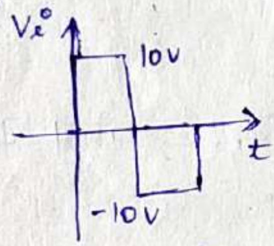
Applying KVL in input loop we get

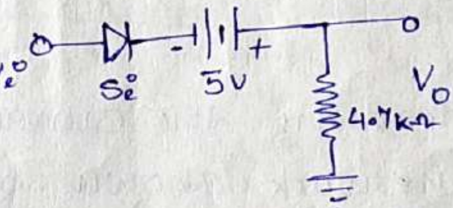
$$18V - 0.7V - 0.7V - I_2 \times 5.6\times10^3 = 0$$

or $\quad I_2 = 2.96\,mA$

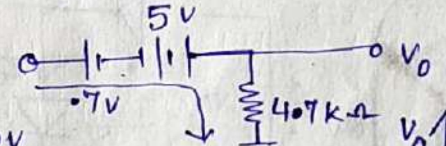
$$I_{D_2} = I_2 - I_1 = 2.96 - 0.259$$
$$= 2.701\,mA$$

Ex: Determine and sketch V_o for following network.



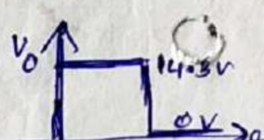


During (+)ve half cycle diode becomes ON.
The circuit reduces as



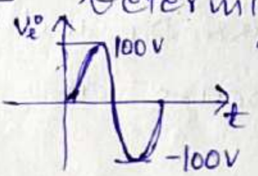
Applying KVL we get

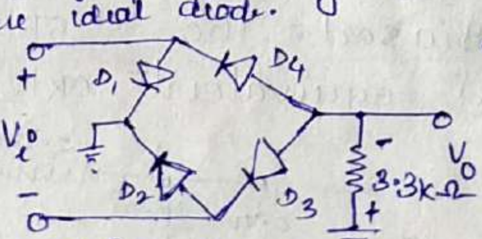
$10V - .7V + 5V = V_o$
or $V_o = 14.3\,V$



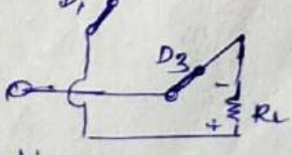
During (−)ve half cycle, diode becomes off. hence $V_o = 0V$

Ex.- Determine the output voltage V_o for given network. Assume ideal diode.



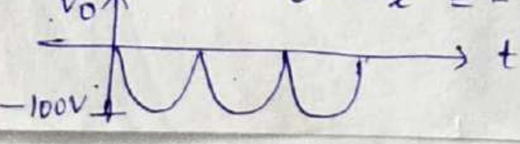


During (+)ve half cycle diode D_1 & D_3 will conduct, the ckt. reduces to

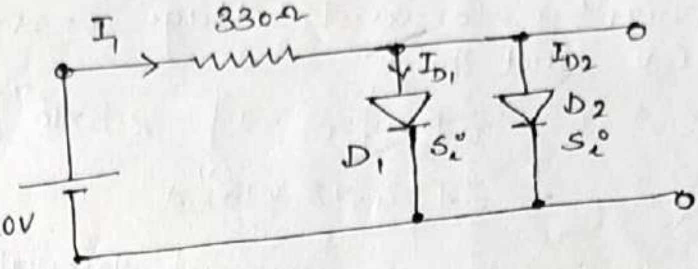


$V_o = -V_i = -100V$

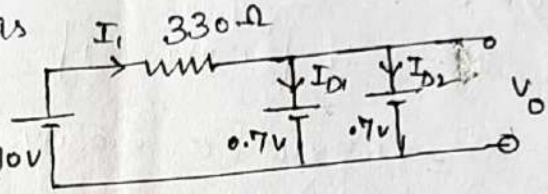
Similarly, during (−)ve half cycle diode D_2 & D_4 will conduct & $V_o = -V_i = -100V$



Example – Determine V_o, I_1, I_{D_1} and I_{D_2} for the following network.



Both diodes of similar characteristics are connected in parallel and is in ON state when $V_i > 0.7V$.
Equivalent ckt is as

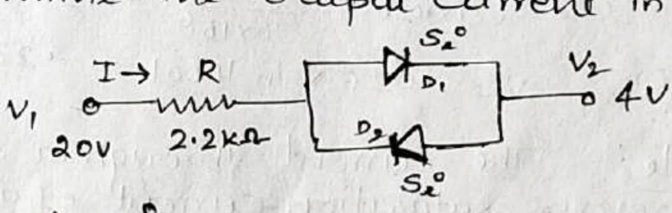


The voltage across parallel elements is always same, therefore the output voltage $V_o = 0.7V$

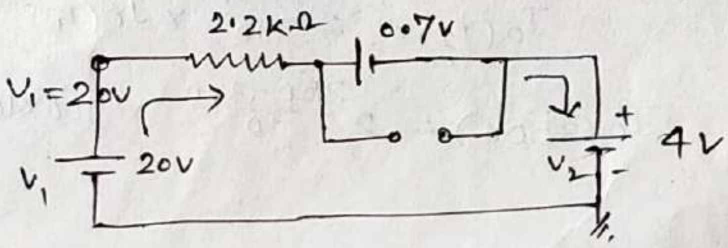
The current $I_1 = \frac{V_i - .7V}{330\Omega} = \frac{10 - .7V}{330\Omega} = 28.18mA$

$I_1 = I_{D_1} + I_{D_2}$ $\therefore$ $I_{D_1} = I_{D_2} = \frac{I_1}{2} = \frac{28.18}{2} = 14.09mA$

Example: Determine the output current in given network



Equivalent ckt of given network can be redrawn as



Applying KVL we get · $+20V - I \times 2.2\times10^3 - .7V - 4V = 0$

or $I = \frac{20 - 4V - 0.7V}{2.2\times10^3} = 6.95mA$

Example :- The current flow through a diode is about 2.5×10^{-7} A at room Temperature of 300k when a reverse voltage is applied. Determine the current through diode when a forward voltage 0.2 V is applied, assume $V_T = .026$ V and $\eta = 1$.

$$\therefore \quad I = I_0 \left[e^{\frac{V}{\eta V_T}} - 1 \right] = 2.5 \times 10^{-7} \left[e^{\frac{0.2}{1 \times .026}} - 1 \right]$$

$$= 5474.75 \times 10^{-7} \text{ A}$$

Example :- Determine the current through a Germanium diode when a forward voltage of 0.35 V is applied at the temp. of 350K, assuming $I_0 = 1.5$ mA.

$$I = I_0 \left[e^{\frac{V}{\eta V_T}} - 1 \right] \qquad V_T = \frac{T}{11600} = \frac{350}{11600} = .03017 \text{V}$$

$$= 1.5 \times 10^{-3} \left[e^{\frac{.35}{1 \times .03017}} - 1 \right] = 163.80 \text{ Ampere}.$$

Example :- The reverse saturation current of Germanium diode is 10 μA at the temperature 300K. Determine forward bias voltage to be applied across the p-n junction to obtain a current of 100 mA.

$$\therefore \quad V_T = \frac{T}{11600} = \frac{300}{11600} \text{ V} = .026 \text{ V}$$

$$I = I_0 \left[e^{\frac{V}{\eta V_T}} - 1 \right] \quad \text{or} \quad e^{\frac{V}{\eta V_T}} = \frac{I}{I_0} + 1$$

$$\text{or} \quad e^{\frac{V}{1 \times .026}} = \frac{100 \times 10^{-3}}{10 \times 10^{-6}} + 1 = 10001$$

$$\text{or} \quad V = .026 \times \ln 10001 = .239 \text{ V}.$$

Example :- The current through a silicon diode has a reverse saturation current of about 100 μA at room temperature ~~of~~ 300K. Calculate reverse saturation current at 350K.

$$I_0(T_2) = 2^{\frac{T_2 - T_1}{10}} \times I_0(T_1)$$

$$I_0(350K) = 2^{\frac{350-300}{10}} \times 100 \times 10^{-6} = 3200 \mu A$$