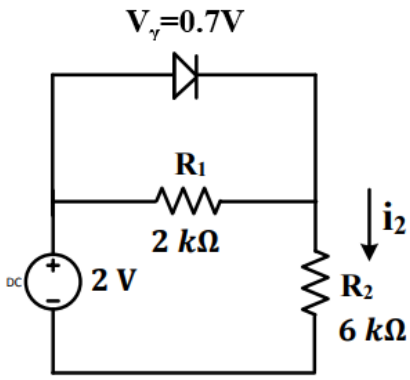
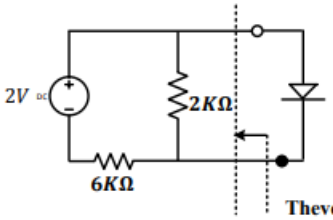
جواب تمرینات سری ششم

۲-

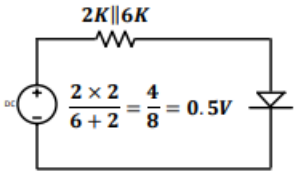
شکل (الف)



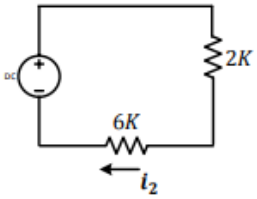
Soln. The given circuit can be redrawn as



This circuit can be further simplified using Thevenins theorem



Voltage across diode is 0.5V thus the diode is OFF. The circuit reduces to

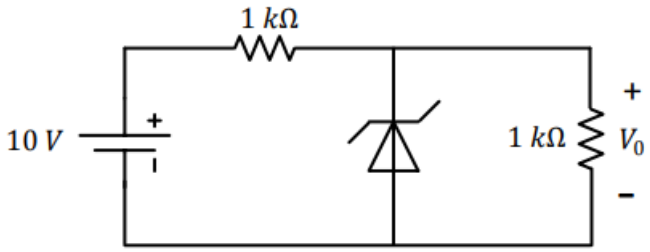


The current through 6 K

$$i_2 = \frac{2}{2K+6K} = \frac{2}{8K} = 0.25\ mA$$

Answer: 0.25 mA

شکل (ب)



V_z= 6V, V_γ=0.7V

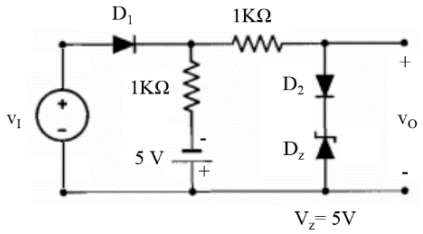
Zener voltage = 6 V

Zener diode is reverse biased during its operation. Here with the applied voltage, the voltage across the Zener diode is

$$V_0 = \frac{1\,K\Omega}{1K+1\,K\Omega} \times 10V = 5V$$

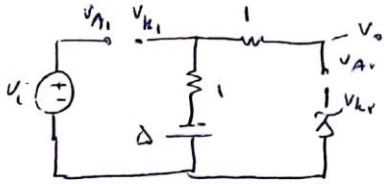
Diode will be reverse biased but not in the Zener region, so open circuited.

Answer Thus, V_0 = 5V



-۳

D_1, D_2 : off



$V_o = -5$

بررسی شرط‌های خاموش بودن

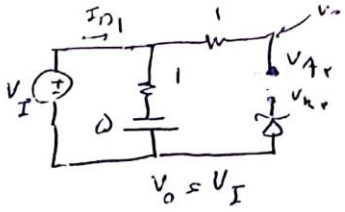
$V_{A_1} - V_{k_1} < 0$ $\quad V_{A_2} - V_{k_2} < 0$

$V_I - (-5) < 0$ $\quad -5 - V_2 < 0$

$V_I < -5$ $\quad$ شرط برقرار

(۱) $V_I < -5 \longrightarrow V_o = -5$

D_1 : on ; D_2 : off



$V_o = V_I$

$V_{A_2} - V_{k_2} < 0$

$V_I - V_2 < 0$

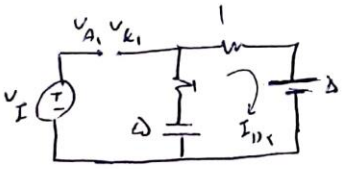
$V_I - 5 < 0$ $\quad V_I < 5$

$I_{D_1} > 0$

$I_{D_1} = \frac{V_I + 5}{1} > 0$ $\quad V_I > -5$

(۲) $-5 < V_I < 5$ $\quad V_o = V_I$

D_1 : off , D_2 : on

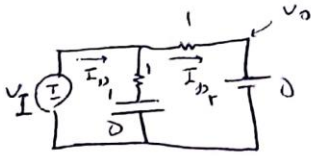


$I_{D_2} = \frac{-10}{2} = -5 < 0$

فرض روشن بودن D_2 باطل است

D_1 : on $\quad D_2$: on

$V_o = 5$

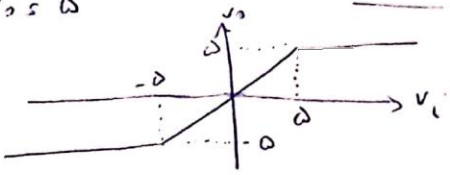


$I_{D_2} = \frac{V_I - 5}{1} > 0$ $\quad V_I > 5$

$I_{D_1} = \frac{V_I + 5}{1} + \frac{V_I - 5}{1} > 0$ $\quad V_I > 0$

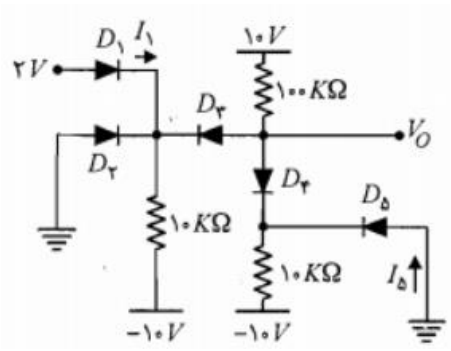
اشتراک دو بازه $\quad V_I > 5$

(۳) $V_I > 5$ $\quad V_o = 5$



۴-

شکل (الف)



با توجه به مدار داریم: $D_1: ON \quad D_2: OFF \quad D_3: OFF \quad D_4: ON \quad D_5: ON$

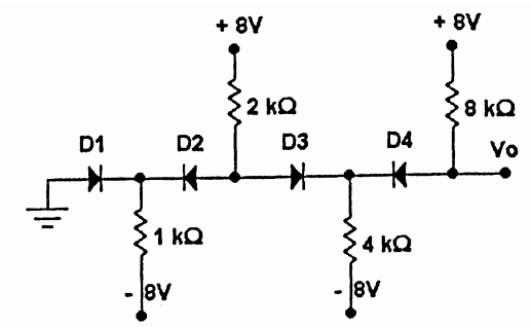
$$I_1 = \frac{2V - (-10^V)}{10\,K\Omega} = 1/2\,mA$$

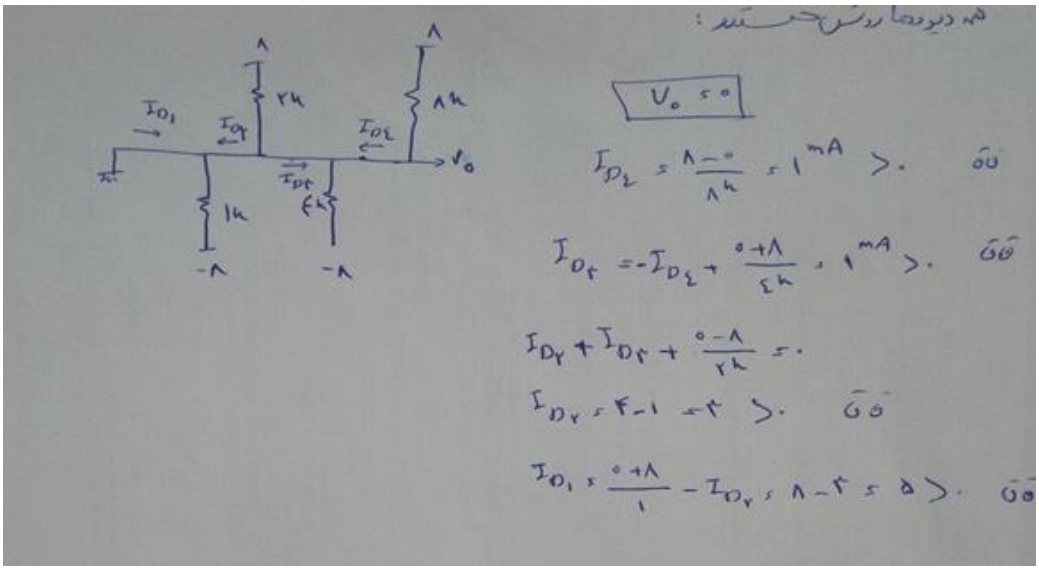
و چون D_4 و D_5 روشن می‌باشند پس $V_0 = 0^V$ می‌باشد.

$$KCL \text{ در نقطه A}: \frac{V_0 - 10^V}{100\,K\Omega} - I_5 + \frac{V_0 - (-10^V)}{10\,K\Omega} = 0$$

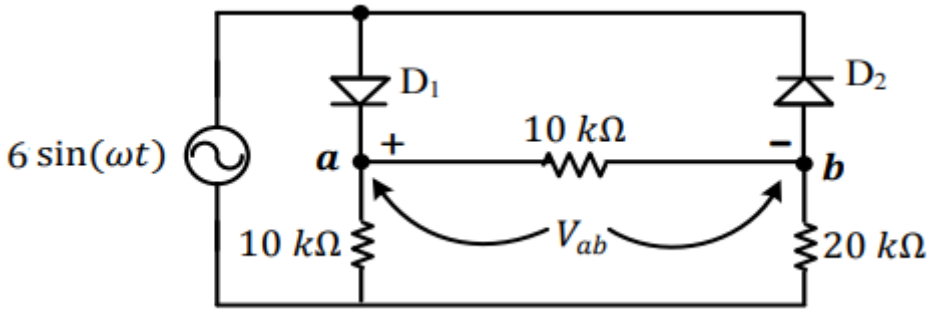
$$V_0 = 0^V \rightarrow \frac{-10}{100} - I_5 + \frac{10}{10} = 0 \rightarrow I_5 = 1 - 0/1 = 0/9\,mA$$

شکل (ب)





-٥

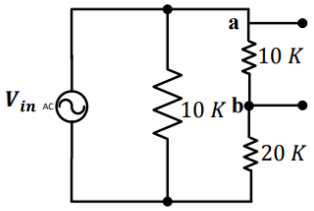


D_1 is Forward biased and

D_2 is Reverse biased

The circuit reduces to

$$V_{in} = 6 \quad sin\ \omega t$$



$$V_{ab} = \frac{10\ K}{10\ K + 20\ K} \cdot V_{in}$$

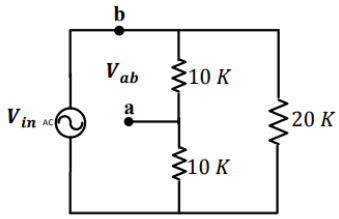
$$= \frac{V_{in}}{3} = \frac{6}{3} sin\ \omega t = 2 \quad sin\ \omega t$$

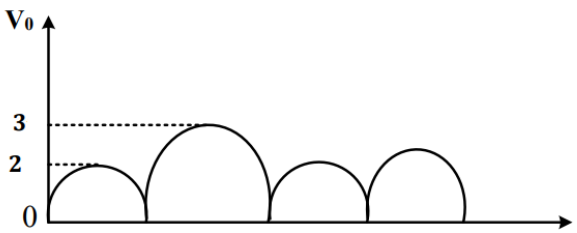
D_1 is Reverse biased

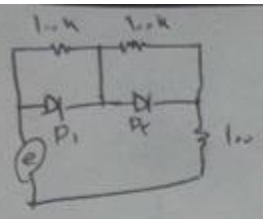
D_2 is Forward biased

$$V_{ab} = \frac{10K}{10K + 10K} \cdot V_{in} = {V_{in}}/{2}$$

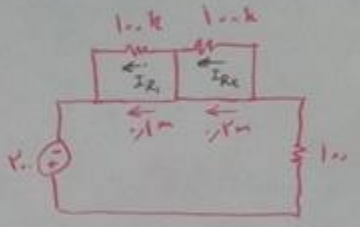
$$= \frac{6 \quad sin\ \omega t}{2} = 3 \quad sin\ \omega t$$







چون در صورت سوال صحبتی از ولتاژ مکوس دیودها
خواسته نشده، یعنی دیودها مکوس بایاس شده‌اند
و جریان از شاخه مکوس از دیودها عبور نمی‌کند.



KVL $\quad ۲۰۰ = ۱۰۰^{k} I_{R_1} + ۱۰۰^{k} I_{R_2} + ۱۰۰(۰٫۲ + I_{R_2})$ (۱)

KCL $\quad I_{R_1} + ۰٫۱^{m} = ۰٫۲^{m} + I_{R_2} \qquad I_{R_1} = ۰٫۱^{m} + I_{R_2}$ (۲)

(۲) در (۱) $\Rightarrow$ $۲۰۰ = ۱۰۰^{k}(۰٫۱^{m} + I_{R_2}) + ۱۰۰^{k} I_{R_2} + ۱۰۰(۰٫۲^{m} + I_{R_2})$

$۲۵۰ = ۱۰ + ۲۰۰^{k} I_{R_2} + ۲۰^{m} + ۱۰۰ I_{R_2}$

$۱۸۹٫۹۸ = ۲۰۰٫۱^{k} I_{R_2}$

$I_{R_2} = \underline{۰٫۹۴۹^{mA}}$

$I_{R_1} = ۰٫۱^{mA} + ۰٫۹۴۹^{m} = \underline{۱٫۰۴۹^{mA}}$

$V_{R_1} = ۱۰۰^{k} \times I_{R_1} = \underline{۱۰۴٫۹^{v}}$

$V_{R_2} = ۱۰۰^{k} \times I_{R_2} = \underline{۹۴٫۹^{v}}$