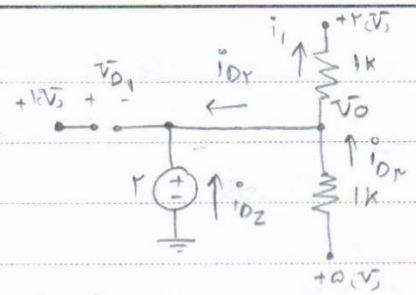
۲ـ




فرض: $D_1$: off

$D_2$, $D_3$ : on

$D_Z$ : reverse bias

$V_O = 2 \Rightarrow i_{D_3} = \frac{5-2}{1k} = 3m > 0$

$i_1 = 0 \Rightarrow i_{D_2} = i_{D_3} = 3m > 0$

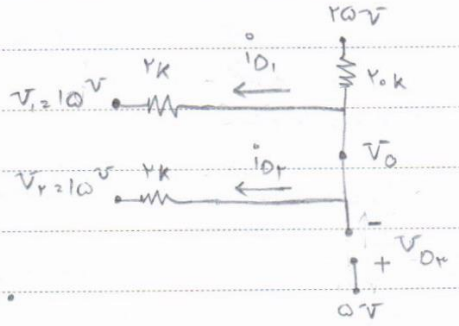
$V_{D_1} = -1 < 0$

$i_{D_Z} = -i_{D_2} = -3m < 0$

فرض های دیودها برقرار است.

$\Rightarrow \boxed{I = 3m}$

۳ـ




حالت اول: $V_1 = 10$, $V_2 = 10$

فرض: $D_2$: on

$D_1$, $D_2$ : off

KCL: $\frac{V_O - 25}{20k} + \frac{V_O - 10}{2k} + \frac{V_O - 10}{2k} = 0$

$\Rightarrow V_O - 25 + 20V_O - 300 = 0 \Rightarrow 21V_O = 325 \Rightarrow \boxed{V_O \simeq 15,47}$

$i_{D_1} = i_{D_2} = \frac{15,47 - 10}{2k} > 0$

$V_{D_2} = 5 - 15,47 < 0$

فرض های دیودها درست است.

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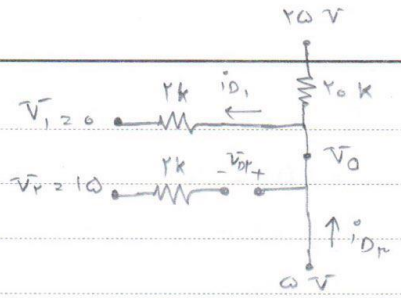
حالت دوم: $V_1 = 0$ , $V_2 = 10$




فرض: $D_1$: off

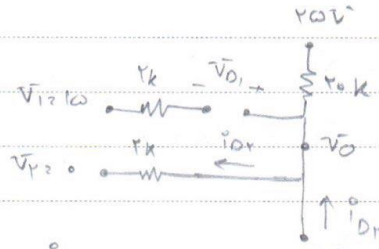
$D_2$, $D_3$: on

$V_0 = 0$

$V_{D_2} = -10 < 0$ , $i_{D_1} = 2.5\,mA > 0$ → فرض‌ها درست است

$-i_{D_3} - 1m + 2.5m = 0 \Rightarrow i_{D_3} = 1.5\,mA > 0$

حالت سوم: $V_1 = 10$ , $V_2 = 0$




فرض: $D_1$: off

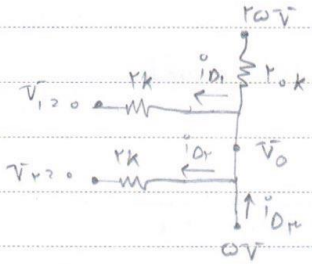
$D_2$, $D_3$: on

$V_0 = 0$

$V_{D_1} = -10 < 0$ , $i_{D_2} = 2.5\,mA > 0$ → فرض‌ها درست است

$-i_{D_3} - 1m + 2.5m = 0 \Rightarrow i_{D_3} = 1.5\,mA > 0$

حالت چهارم: $V_1 = 0$ , $V_2 = 0$



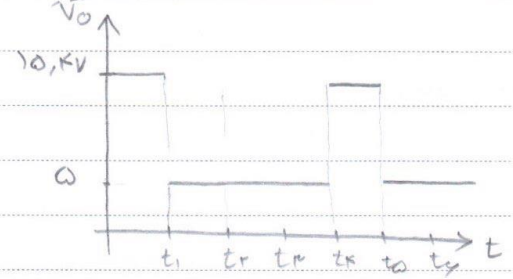

فرض: $D_1$, $D_2$, $D_3$: on

$V_0 = 0$

$i_{D_1} = i_{D_2} = 2.5\,mA > 0$

$-i_{D_3} + 2.5m + 2.5m - 1m = 0 \Rightarrow i_{D_3} = 4m > 0$ → فرض‌ها درست است

سیگنال خروجی:



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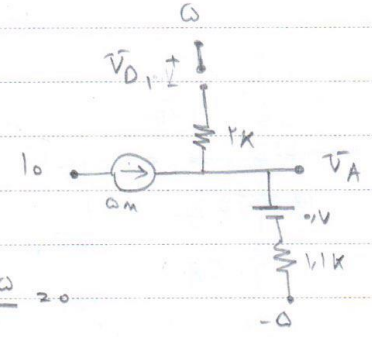
۴- مدارات)

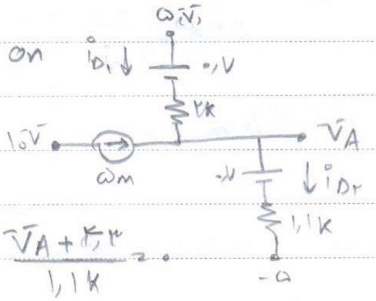
فرض: $D_1$: off  $D_2$: on




$$-۵m + \frac{\bar{V}_A + ۰,۷ + ۵}{۱,۱k} = ۰$$

$$\Rightarrow \bar{V}_A + ۵,۷ = ۵,۵ \Rightarrow \bar{V}_A = ۰,۲ \rightarrow \bar{V}_{D_1} = ۴,۸ > ۰,۷ \rightarrow \text{فرض غلط} \times$$

فرض: $D_1$, $D_2$: on




$$-۵m + \frac{\bar{V}_A - ۴,۳}{۲k} + \frac{\bar{V}_A + ۴,۳}{۱,۱k} = ۰$$

$$\Rightarrow ۳,۱\bar{V}_A + ۳,۸V = ۱۱ \Rightarrow \boxed{\bar{V}_A = ۲,۳}$$

$$i_{D_1} = \frac{۴,۳ - ۲,۳}{۲k} = \boxed{۱m > ۰}$$

فرض صادرات اند. ✓

$$i_{D_2} = \frac{۲,۳ - ۰,۷ + ۵}{۱,۱} = \boxed{۶m > ۰}$$

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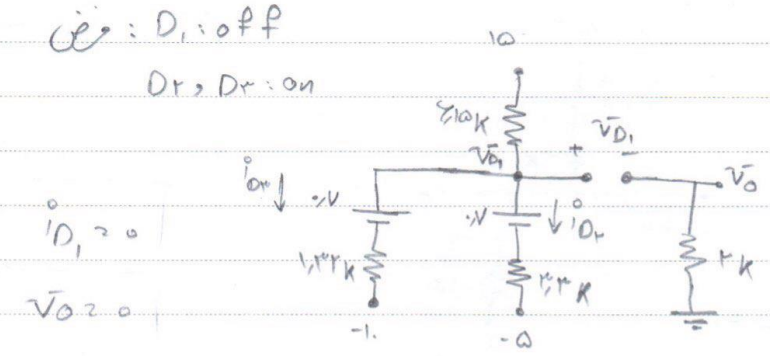
حالت اول: $D_1$ : off

$D_2$ , $D_3$ : on



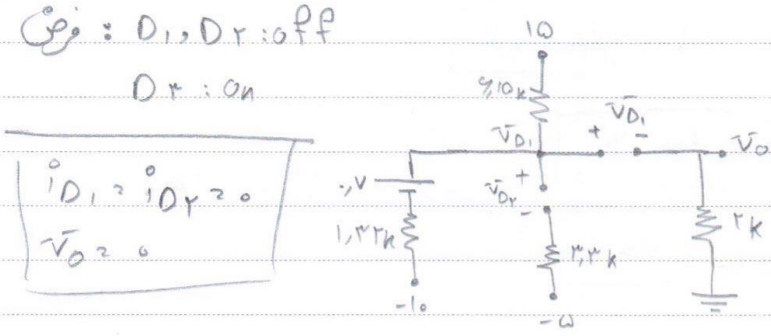

$$\frac{V_{D_1} - 10}{4.7k} + \frac{V_{D_1} - 0.7 + 5}{2.2k} + \frac{V_{D_1} - 0.7 + 10}{1.32k} = 0 \Rightarrow V_{D_1} = -4.1341 < 0.7V$$

$$i_{D_3} = \frac{-4.1341 - 0.7 + 10}{1.32k} = 3.248\,mA > 0$$

$$i_{D_2} = \frac{-4.1341 - 0.7 + 5}{2.2} = -0.164\,mA < 0 \rightarrow \text{غیر قابل قبول}$$

حالت دوم: $D_1$ , $D_2$ : off

$D_3$ : on




KVL : $2 = i_{D_3} \times 4.7k + 0.7 + i_{D_3} \times 1.32 \Rightarrow i_{D_3} = 3.2203\,mA > 0$

$10 - V_{D_1} = 3.2203\,mA \times 4.7k \Rightarrow V_{D_1} = -5.000 < 0.7 = V_A$

$V_{D_2} = -5.000 + 5 = 0.000 < 0.7V$ → غیر قابل قبول است

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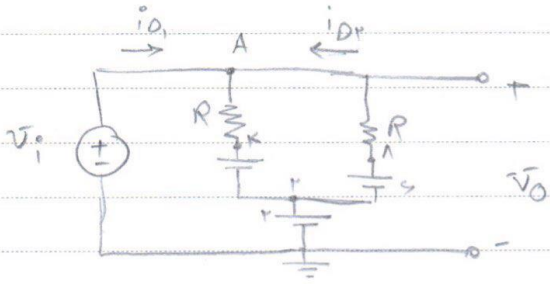
$V_i^\circ = V_0 \longrightarrow D_1, D_2 : on$ — ه



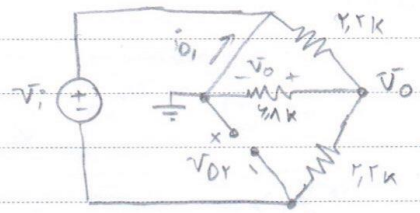

$$-i_{D_1}^\circ + \frac{V_i^\circ - 6}{R} + \frac{V_i^\circ - 8}{R} = 0 \Rightarrow i_{D_1}^\circ = \frac{2V_i^\circ - 14}{R} > 0 \longrightarrow \boxed{V_i^\circ > 7}$$

$$i_{D_2} = \frac{8 - V_i^\circ}{R} > 0 \Rightarrow V_i^\circ < 8 \longrightarrow \boxed{7 < V_i^\circ < 8}$$

۶ـ الف

فرض: $D_2 : off$

$D_1 : on$



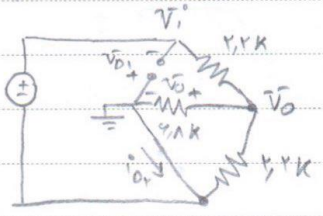

$$\frac{V_0}{2.2K} + \frac{V_0}{9.8K} + \frac{V_0 + V_i^\circ}{2.2K} = 0 \Rightarrow \boxed{V_0 = -0.64\, V_i^\circ}$$

$V_{D_2} = +V_i^\circ < 0$

$$i_{D_1}^\circ = \frac{V_0}{9.8K} = -65.29\, V_i^\circ \times 10^{-6} > 0 \Rightarrow \boxed{V_i^\circ < 0}$$

فرض: $D_1 : off$

$D_2 : on$




$$\frac{V_0}{2.2K} + \frac{V_0}{9.8K} + \frac{V_0 - V_i^\circ}{2.2K} = 0$$

$$\Rightarrow \boxed{V_0 = 0.64\, V_i^\circ}$$

$V_{D_1} = -V_i^\circ < 0 \Rightarrow V_i > 0$



$$i_{D_2} = \frac{V_0}{9.8K} = 65.29\, V_i \times 10^{-6} > 0 \Rightarrow \boxed{V_i^\circ > 0}$$

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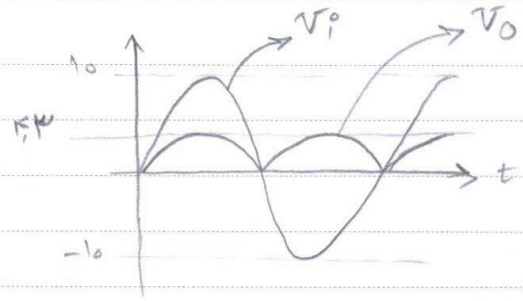
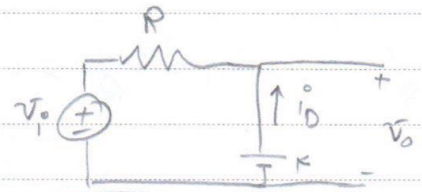
جواب نهایی:



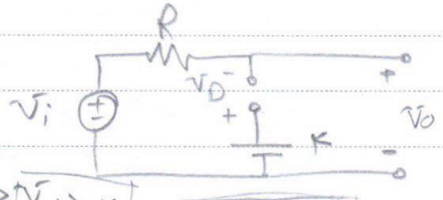

ب)

فرض: D: on



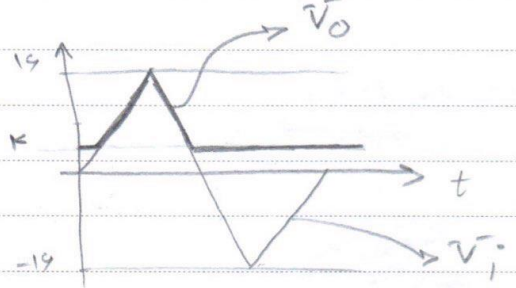

$i_D = \frac{۴ - v_i}{R} > ۰ \rightarrow v_i < ۴$ ، $v_o = ۴$

فرض: D: off




$v_D = ۴ - v_i < ۰ \rightarrow v_i > ۴$ ، $v_o = v_i$

جواب نهایی



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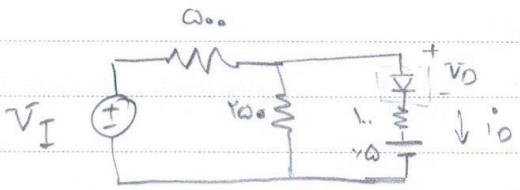
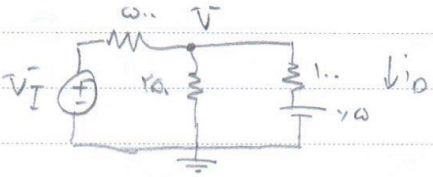
مدار معادل



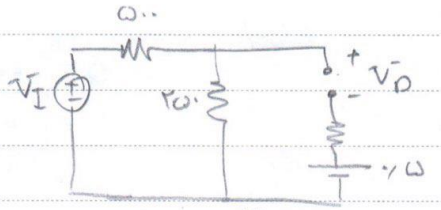

حالت: D: on




$$\frac{V-V_I}{500}+\frac{V}{250}+\frac{V-0.7}{100}=0 \Rightarrow 8V-V_I=2.7 \Rightarrow V=\frac{2.7+V_I}{8}$$

$$I_D=\frac{\frac{2.7+V_I}{8}-0.7}{100}=\frac{V_I-1.7}{800}>0 \Rightarrow \boxed{V_I>1.7}$$

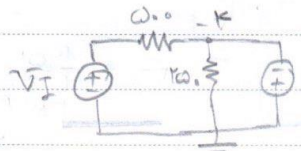
حالت: D: off




$i_D=0$

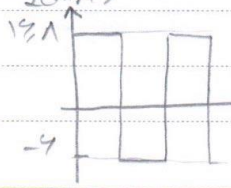
$$-5<V_D=\frac{250}{250+500}\times V_I-0.7<0 \Rightarrow -5<\frac{1}{3}V_I-0.7<0 \Rightarrow -12<V_I<1.7$$

حالت: D: break




$$KCL: \frac{-5-V_I}{500}+\frac{-5}{250}+i_D=0$$

$$\Rightarrow i_D=\frac{12+V_I}{500}<0 \Rightarrow V_I<-12$$

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