منظم شد

۹۷۱۰۹۹۸۷ سوال

① الف)

$v_i = 0 \rightarrow v_o = 0 \rightarrow v_b = 0.7V$

ب)

$$P_L = \frac{V_{om}^2}{2R_L} \rightarrow V_{om} = \sqrt{2R_L P_L}$$

ج)

$$V_{cc} - V_o^+ \geq 0.2 \rightarrow V_{cc} - 0.2 \geq V_o^+$$

$$\frac{V_o^-}{R_b \parallel R_L} < I_{CQ} \rightarrow |V_o^-| \leq \frac{(R_b \parallel R_L) V_{cc}}{R_b}$$

د)

$$V_{om} = \min\left(V_{cc} - 0.2 \, , \, \frac{-R_L V_{ee}}{R_b + R_L}\right) \quad \begin{cases} V_{cc} = V_{om} + 0.2 \\ V_{om} = -\dfrac{R_L V_{ee}}{R_b + R_L} \end{cases}$$

$$P_{total} = V_{cc} I_{CQ} - V_{ee} I_{CQ} = \frac{V_{om}}{R_L}\left(1 + \frac{R_L}{R_b}\right)\left(V_{om} + 0.2 + V_{om}\left(1 + \frac{R_b}{R_L}\right)\right)$$

$$\rightarrow P_{\text{منابع}} = \frac{\sqrt{2P_L R_L}}{R_L}\left(1 + \frac{R_L}{R_b}\right)\left(\sqrt{2R_L P_L}\left(2 + \frac{R_b}{R_L}\right) + 0.2\right)$$

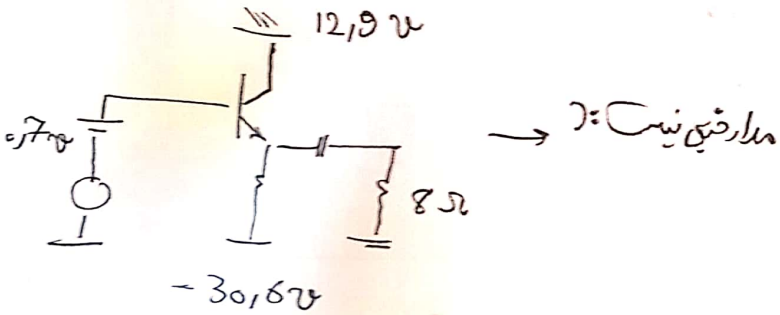
ه)

$$P_{\text{منابع}\,min} \rightarrow \frac{\partial}{\partial R_b} \quad + \frac{R_L}{R_b^2}\left(\text{———} \right) = \sqrt{2P}\,\frac{V_{om}}{R_L}\left(1 + \frac{R_L}{R_b}\right)$$

$$\rightarrow R_b = R_L \sqrt{2 + \frac{0.2}{\sqrt{2R_L P_L}}}$$

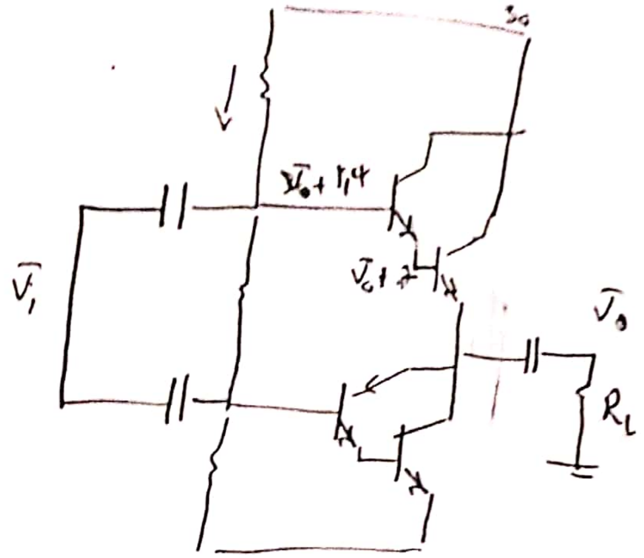
$R_L = 8\Omega$ P_L 10W $\rightarrow$ $R_b \hat{=} 11{,}4\Omega \rightarrow P_{\text{ورودی}} = 11{,}7W$ ج

$P_L = 10\ W$ $\eta = 8{,}5\ \%$



مدار خنثی نیست

سوال 14



$30 - (V_o^+ + .7) \geq .5$

$28,8 \geq V_o^+$

8

$30 > V_o + 1,4 \rightarrow 28,6 \geq V_o$

$\rightarrow V_{o\,max}^+ = 28,6$

ب) $\rightarrow P_L = \frac{1}{2} \frac{V_{om}^2}{R_1} = 51,12\ W$

سوال 13

الف) $2W = \frac{V_{Lm}^2}{2 \times 4} \rightarrow V_{Lm} = 4v \quad I_L = 1\ A$

$\rightarrow V_{C_3} = 4 + .3 + .7 = 5,3v$

$I_{E3} = \frac{I_L}{20} = \frac{1}{20} A = I_{C Q_3} = \frac{1,97 - .7}{R} \rightarrow R = 20 \times (1,95 - .7) \times \frac{19}{20}$

$= 23,75\ \Omega$

ب)

$\& \ V_{C3} = 5,3v \rightarrow V_{E_3} = 5,2$

$V_{cc} = 5,2 + \frac{1,25}{RI} = 6,45v \rightarrow V_{cc} > 6,45v$

$= 6,45$

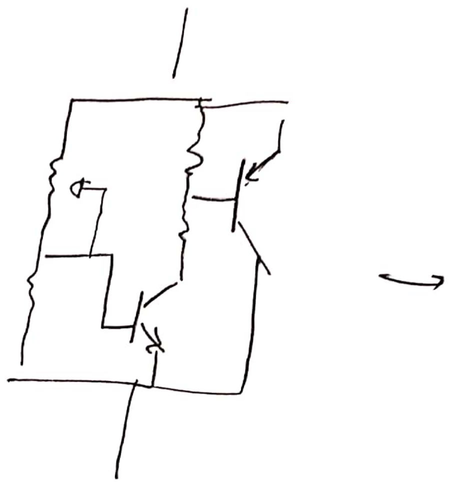
(2

$V_{sup} = \frac{2 V_{cc} I_Q}{\pi} = \frac{2 V_{cc}}{\pi} \times I_E = 4,108\ W$ (1 A)

$\rightarrow \eta = \frac{2}{4,108} = 48,7\%$

۵

ولتاژ رگولاتور



معادل زینر

سوال ۱۴

$P_L = \frac{V_p^2}{2R_L}$ $P_{sup} = \frac{2V_{cc}I_{cc}}{\pi} = \frac{2V_{cc}}{\pi}\left(\frac{V_p}{R_L}\right) + 2V_{cc}\times\left(\frac{V_p}{\beta R_L}\right)$

β محدود

$\rightarrow \eta = \frac{P_L}{P_{sup}} = \frac{V_p}{4V_{cc}\left(\frac{1}{\beta}+\frac{1}{\pi}\right)}$

$V_p \simeq V_{cc}$

$= \frac{1}{4\left(\frac{1}{\beta}+\frac{1}{\pi}\right)} = 78.5\%$

سوال ۱۵

$I_{C_1} = I_{C_2} = 1mA$ $I_{C_3} = 3.5 mA$

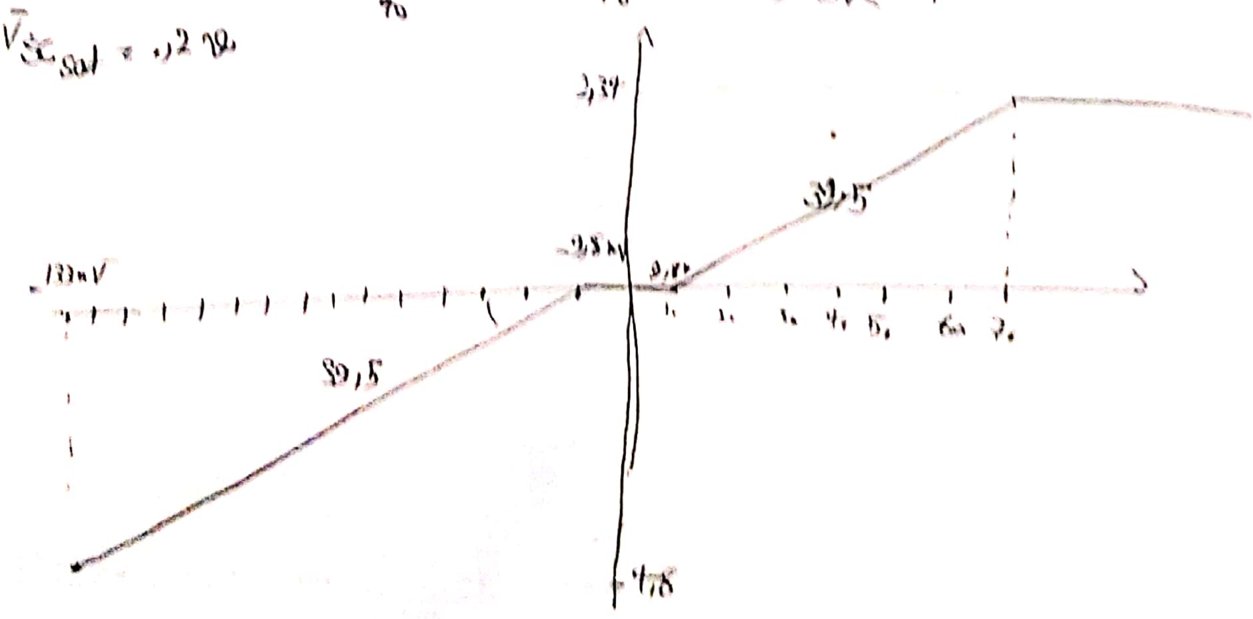
$A_{V} = \frac{1}{2}\times\left(\frac{1}{r_\pi + 1k}\right)\times\beta\times\left(5k \,\|\, r_{\pi_3} + \overbrace{30\times 2\,r_o}^{6k}\right)\times\frac{6}{6 + \frac{1}{g_m}}$

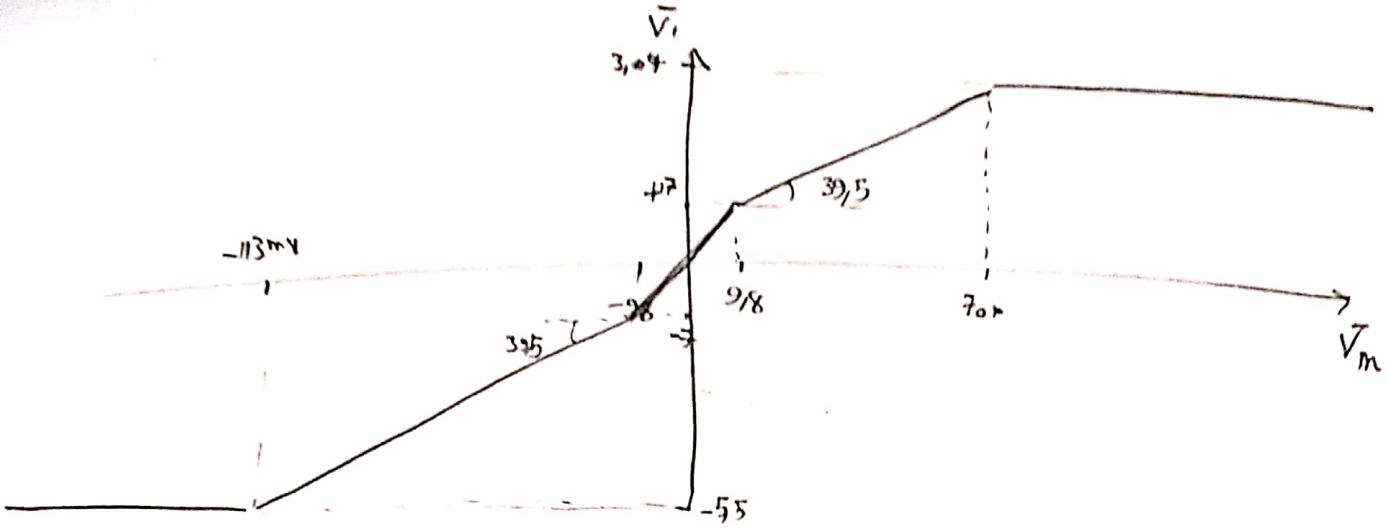
$\simeq 39.5$ Swing $\Delta V < \overbrace{5 - 2}^{4.8 V}$

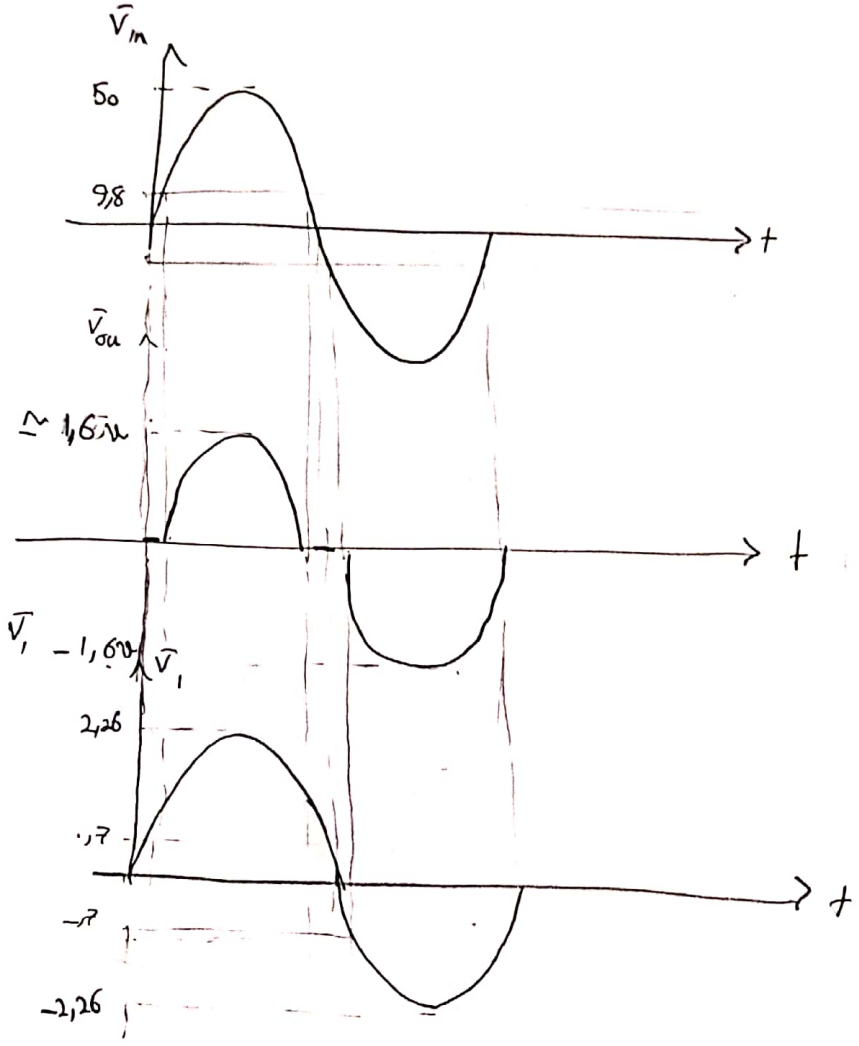
$\frac{\Delta V'}{6} + \frac{\Delta V' + 0.7}{5} < 1mA$

$\frac{2.34}{40} = 0.07$ V_o $\rightarrow \Delta V < 2.34 V$

$V_{CE_{sat}} = 0.2 V$







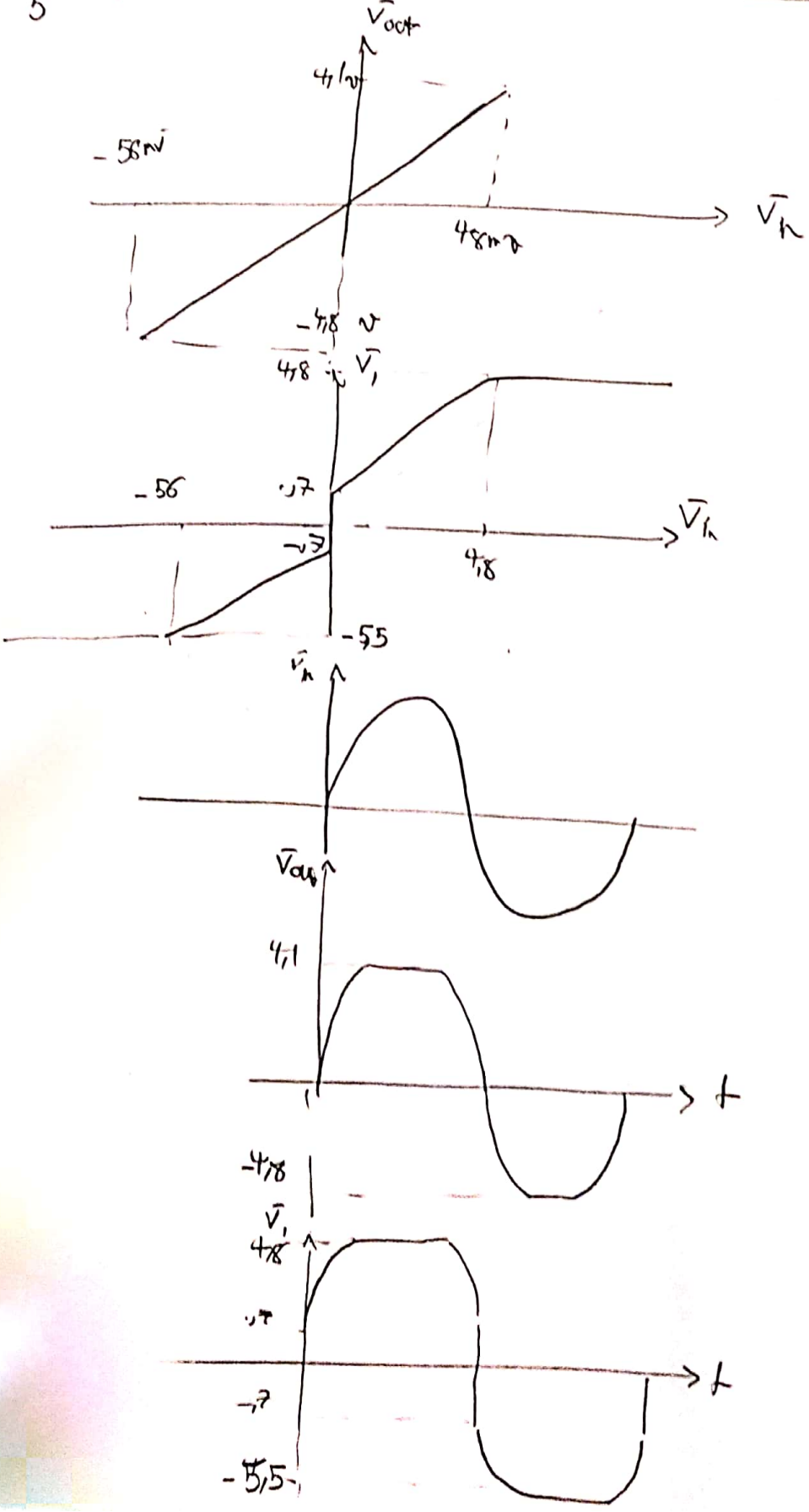
=

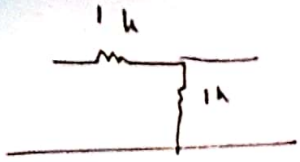
$$A_v = \frac{1}{2} \times \left(\frac{1}{r_\pi + 1k}\right) \times \beta \times (6k + r_{\pi_3}) \times \frac{6}{6 + r_\pi} \approx \boxed{86}$$

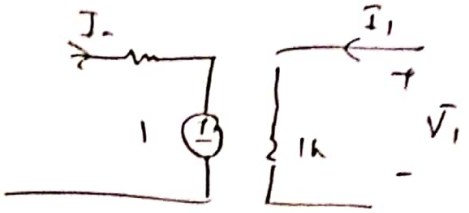
(2

$$\bar{V} - 5 \leq 0 \rightarrow \Delta\bar{V} < 4{,}8$$

$$\frac{\Delta\bar{V} + 0{,}7}{5} < 1 \rightarrow \Delta\bar{V} < 4{,}3 \rightarrow \underline{-4{,}8 < \bar{V}_{out} < 4{,}8}$$







f_2 1

(ب

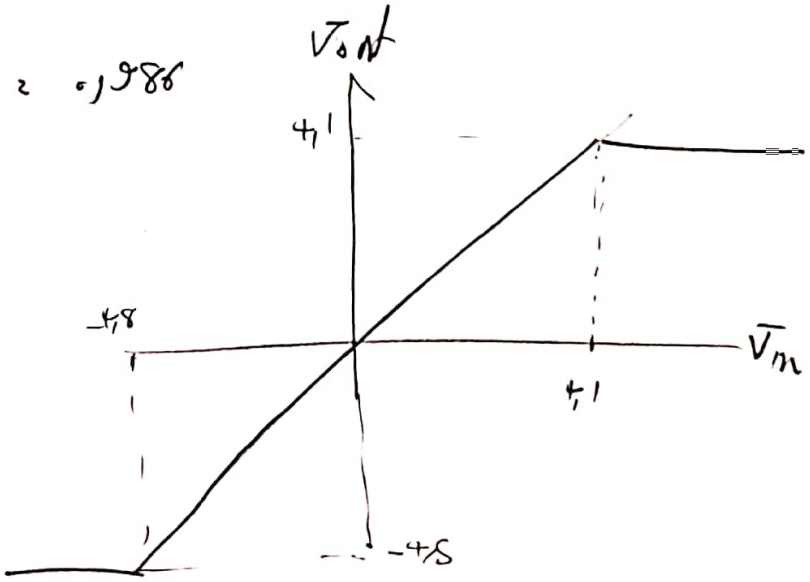
	1	2	3	4
I_C	1mA	1mA	NA	NA
V_{CE}	10.7V	5.7V	5V	-5V

(ج

$$\alpha = \frac{1}{2} \times \left(\frac{1}{r_\pi + 1k}\right) \times \beta \times 30 \times (1k \| 0.2k) \cong 7.4$$

(د

$$\rightarrow \quad A = \frac{\alpha}{1 + \alpha f} = 0.986$$



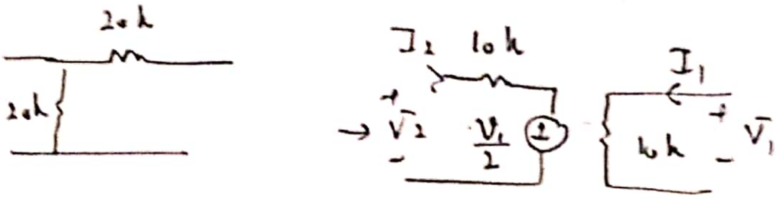
$R_{th} = 3.5 \times 2 = 7k\Omega$

$\rightarrow R_{if} = 7(1 + \alpha f) - 2 \cong 500k$

$R_{out} = R_{out} \| 200\Omega = \frac{11.67k}{1 + \alpha f} \| 200\Omega \cong 2.3\Omega$

سوال 16

الف)



ان $\rightarrow \frac{af}{1+af} \simeq \frac{1}{f} = \frac{1}{\frac{1}{2}} = 2$

ب)

	1	2	3	4	5	6	7	8
I_C	۰,5	۰,5	۰,5	۰,5	۰,۰۰5	۰,5	4mA	0
V_{CE}	2,95	2,95	7,7	4,7	-10,2	-10,9	9,9	-10,2

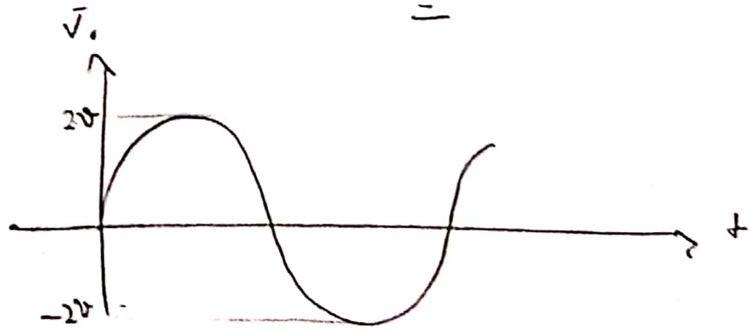
ج)

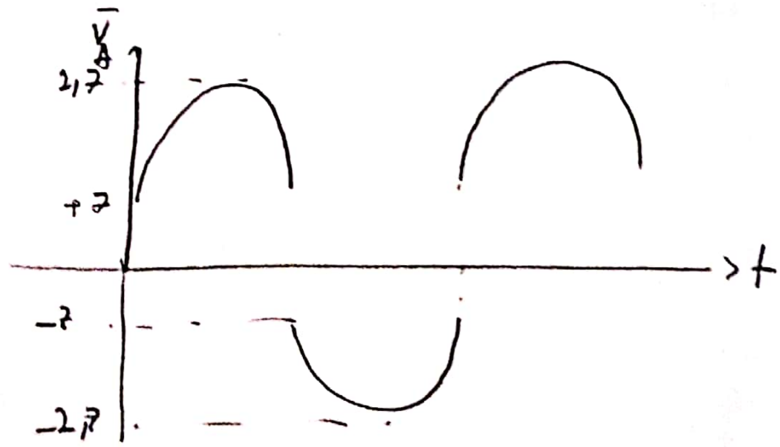
$\left(V^+ + \frac{V_E}{7}\right) \times 1 + 10 \geq 0.7$

$\rightarrow V^+ < 9{,}7v$

$\frac{V_{cm}}{50\Omega} \times \frac{1}{\beta} < 0{,}5 \rightarrow V < 2{,}5 \rightarrow V_{p-p} = 5V$

د)





ه) سوال zi7o بودن