سری 7 — مدار الکترونیک — ۹۷۱۰۹۹۸۷ — کسری فدائی

سوال ۱

$I_{ref} = \frac{8,3}{100}$,45

$4,5 + ,7 + 10 I_{11} = 9$

$10 (I_{11} + \frac{,45}{100}) = ,38$

	1	2	3	4	5	6	7	8	9	10	11	12
I_C	$\frac{,41}{100}$	,41	,41	$\frac{,41}{100}$	,41	,41	,83	,83	,83	,83	0,34	,45
V_{CE}	5,2	5,2	5,2	5,2	-,7	-,7	,7	3,1	8,3	,7	5,2	4,5v

ب)

$r_{in} = \overset{60k}{r_{\pi_1}} + (\beta+1)(\overset{6,1k}{r_{\pi_2}}) = 1226,1k$

$\rightarrow R_{in} = 2meg \parallel 2meg \parallel 2 \times r_{in} = 710\ k\Omega$

$R_{out} = 1meg \parallel 1k \parallel \overset{5,5\Omega + \frac{10k}{\beta}}{r_{m_{12}}} = 95,5\Omega \simeq 95\Omega$

ج)

$A_{id} = \frac{g_{m_3}}{2}(r_{o6} \parallel \overset{50}{r_{o3}} \parallel \overset{3k}{r_{\pi 9}}) = 23,44$

$A_2 = -g_{m_9} \times (r_{o9} \parallel r_{o10} \parallel \overset{7,4k}{r_{\pi_{11}}}) = -219$

$A_3 = -g_{m_{11}}(10k \parallel 10k \parallel r_{o11}) = -117$

$A_4 = \frac{1,0k \parallel r_{o_m}}{1k \parallel r_{o_n} + \underbrace{\frac{r_\pi}{100}}_{5\Omega}\ r_n'} \simeq 0,999$

$A_v \simeq 60002$ خیلی زیاد!!

د)

$12 \begin{cases} V_o^- = 1k \times 4,5 = -4,5v \\ V^+ = 8,8v \end{cases}$

$V_o^- = -5v$

$\frac{V^-}{10k} = ,3 + 1 \ (V_o^+ + ,7), 12, 3,4$

$\rightarrow P\_P = 6,8v$

الف 12

	1	2	3	4	5	6	7	8	9	10	11
I_C	1mA	1mA	2mA	2mA	2mA	2mA	2mA	1mA	1mA	1mA	1mA 0.98
V_{CE}	$2.4 - V_{BB}$	$2.4 - V_{BB}$	-0.3	-0.3	-0.7	0.7	$V_{BB} - 0.7$	-1	$-1.5V$	0.7	$0.2V$

ب)

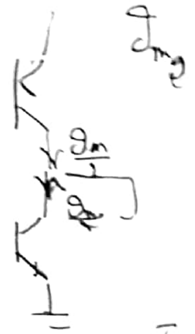
$r_{in} = 2 R_\pi = \underline{5k}$

$$R_{out} = 1k \parallel r_{o_{11}} \parallel r_{o_9}\left(1 + g_{m_9}\left(r_{\pi_9} \parallel r_{o_3} \parallel r_{o_1}\right)\right) = \underline{9.1\,k\Omega}$$

100   1   2.5k   1.2   3.9 meg

ج)

$g_1 v_{in}$ $-g v_{in}$



$$A_{تقاضلی} = + g_{m_1}\left(R_{out}\right) = \underline{364}$$

هـ)

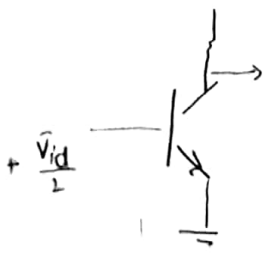
$V_{BB} - 0.7 > 0.2$

$V_{BB} > 0.9$

$$\underline{0.9 < V_{BB} < 2.2\,V}$$

سوال ۱۳) متأسفانه بایاس سوال ایراد دارد

14 سؤال

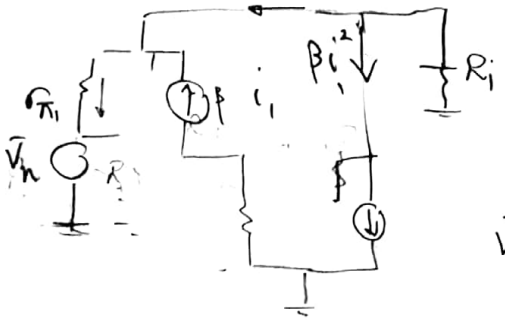


$A_{id} = \frac{3k}{\frac{10k}{100}} = 30$

$A_{cm} = \frac{3k}{200 + \frac{1}{100}} = 1.0.19 \rightarrow CMMR = 66$

12 نمره

15 سؤال



$v_{ih} - r_{\pi_1} i_1 - R_1 \beta^2 i_1 = 0$

$V_o = \beta^2 R_1 i_1 = \frac{\beta^2 R_1 v_{ih}}{r_{\pi_1} + \beta R_1}$

$\beta^2 i_1$

$A_v = \frac{R_1}{\beta r_2 \frac{r_{\pi_2}}{\beta^2} + R_1} = \frac{R_1}{r_{e_2} + R_1}$

$I_{C_2} = \frac{I_{C_2}}{\beta}$

$r_1 = \beta r_2$

$r_2 = \frac{\beta}{\frac{I_{C_2}}{V_2}} =$

10 سؤال

$I_C = \frac{V_E}{.8k}$

$1.\frac{V_E}{8k} \times 1k = V^+$

$V^+ = \frac{1.V_E}{8}$

$2,8 - \frac{k V_E}{8} - V^- > .8 V_E + .2$

$V^- = 2,8 - \frac{18}{8} V_E - V^- = \frac{10}{8} V_E$

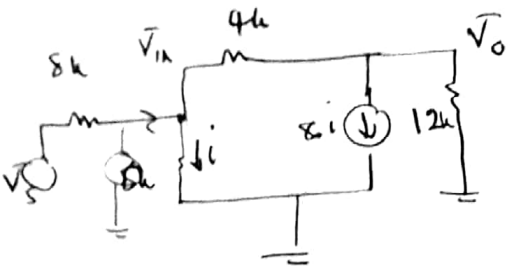
$\begin{cases} V^+ = \frac{V_E}{.18} \\ V^- = 2,8 - \frac{18}{8} V_E \end{cases} \rightarrow V_E = .8\ v$

$.1 \quad 2,8 = \frac{28}{8} V_E$

$.8v = V_E$

$\rightarrow 1,5\ v \rightarrow R_i = 10k$

سوال ۹



$$\frac{\bar{V}_{in}-\bar{V}_o}{4k}+\frac{\bar{V}_{in}}{8k}=i$$

$$\frac{\bar{V}_o-\bar{V}_{in}}{4k}+\frac{\bar{V}_o}{12k}+80\frac{\bar{V}_{in}}{8k}=0 \rightarrow \bar{V}_o\left(\frac{1}{3k}\right)=-9,75\,\bar{V}_{in}$$

$$\rightarrow \bar{V}_o=-29,25\bar{V}_{in}=-3\bar{V}_{in}$$

$$\bar{V}_{in}\left(\frac{3}{4k}+\frac{1}{8k}\right)=i \rightarrow R_{in}=126,98\simeq 125\Omega$$

گزینه 3

سوال ۱۸

$$=\frac{\frac{1}{\left(r_\pi+\beta\,100\Omega\right)}}{\left(\left(r_\pi+\beta\times100\Omega\right)+\beta r_\pi\right)}\times\frac{\frac{50}{10k}}{\left(100\Omega+\frac{r_\pi}{\beta}50\right)\Omega}=50$$

گزینه 3

=

سوال ۱۹

$$\bar{V}_E=-5V+2\times2,5=0$$

$$\rightarrow \bar{V}=4,8$$

$$4,8+2,5=7,3V$$

$$V_o=2,5\times(2k\|12k)=2,5V$$

=

سوال ۱۰

گزینه 3

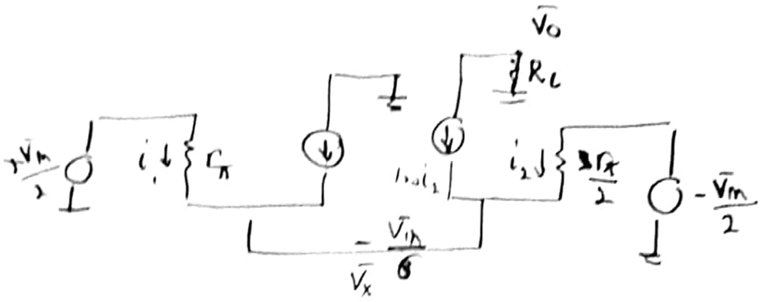
$I_C=1mA \qquad r_o=10k\Omega$

$$A_{\bar{V}}=\frac{-10k\Omega}{\frac{2,5k}{100}}=-400$$

$+\ \dfrac{R_C}{R_s + \frac{r_\pi}{\beta}}$ $g_m(10k\Omega \,\|\, r_{o2}(1+\beta) \,\|\, \infty)$ 111

,5 mA $\dfrac{1}{50} \times 10k\Omega = 200$

$\dfrac{\beta}{\frac{I_C}{V_T}}$ 112



$\dfrac{V_x - \frac{V_{in}}{2}}{r_\pi} + \dfrac{V_x + \frac{V_{in}}{2}}{\frac{r_\pi}{2}} = 0 \rightarrow \dfrac{3V_x}{r_\pi} = \dfrac{V_{in}}{r_\pi}\left(\frac{1}{2} - 1\right)$ $-\frac{1}{2}$

$V_x = \dfrac{V_{in}}{-6}$

$-\dfrac{3V_{in}}{3\times 2} + \dfrac{V_{in}}{6} = -\dfrac{2V_{in}}{6} = -\dfrac{V_{in}}{3}$

$100 \times \dfrac{\frac{V_{in}}{3}}{\frac{r_\pi}{2}} \rightarrow \dfrac{2}{3}\,100\,\dfrac{V_{in}}{r_\pi} \rightarrow \dfrac{4}{3}\times 60 = 80 \rightarrow$ 13 سؤال

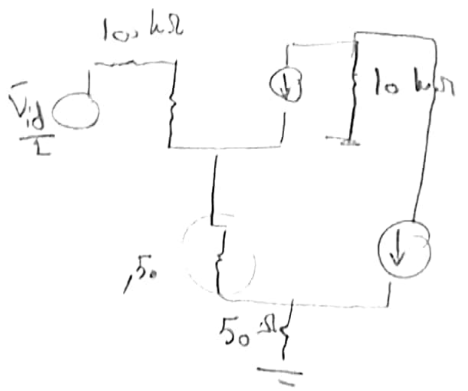
113

-4

$(2,8+1,4)I = 6V$

$\rightarrow 1,42 \quad \dfrac{I}{5} = 1mA$

$I_1 = I_2 = ,5mA \quad I_3 = I_4 = \dfrac{,5}{100}$ mA



$\dfrac{\frac{V_{id}}{2}}{100k\Omega + \beta(\beta r_\pi + \beta 50)}$

$5k$

$1,600\ k$

$V_{out} = \dfrac{V_{id}}{3200k} \times 100 \times 100 \times 1000$

$\rightarrow \dfrac{V_{out}}{V_{id}} = 31,25$

مسئلہ 14

$$\frac{\bar{V}_o}{-\frac{\bar{V}_{id}}{2}} = -\frac{\frac{8}{(3\|6)+6}}{25\,\Omega} = -320$$

$$\rightarrow \frac{\bar{V}_o}{\bar{V}_{id}} = 160$$