جناب دکتر مختارزاده

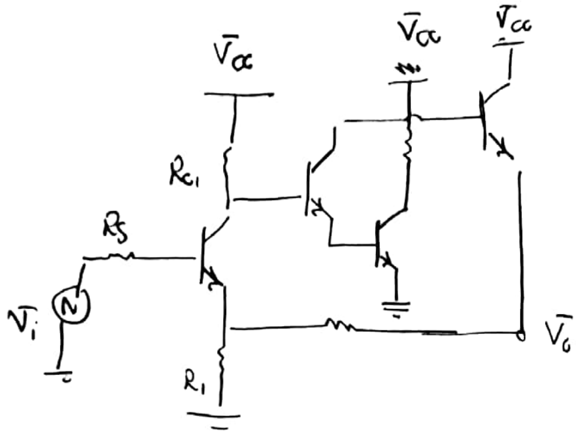
به نام ایزد

آرکی فدایی ۹۸۱۰۹۹۸۷

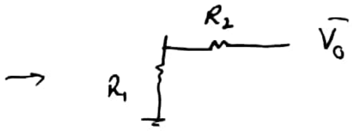
تمرین ۱۰

سوال ۱۱

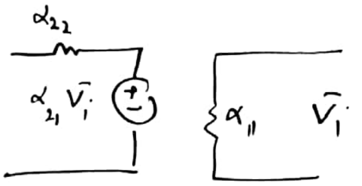
الف)



$\rightarrow$



سری موازی

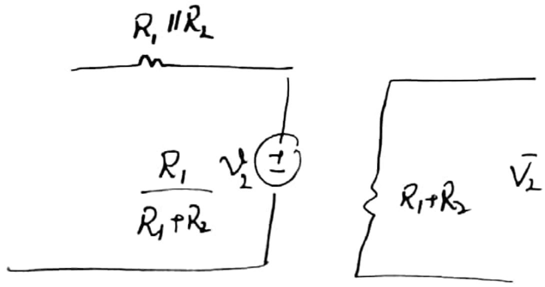


$$\alpha_{11} = \frac{I_1}{V_1} = \frac{1}{R_1+R_2}$$

$$\alpha_{22} = \frac{V_2}{I_2}\Big|_{V_1=0} = R_1 \parallel R_2$$

$$\alpha_{21} = \frac{V_2}{V_1}\Big|_{I_2=0} = \frac{R_1}{R_1+R}$$

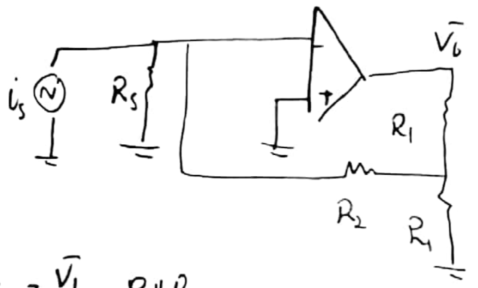
$\rightarrow$

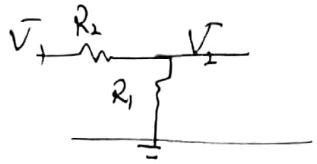


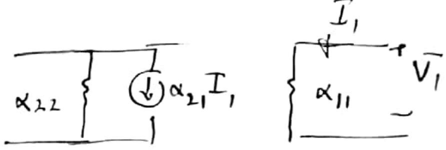
$$f = \frac{R_1}{R_1+R_2}$$

ب)

موازی سری





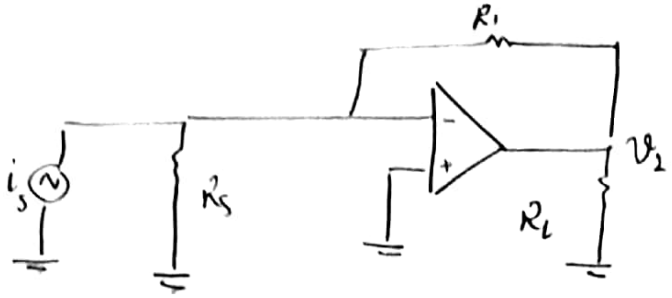


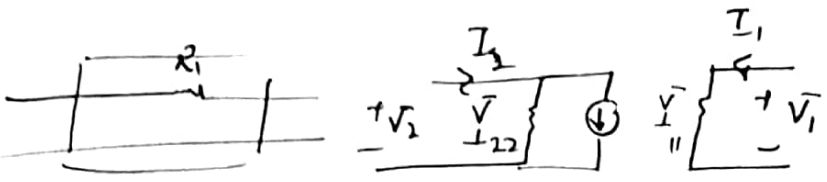
$$\alpha_{11} = \frac{V_1}{I_1} = R_1 \parallel R_2$$

$$\alpha_{22} = \frac{I_2}{V_2} = \frac{1}{R_1+R_2} \qquad \alpha_{21} \frac{I_2}{I_1} = -\frac{R_1}{R_1+R_2}$$

$$f = -\frac{R_1}{R_1+R_2}$$

ج)

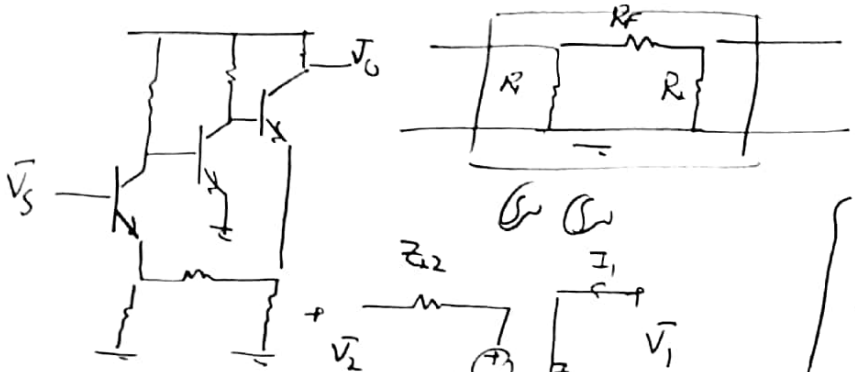




$$\begin{cases} Y_{11} = \frac{I_1}{V_1} = \frac{1}{R_1} \\ Y_{22} = \frac{1}{R_1} \\ Y_{21} = -\frac{1}{R_1} \end{cases}$$

$$f = -\frac{1}{R_1}$$

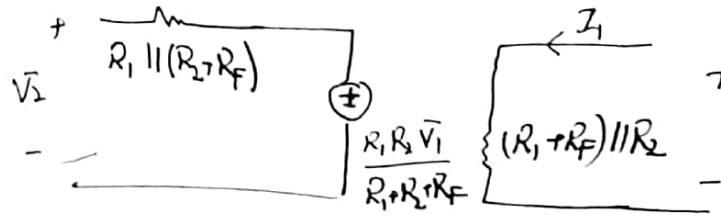
د)



$$\begin{cases} Z_{11} = \frac{V_1}{I_1} = (R_1 + R_F) \| R_2 \\ Z_{21} = \frac{V_2}{I_1} = \frac{R_1 R_2}{R_1 + R_2 + R_F} \end{cases}$$

$$Z_2 = (R_F + R_2) \| R_1$$

$$f = \frac{R_1 R_2}{R_1 + R_2 + R_F}$$



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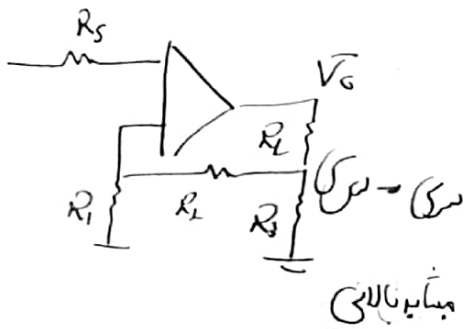
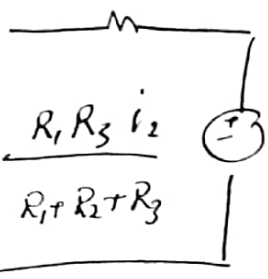
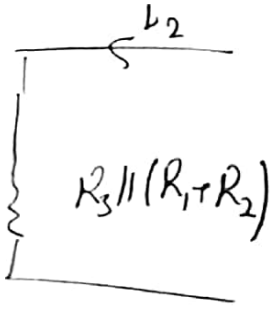
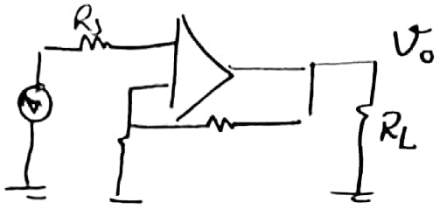


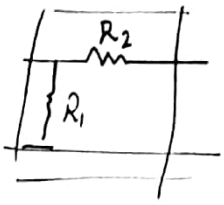




$$f = \frac{R_1 R_3}{R_1 + R_2 + R_3}$$

i)

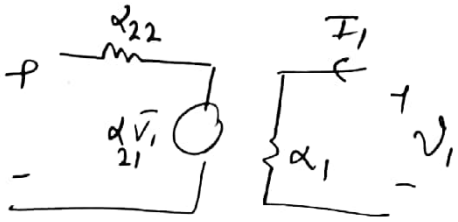




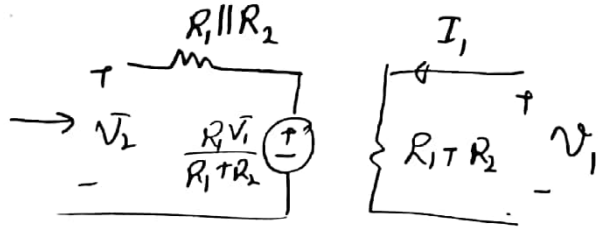
$$\alpha_{22} = \frac{\bar{V}_2}{\bar{I}_2} = R_1 \| R_2$$

$$\alpha_{11} = \frac{1}{R_1 + R_2}$$

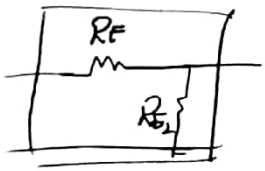
$$\alpha_{21} = \frac{R_1}{R_1 R_2}$$

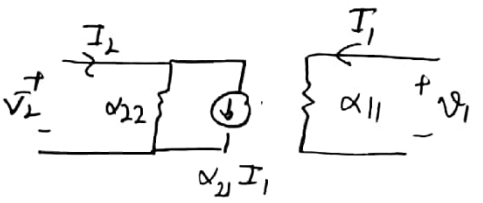


e $f = \dfrac{K_1}{R_1 + R_2}$



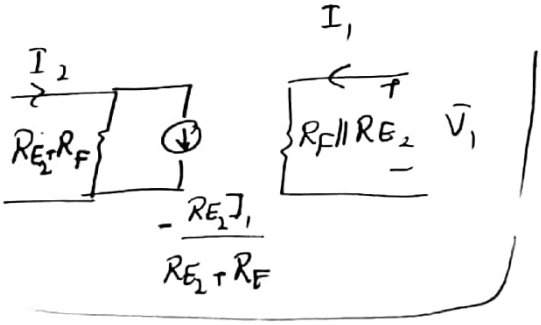
j)



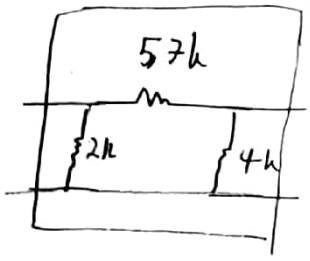


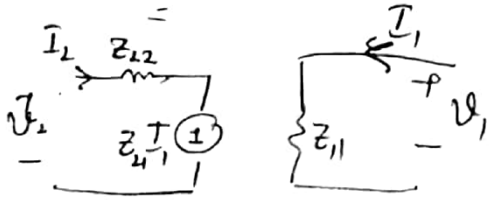
$$\begin{cases} \alpha_{11} = \dfrac{\bar{V}_1}{\bar{I}_1} = R_F \| R_{E_2} \\ \alpha_{21} = \dfrac{-R_{E_2}}{R_{E_2} + R_F} \\ \alpha_{22} = \dfrac{1}{R_F + R_F} \end{cases}$$

$$f = \frac{-R_{E_2}}{R_{E_2} + R_F}$$



2)

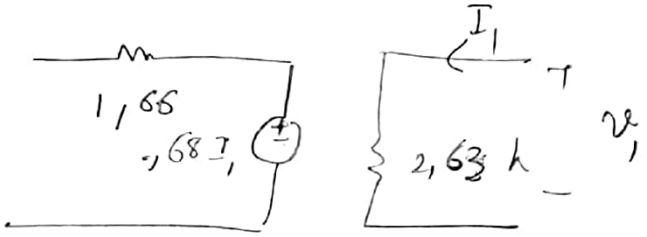




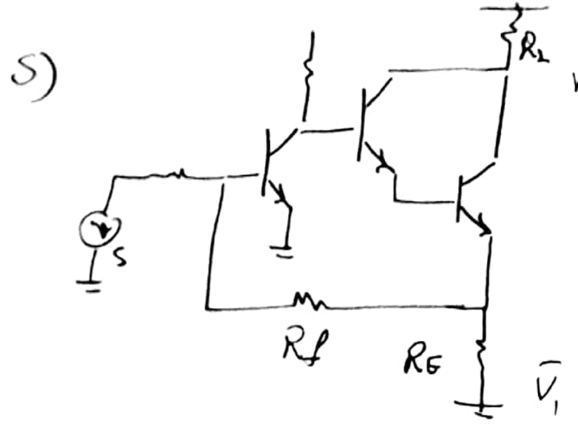
$$z_{22} = (5{,}7 + 4) \| 2 \approx 1{,}66\ k \qquad z_{21} = \frac{2 \times 4}{2 + 4 + 5{,}7} = 0{,}68\ k$$

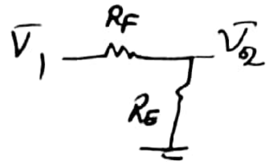
$$z_{11} = (2 + 5{,}7) \| 4 = 2{,}63\ k$$

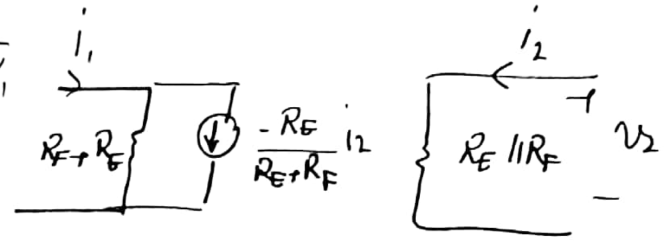
$f = 0{,}684\ k$



a) موازی - سری

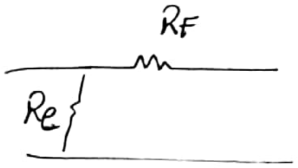


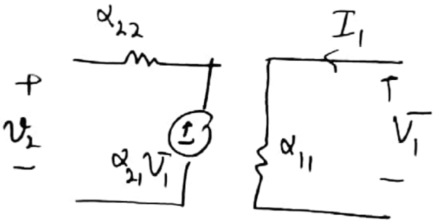




$$f = -\frac{R_E}{R_E+R_F}$$

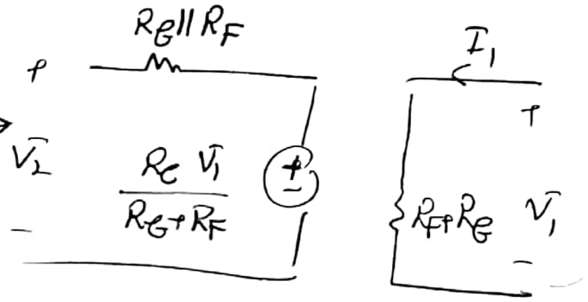
b) سری موازی



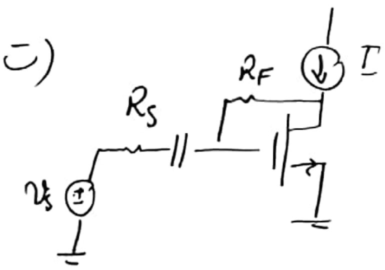


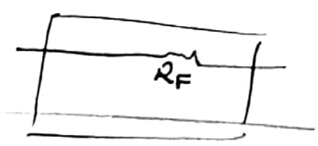
$$\alpha_{22} = R_G \| R_F$$
$$\alpha_{11} = \frac{1}{R_F+R_G}$$
$$\alpha_{21} = \frac{R_G}{R_F+R_G}$$

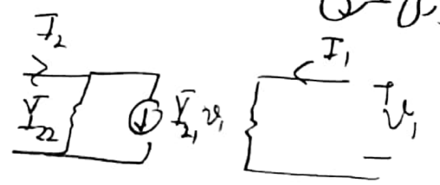
$$f = \frac{R_G}{R_G+R_F}$$



c) موازی سری

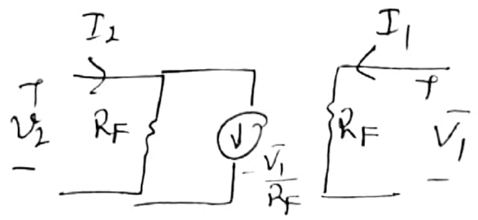




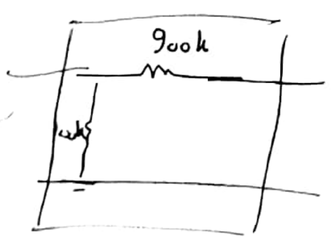


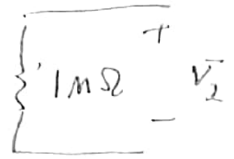
$$Y_{22} = \frac{1}{R_F}$$
$$Y_{11} = \frac{1}{R_F}$$
$$Y_{21} = \frac{-1}{R_F}$$

$$f = -\frac{1}{R_F}$$

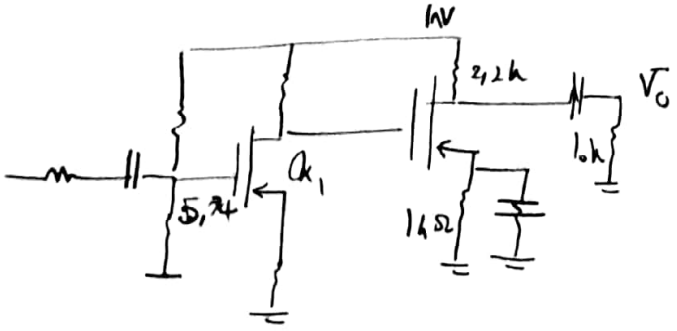


d) سری موازی





$$f = 0.1$$



$5,74 - V_{GS} + (1,5k)\, I_D = 0$

$I_{D_1} = 0,25 \times (5,74 - 1,5 I_D - 2)^2 \rightarrow (4 I_{D_1})^2 = (3,74)^2 - 3,74 I_D + 3,74 I_D^2$

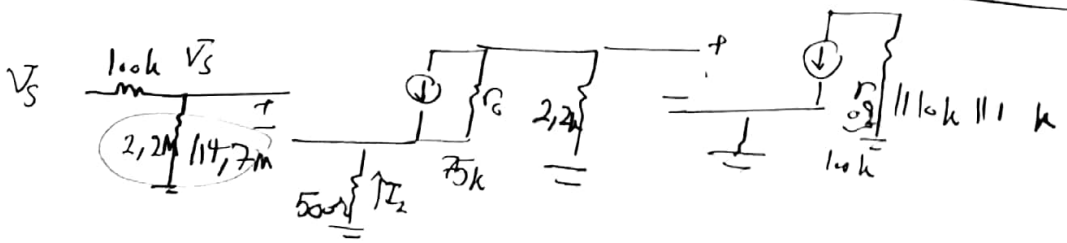
$\rightarrow I_{D_1} = 1,93\,mA \quad V_{GS} = 4,775\,V$

$V_{D_1} = V_{G_2} = 18 - 1,93 \times 2,2 = 13,75\,V$

$\rightarrow I_{D_2} = 0,15 (13,75 - 2,6 - I_{D_2})^2 \rightarrow I_{D_2} = 5,25\,mA$

$V_{GS_2} = 13,75 - 1 \times 5,24 = 8,5\,V$

$g_{m_2} = \dfrac{2 \times 5,25}{8,51 - 2,0} = \underline{1,78\,mV}$ $\quad \underline{g_{m_1} = 1,4\,mV}$



$0,5 I_2 + 75 (I_2 + 1,4 V_1) + 2,2k\, I_2 = 0$

$I_2 = -\dfrac{105 V_1}{77,7} \rightarrow V_2 = -1,66 V_S$

$V_o = (100k \| 1,0k \| 1k) \times -1,78mV \times -1,66 = \underline{2,66}$

سوال 13 از $G_m r_o$ استفاده کنید

$$G_m = \frac{g_{m2}}{2} \times \frac{1}{2} \times 2 = 5\,\Omega$$

$$R_{out} = r_{o1} \uparrow\uparrow \left(g_{m4} r_{o3} \left(G \uparrow\uparrow \left(r_{o1} \uparrow\uparrow \frac{1}{g_{m6}} \right) \right) + r_{o1} + r_{o2} \left(r_{o1} \uparrow\uparrow \frac{1}{g_{m6}} \right) \right)$$

$$= 6,645$$

$$\rightarrow A_v = 33,3$$