

حل ۱۰۳

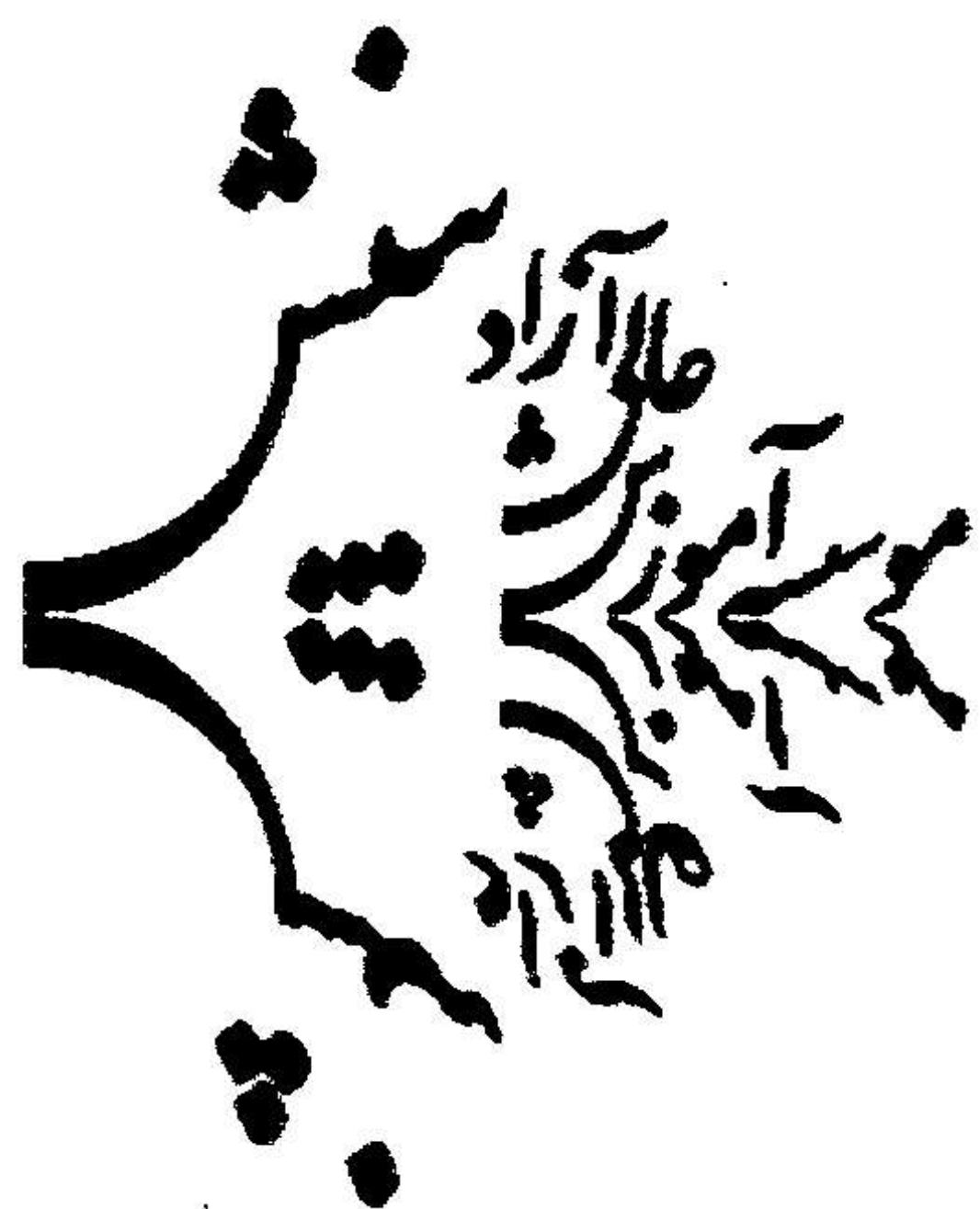
$$V_{D_1} = -V_{D_Y} \Rightarrow \eta V_T \ln \left[\frac{i_{D_1}}{I_{S_1}} + 1 \right] = -\eta V_T \ln \left[\frac{i_{D_Y}}{I_{S_Y}} + 1 \right]$$

$$\frac{L_{D1}}{1} + 1 = \frac{10}{-r_{L_{D1}} + 10}$$

$$\Rightarrow -Y_{10}^0 - Y_{10}^0 + 10Y_{10}^0 + 10 = 10$$

$$\wedge i_{D_1}^\circ - \gamma i_{D_1}^{\circ \vee} = 0 \quad \Rightarrow \quad i_{D_1}^\circ = \sum v A$$

$$V_{D_1} = \gamma V_T \ln \left[\frac{I_{D_1}}{I_{S_1}} + 1 \right] = \gamma V_T \ln \left[\frac{F_{nA}}{I_{nA}} + 1 \right] = \gamma V_T \ln(\delta)$$



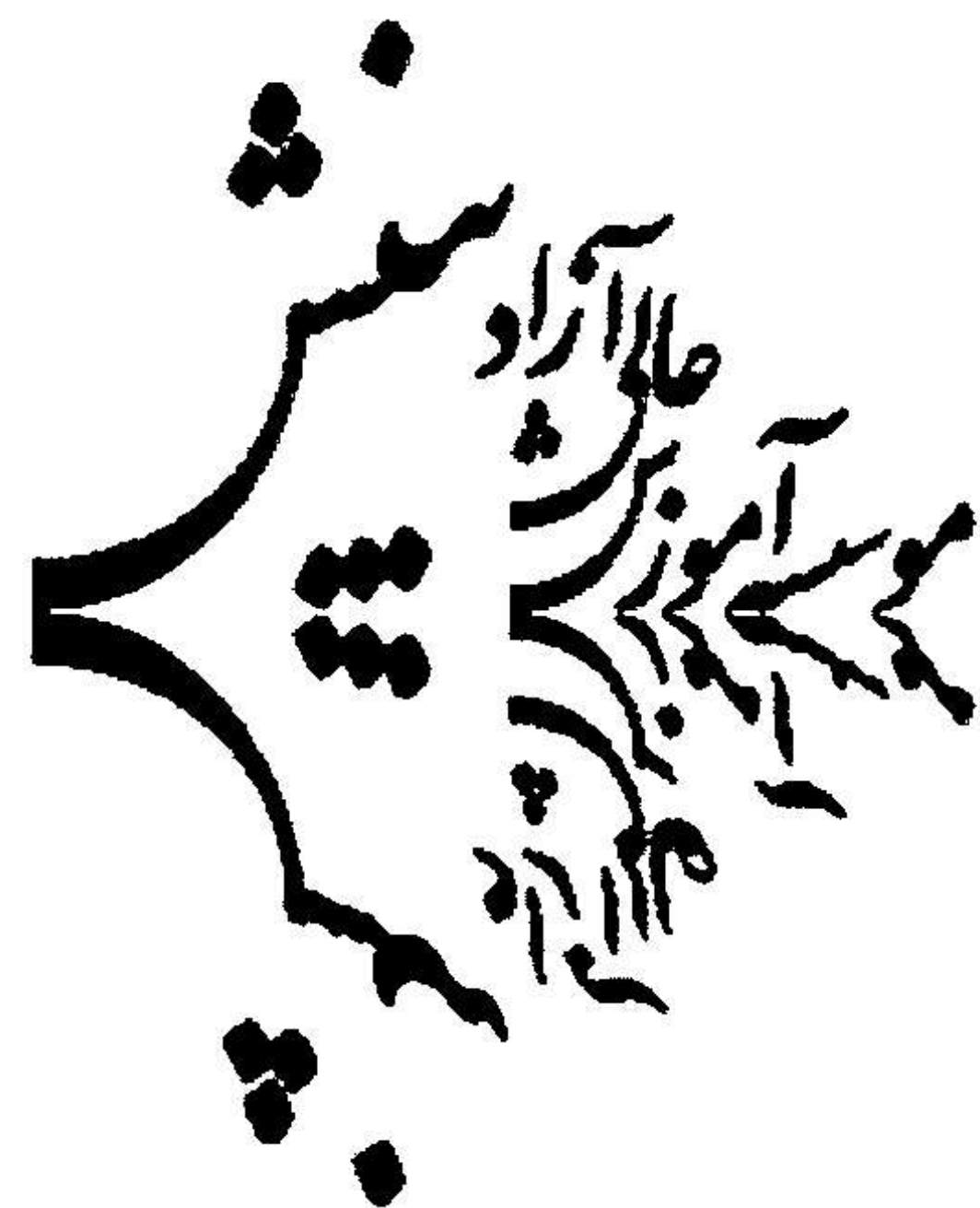
جل ۱۰۴

$$I_{D1} = \frac{1-0}{1k\Omega} = 1mA$$

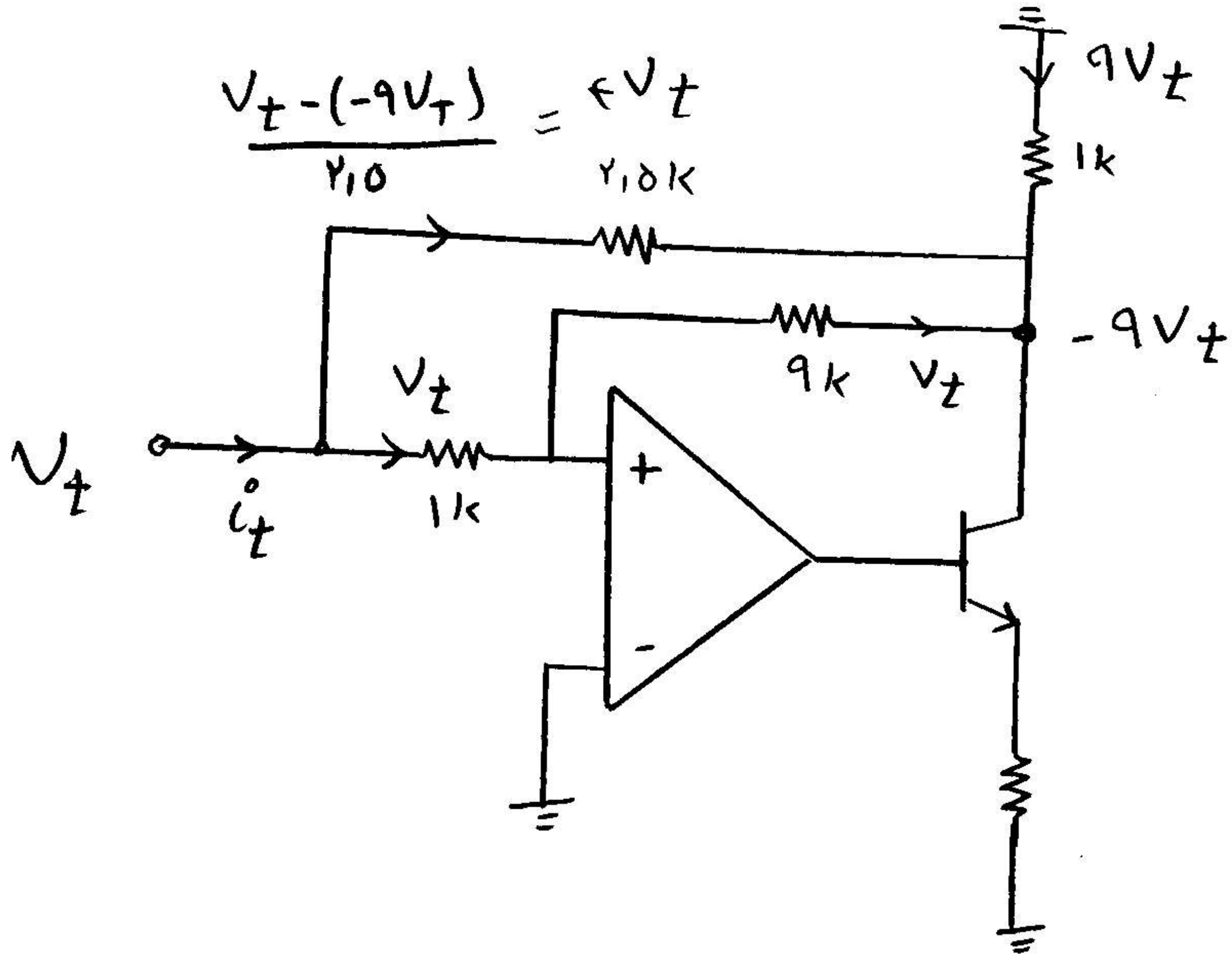
$$k = 1 \frac{mA}{V^2} \Rightarrow V_{GS} = \sqrt{\frac{I_D}{k}} + V_T = 1 + 1 = 2V$$

$$V_G = V_{GS} - 1 = 1V$$

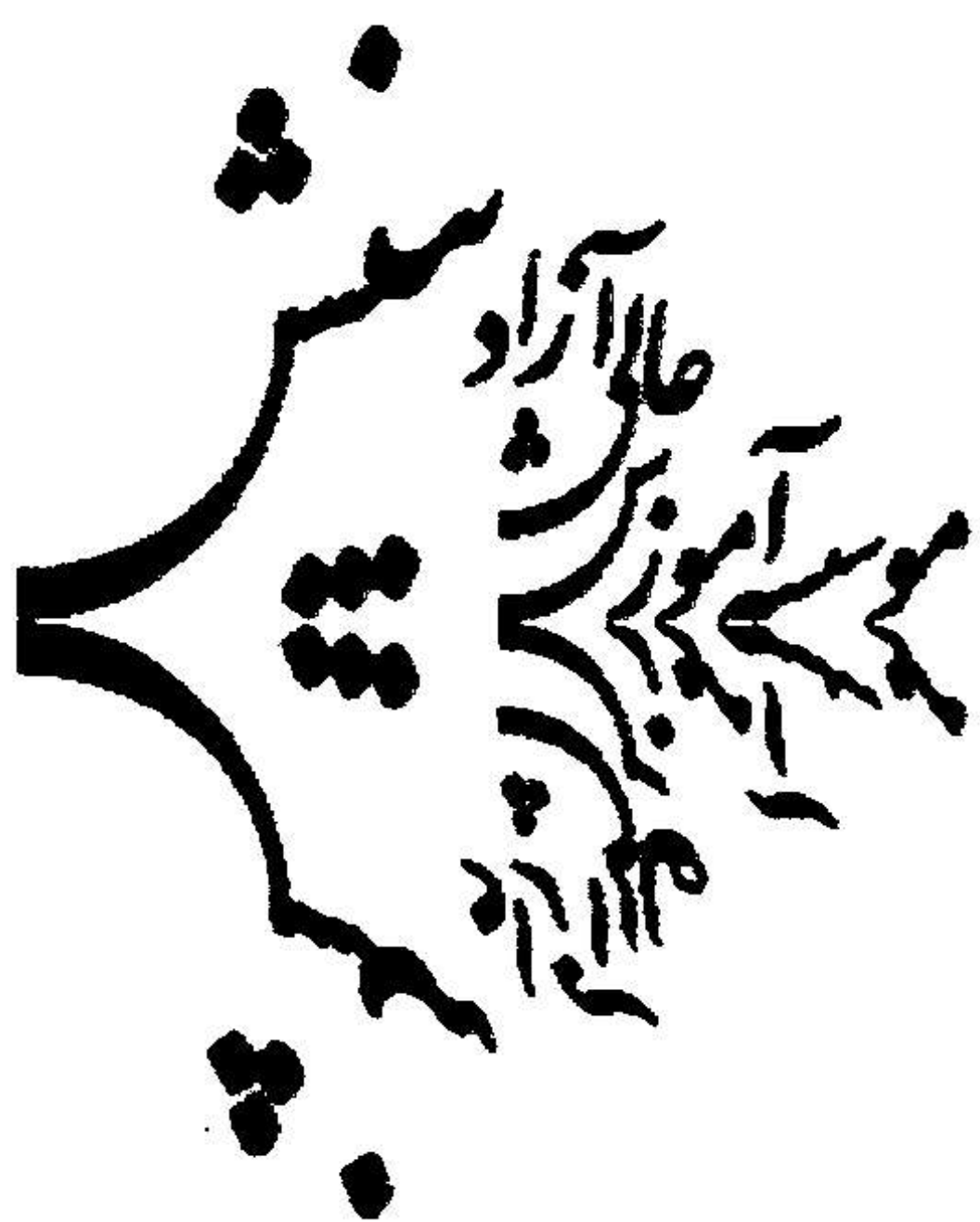
$$V_o = \frac{V}{1k} \times k = 1V$$



(١٥٥) لزينة ٣



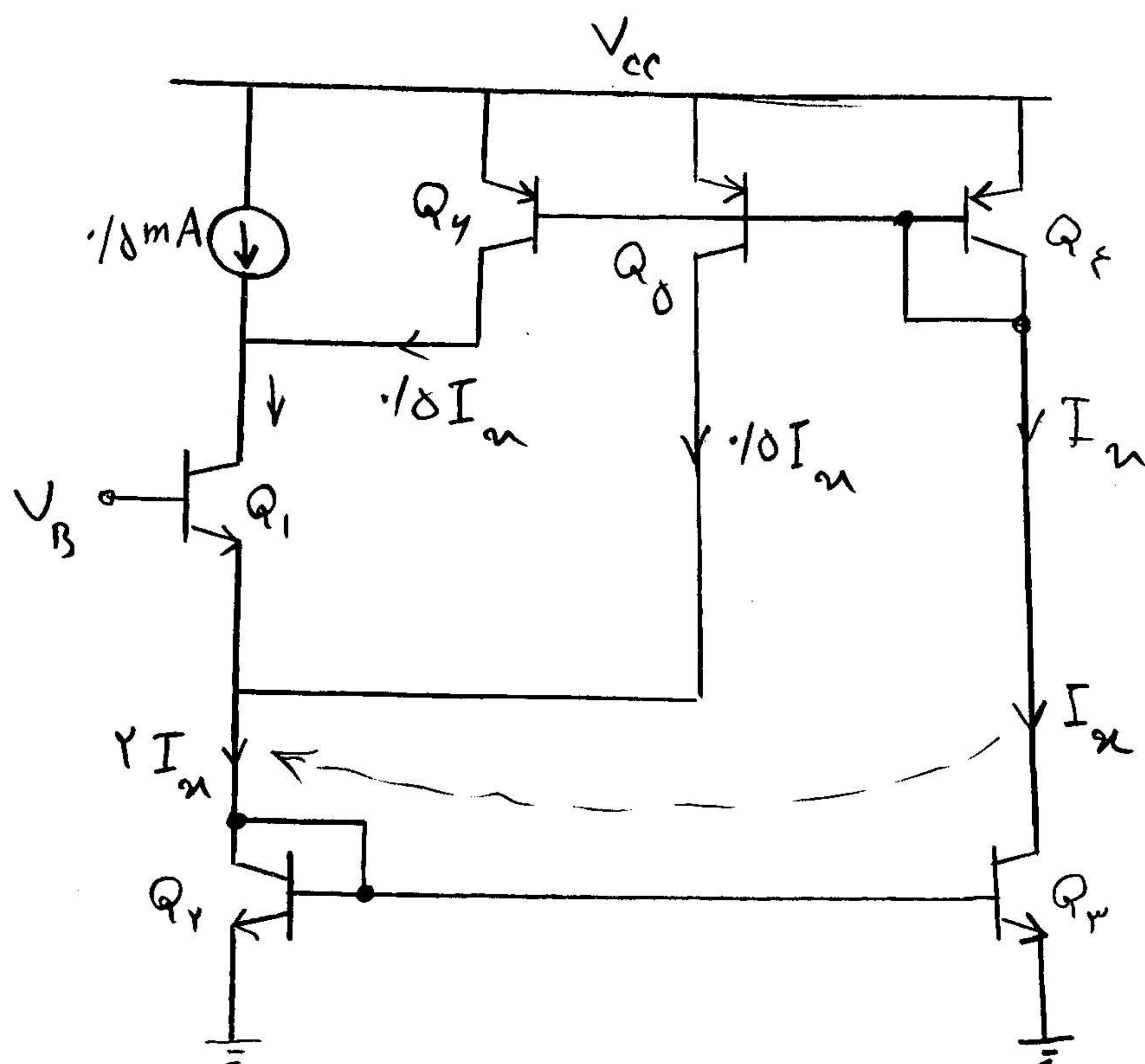
$$I_t = \Delta V_t \Rightarrow R_{in} = \frac{V_t}{I_t} = \frac{1}{0} k\Omega = 200 \Omega$$



سوال :

۱۰۶ - در مدار شکل زیر همه ترانزیستورها در حالت فعال بایاس شده اند مقدار جریان الکترود Q_1

چند میلی آمپر است ؟



$$\beta \gg 1$$

$$A_{E_4} = 2 A_{E_5}$$

$$A_{E_6} = 2 A_{E_{5,4}}$$

$$0.175 \quad (1)$$

$$1 \quad (2)$$

$$1.25 \quad (3)$$

$$1.5 \quad (4)$$

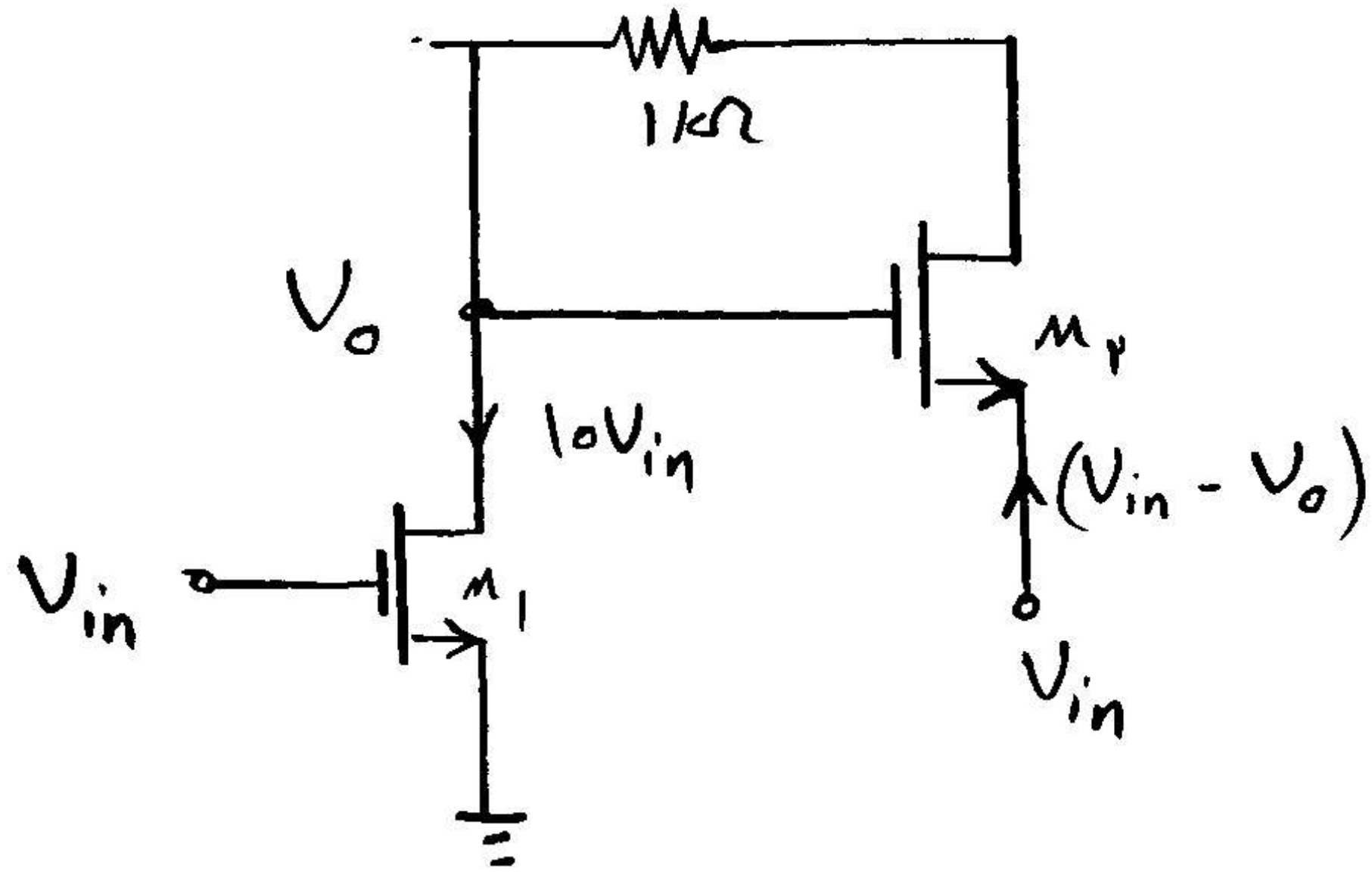
حل) گزینه ۱ صحیح است.

$$0.5 + 0.5 I_n + 0.5 I_n = 2 I_n \Rightarrow I_n = 0.5 \Rightarrow I_{C_1} = 0.5 + 0.5 I_n = 0.75$$

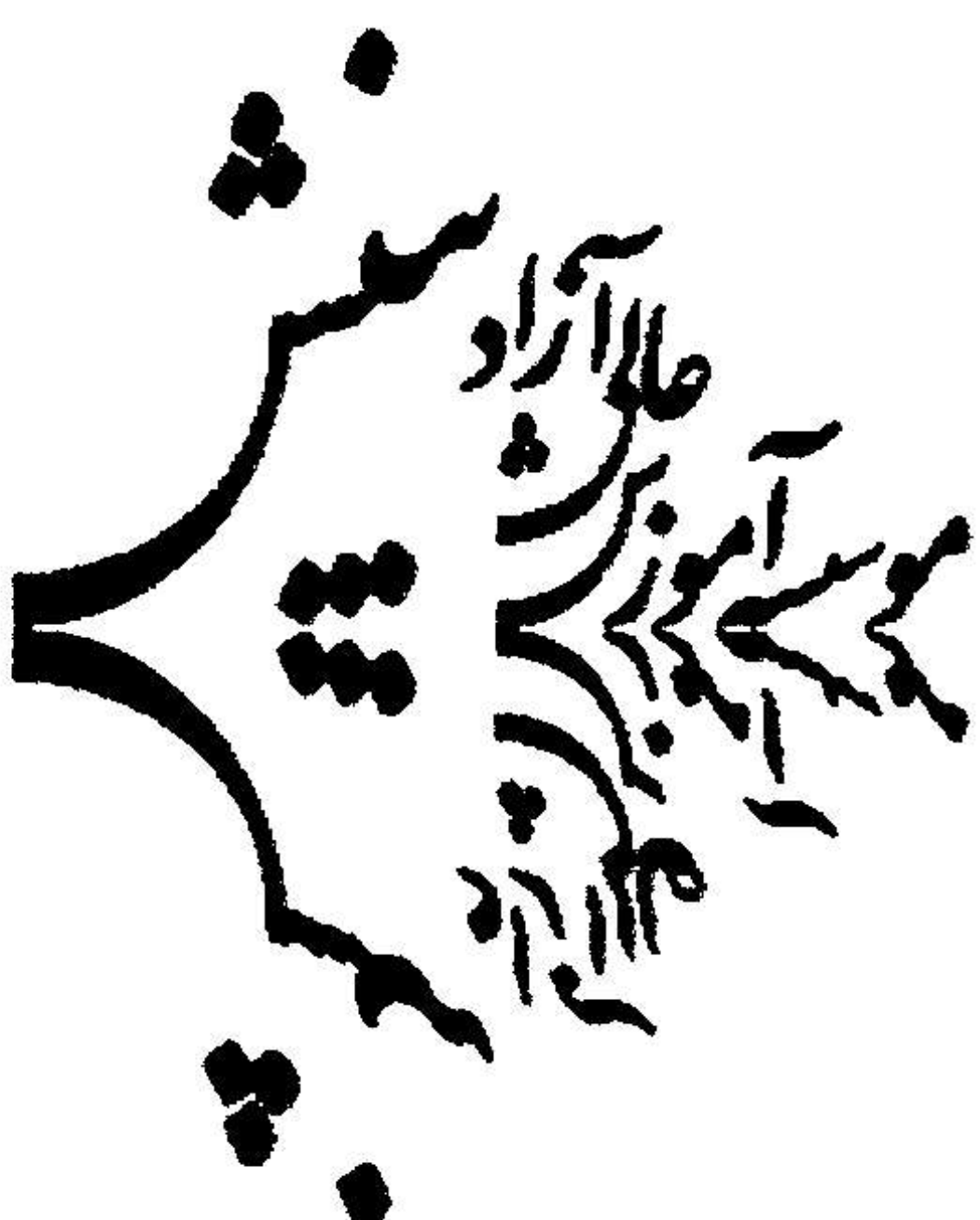
$\frac{10V}{2}$
گزینه ۲

$$I_{D_v} = 0.1 \text{ mA} \rightarrow g_{m_v} = \frac{2 \times 0.1}{.2} = 1 \frac{\text{mA}}{\text{V}}$$

$$I_{D_1} = 1 \text{ mA} \rightarrow g_{m_1} = \frac{2 \times 1}{.2} = 10 \frac{\text{mA}}{\text{V}}$$



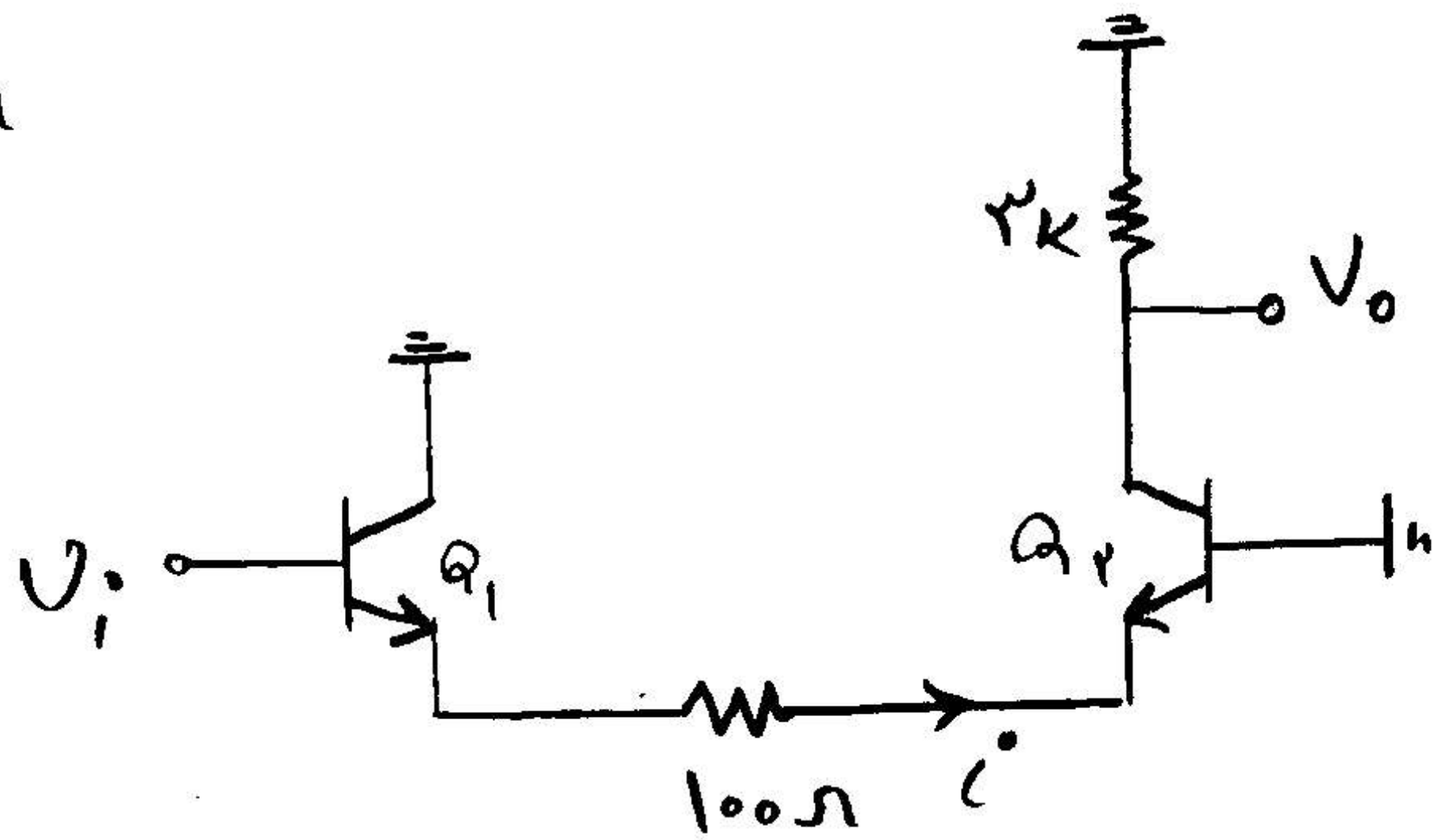
$$10V_{in} = V_{in} - V_0 \Rightarrow V_0 = -9V_{in}$$



۱۰۸
گزیده ۲

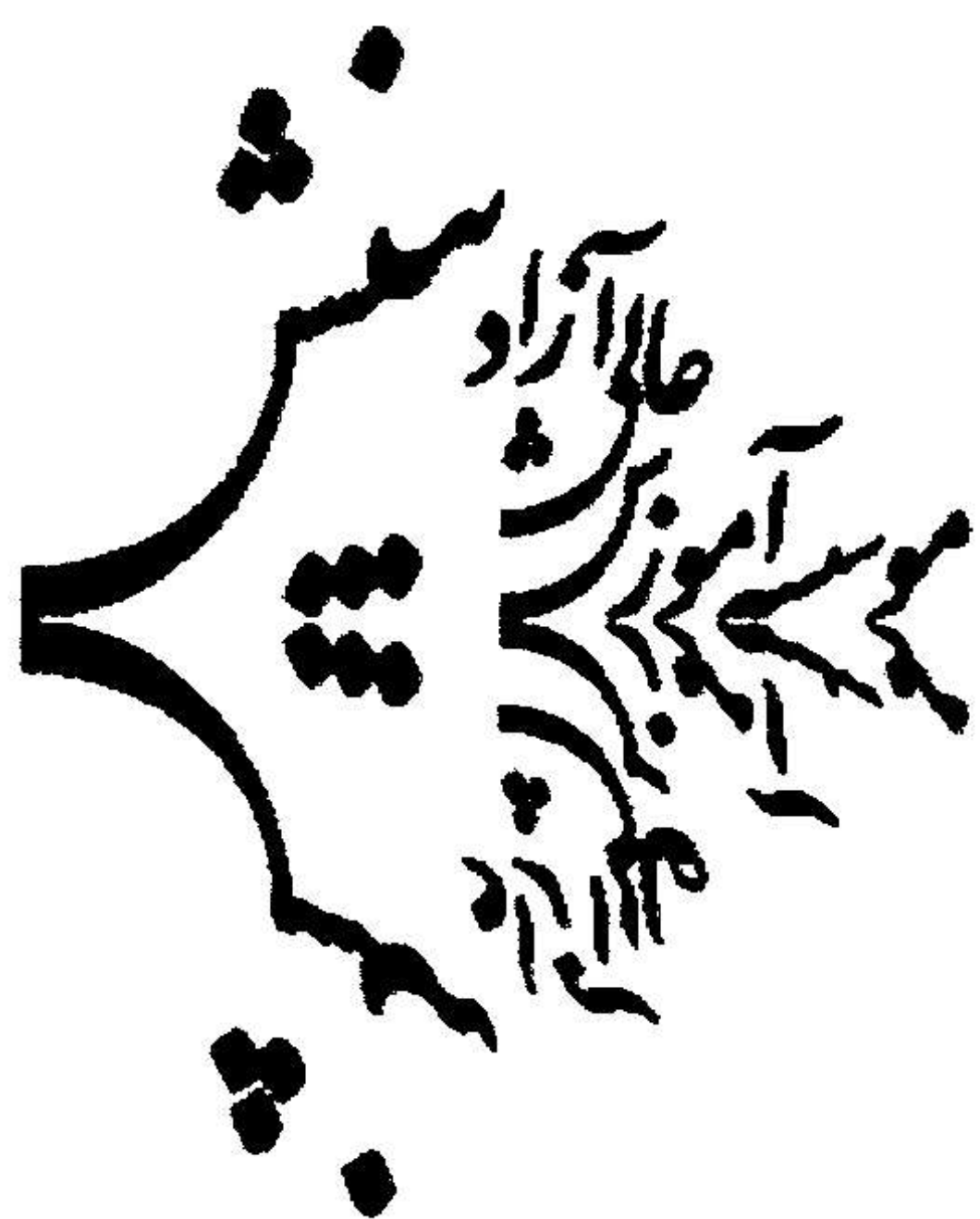
$$I_{C_{1,2}} = \frac{10 - 0.7}{1.5 \text{ k}\Omega} = 7 \text{ mA}$$

$$r_e = 12.5 \Omega$$



$$i_o = \frac{V_i}{100 + 2r_e} = \frac{V_i}{125 \Omega} = 8 V_i \text{ (mA)}$$

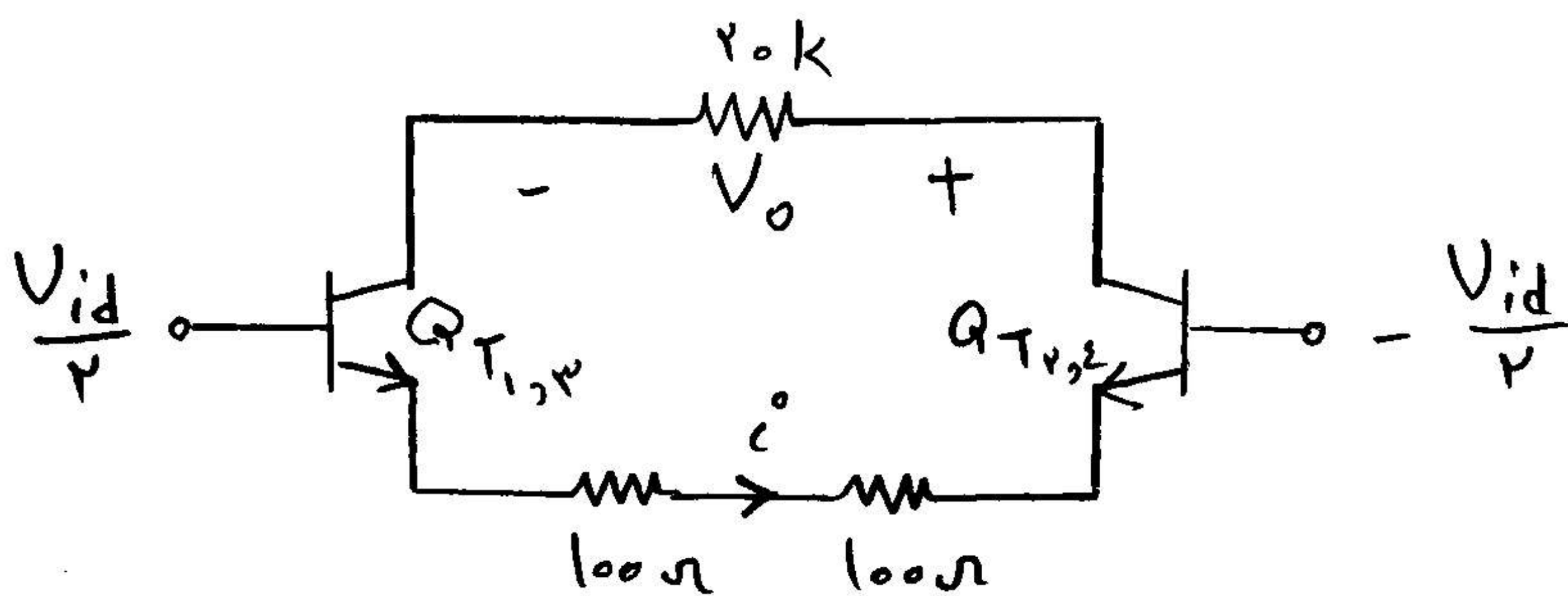
$$V_o = 2 \times i_o = 16 V_i$$



حل ۱۰۹
تجزیه ۱

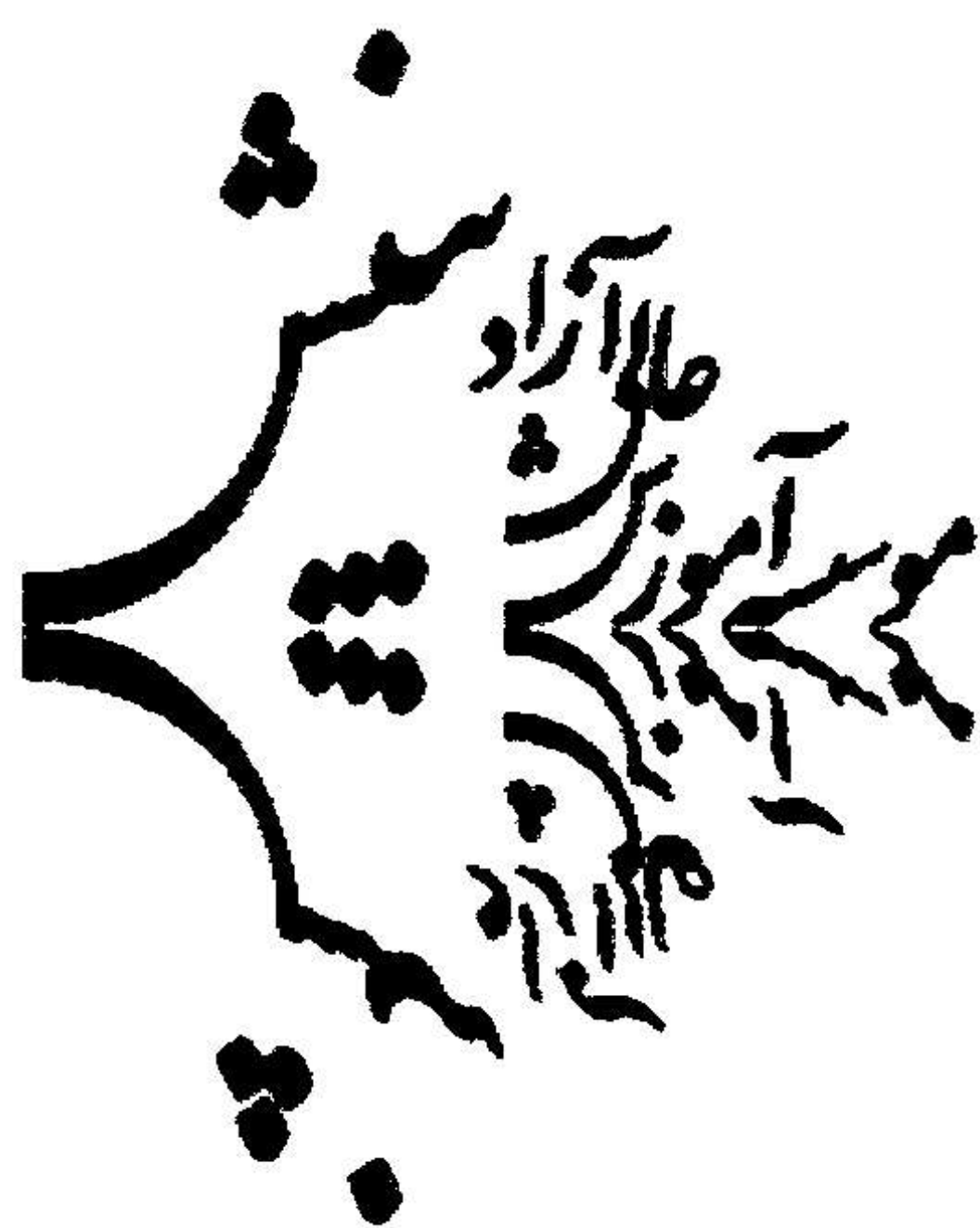
$$g_{m_{1,2}} = 10 \frac{\text{mA}}{\text{V}} \Rightarrow r_{e_{1,2}} = 100 \Omega$$

$$r_{e_{T_{1,2}}} = 400 \Omega$$



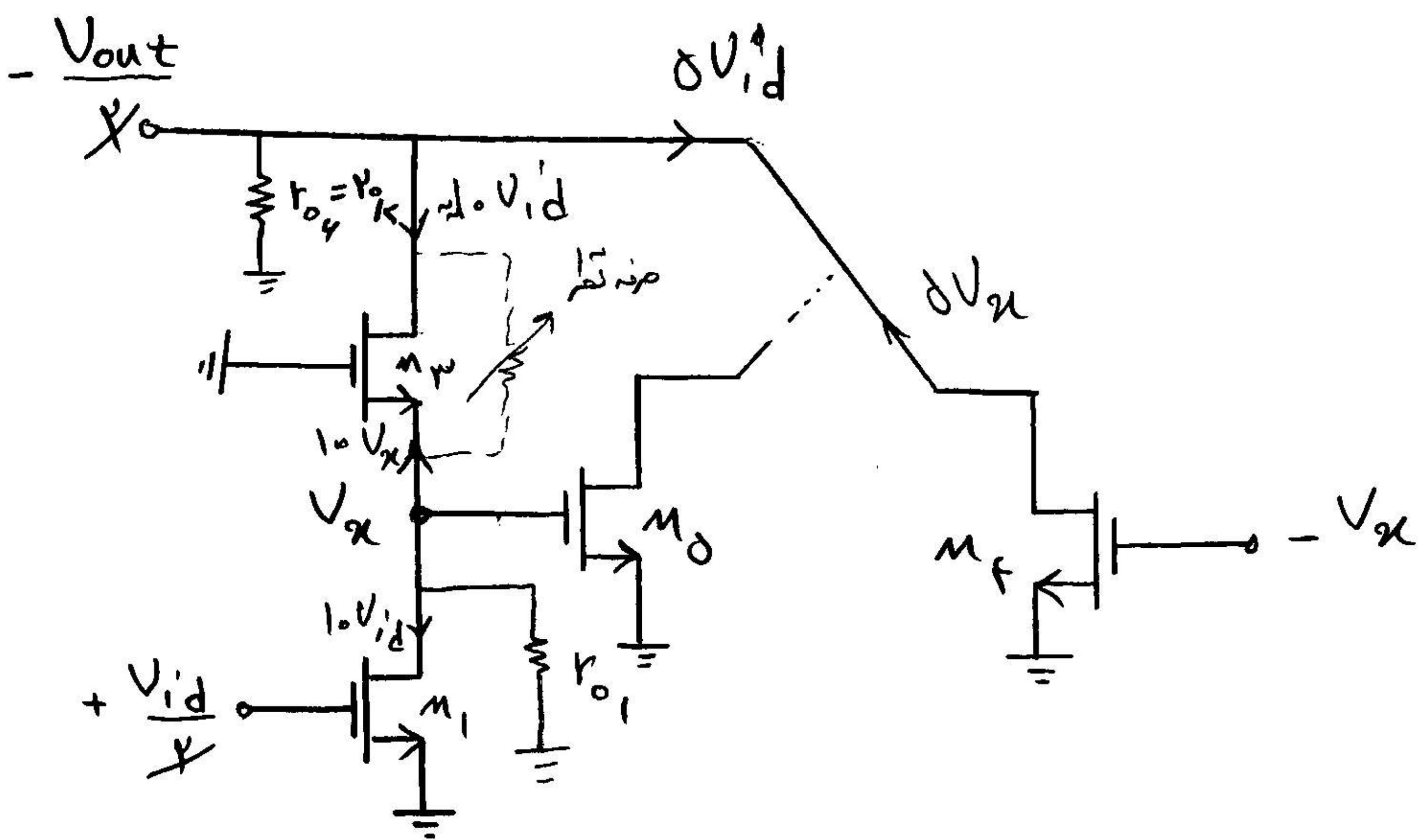
$$i^o = \frac{V_{id}}{400 + 2r_{e_T}} = \frac{V_{id}}{400} = 1.4 \text{mA} V_{id} \text{ (mA)}$$

$$V_o = 20 i^o \approx 28 V_{id}$$



$$I_{D_{1,2}} = 1 \text{ mA} \rightarrow \begin{cases} g_{m_{1-2}} = \frac{2 \times 1}{1.2} = 1.6 \frac{\text{mA}}{\text{V}} \\ r_{o_{1-2}} = 10 \text{ k}\Omega \end{cases}$$

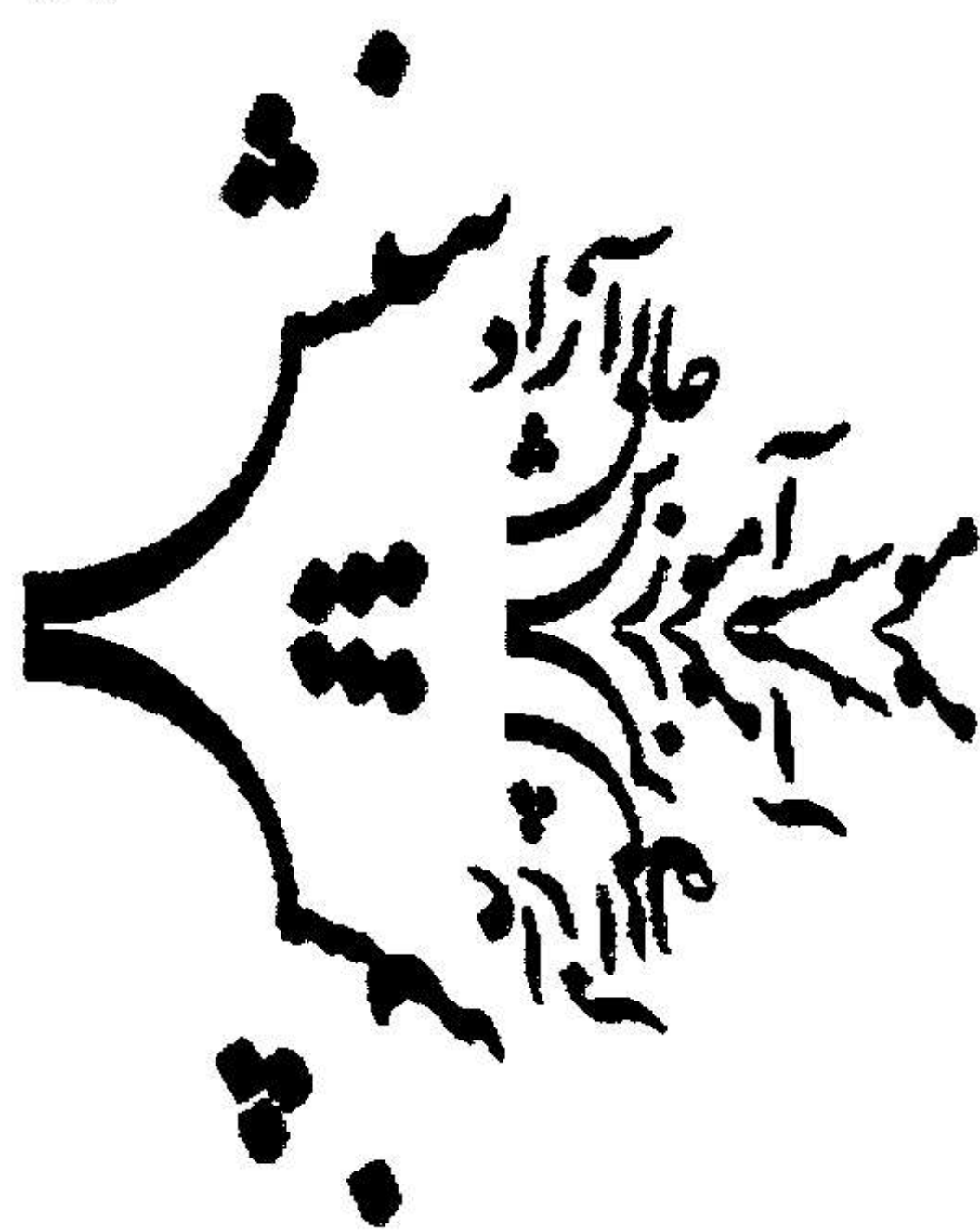
$$I_{D_{3,4}} = 0.1 \text{ mA} \rightarrow \begin{cases} g_{m_{3,4}} = 0.8 \frac{\text{mA}}{\text{V}} \\ r_{o_{3,4}} = 20 \text{ k}\Omega \end{cases}$$



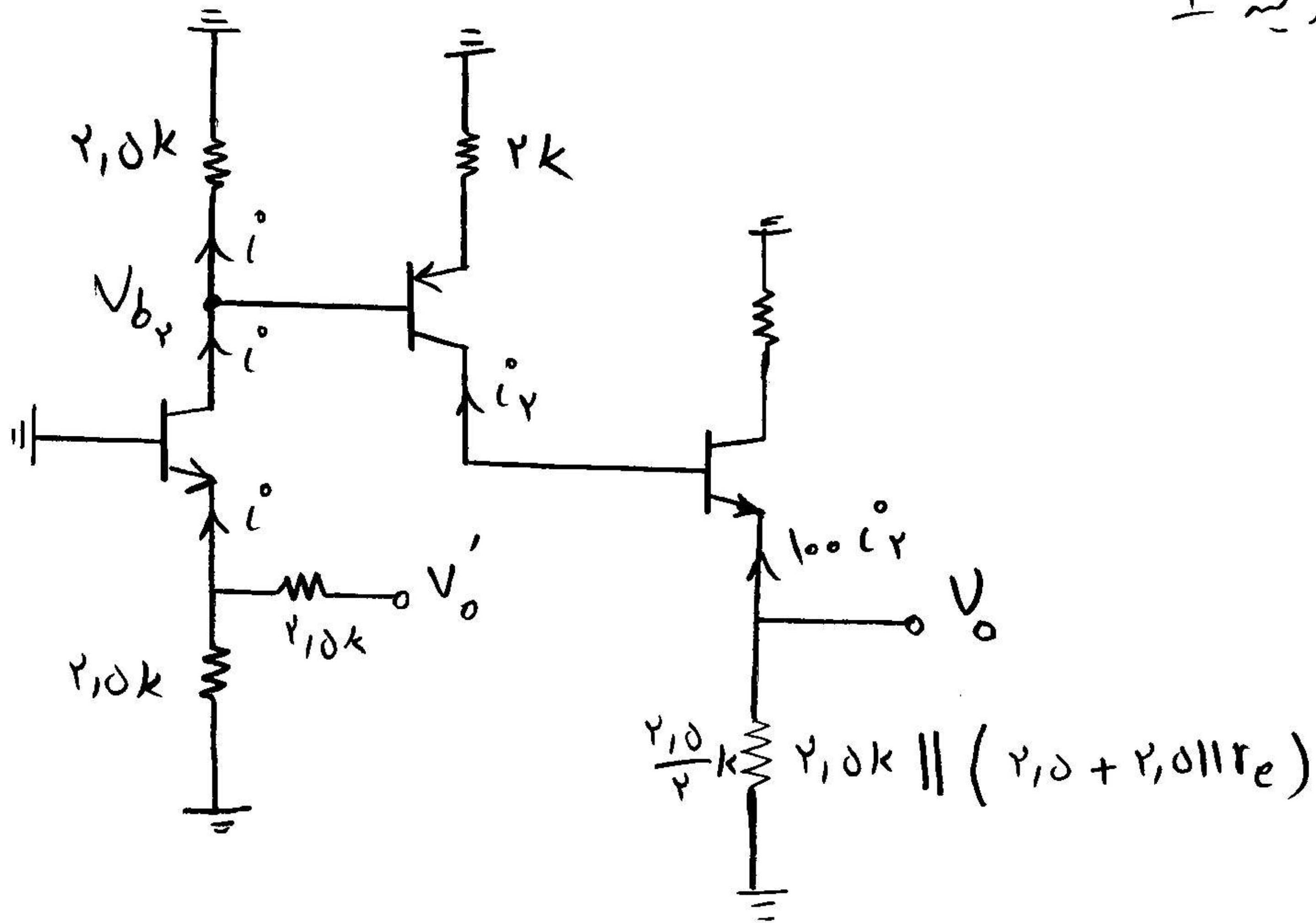
$$1.6 V_{id} + 1.6 V_x + \frac{V_x}{10 \text{ k}} = 0 \Rightarrow V_{id} = -V_x$$

$$-V_{out} = -20 \times 1.6 V_{id} \Rightarrow$$

$$\frac{V_{out}}{V_{id}} = 320$$



حل
الجزء ١



$$r_e = 25 \Omega$$

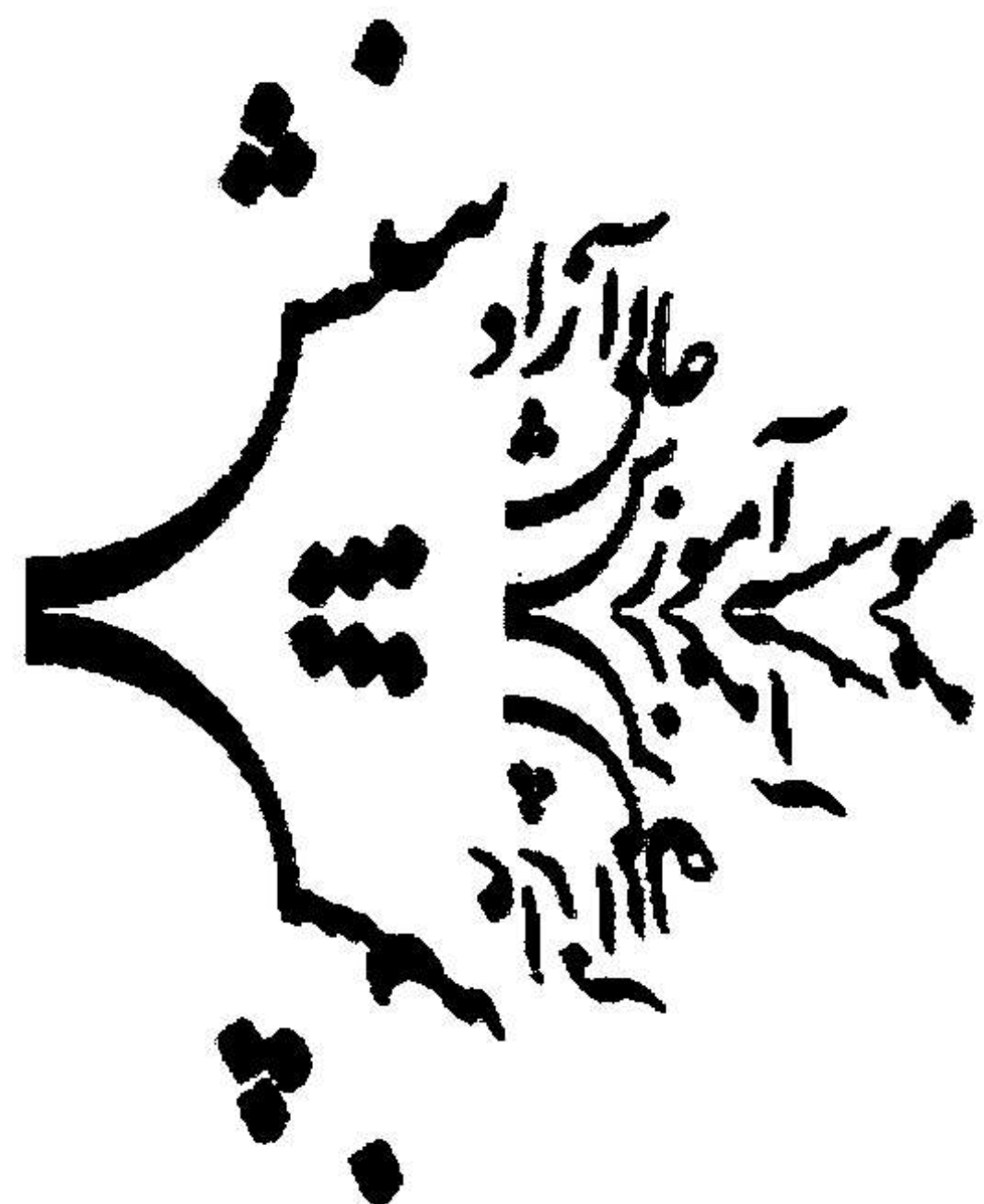
$$i_o \approx \frac{V_o'}{210 + r_e} \approx \frac{V_o'}{210k}$$

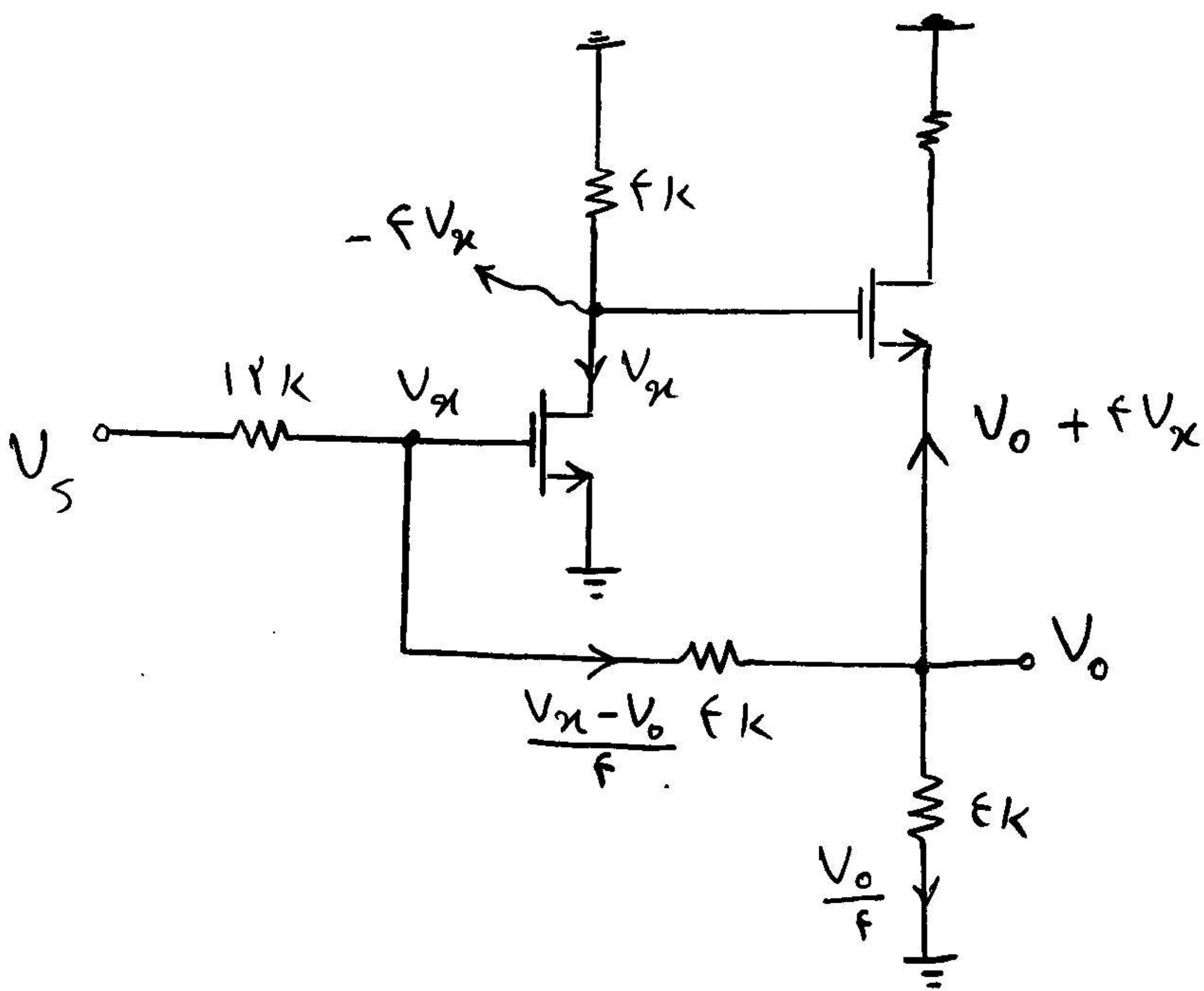
$$V_{b_r} \approx V_o'$$

$$i_r = \frac{V_o'}{2 + r_e} \approx \frac{V_o'}{2}$$

$$V_o = 100 i_r \times \frac{210}{2} = 100 \times \frac{V_o'}{2} = 42,0 V_o'$$

$$\frac{V_o}{V_o'} = 42,0 \text{ : } \text{بزرگ حلقه}$$





$$\underline{kcl} : \frac{V_n - V_o}{f} = \frac{V_o}{f} + V_o + fV_n$$

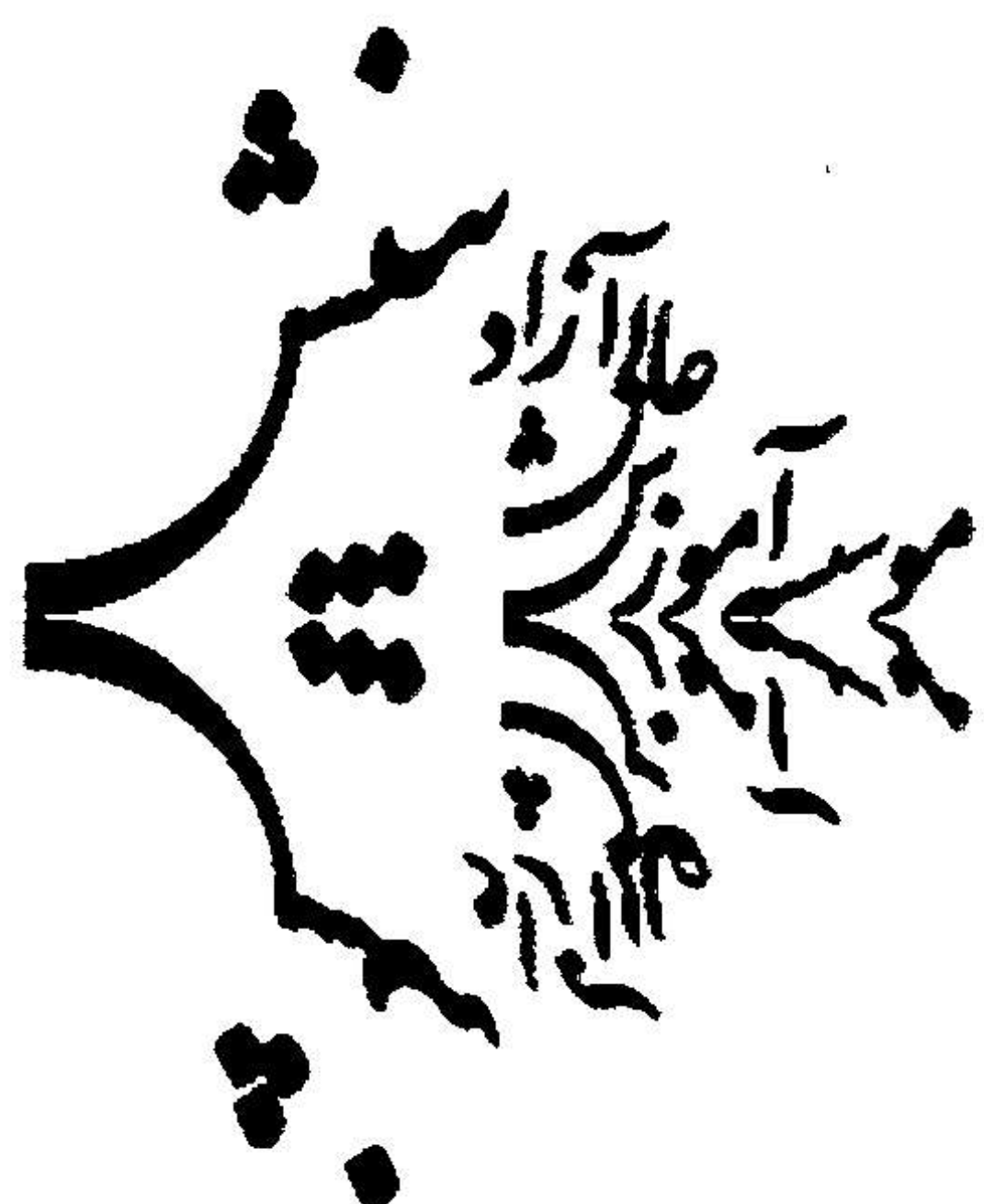
$$V_x - V_0 = V_0 + fV_0 + 14V_x$$

$$-4V_0 = 18V_x \Rightarrow V_x = \frac{-1}{9} V_0 = -9\% V_0$$

$$\frac{V_S - V_n}{n V_T} = \frac{V_n - V_0}{V_T} \Rightarrow V_S = n V_n - (n-1) V_0$$

$$V_s = -f_1 q V_0 \Rightarrow \frac{V_0}{V_s} = \frac{-1.0}{1.4} \approx \frac{-1.0}{\epsilon_0}$$

$$\frac{V_0}{V_s} = \frac{-1}{9}$$



حل ۱۱۳ ~ لکچر ۵ (۲)

$$\hat{I}_C(\max) = I_{CQ} = \frac{V_{CC} - V_{CE(sat)}}{R_{DC} + R_{AC}} = \frac{4}{12 + 12 + 6 \times 9\Omega} = 0.1A$$

$$I_L = 2I_C = 0.2A \rightarrow P_L = \frac{1}{2} R_L I_L^2 = \frac{1}{2} \times 1 \times \frac{4}{100} = 0.02W$$

$$P_L = 140 \text{ mW}$$

حل ۱۱۴

$$I_L(\max) = \frac{0.14}{1\Omega} = 0.14A = 140 \text{ mA}$$

$$I_{B1} = 4 \text{ mA}$$

$$I_{C1} = 4 + I_{2,k} = 14 \text{ mA}$$

$$R = \frac{12V - 0.14}{14} = \frac{11.86}{14 \text{ mA}} = 0.847 \text{ k} = 847\Omega$$

علیرضا باغستانی
با انرژی و مفصلیت

