ELEKTRONİK-2 2.Ödev

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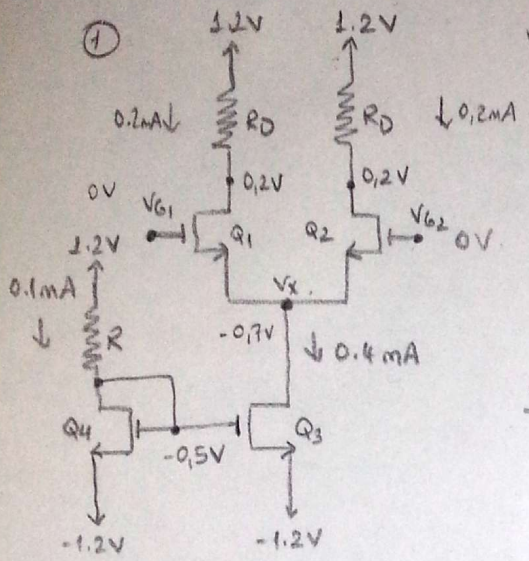
① 

$V_{G1} = V_{G2} = 0V$

$V_{GS} - V_t = 0.2V$, $V_t = 0.5V$

$\mu_n . C_{ox} = 250 \mu A/V^2$, $\lambda = 0$.

a) $I_{D1} = I_{D2} = 0.2\ mA$.

$\frac{1,2 - 0,2}{0,2m} = R_D \Rightarrow \boxed{R_D = 5k}$

Bütün tranzistorler için $V_{GS} - V_t = 0.2V$ verilmiş.

O zaman $V_{GS_1} = V_{GS_2} = V_{GS_3} = V_{GS_4} = 0.7V$

Bu durumda ;

$V_{G3} = V_{G4} = V_{D4} = -0,5V$ olur.

$R = \frac{1,2 - (-0,5)}{0,1m} \Rightarrow \boxed{R = 17k}$

b) $V_x = V_{D3} = V_{S2} = V_{S1} = -0,7V$.

Bütün tranzistorler doymadadır.

$I_{D1} = I_{D2} = 0,2.10^{-3} = \frac{1}{8} . 250.10^{-6} . \frac{W}{L} . (0,2)^2$.

$1,6 = \frac{W}{L} . \frac{4}{100} \Rightarrow \frac{16}{4} = \frac{4W}{100L} \Rightarrow \boxed{\left(\frac{W}{L}\right)_1 = \left(\frac{W}{L}\right)_2 = 40}$

$0,4.10^{-3} = \frac{1}{8} . 250.10^{-6} . (0,2).(0,2).\left(\frac{W}{L}\right)_3$

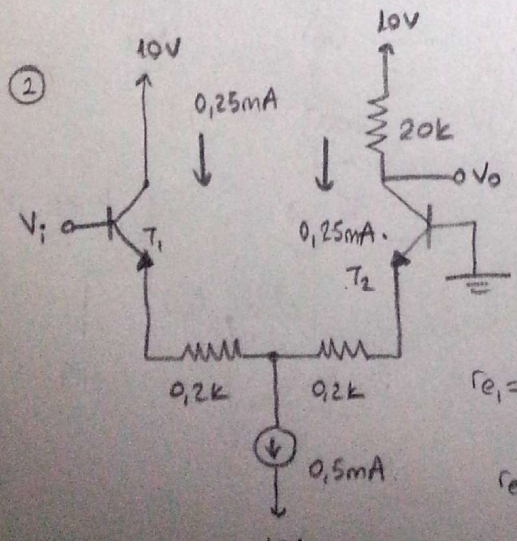
$3,2 = (0,2).(0,2).\left(\frac{W}{L}\right)_3$

$\frac{16}{0,2} = 80 \Rightarrow \boxed{\left(\frac{W}{L}\right)_3 = 80}$

$0,1.10^{-3} = \frac{1}{8} . 250.10^{-6} . (0,2).(0,2).\left(\frac{W}{L}\right)_4$

$(0,8) = (0,2).(0,2).\left(\frac{W}{L}\right)_4$

$\boxed{\left(\frac{W}{L}\right)_4 = 20}$

② 

a) $V_o = \frac{-R_C}{2r_e} . V_i \Rightarrow \frac{V_o}{V_i} = \frac{-20k}{0,2k} = \frac{-100}{5}$

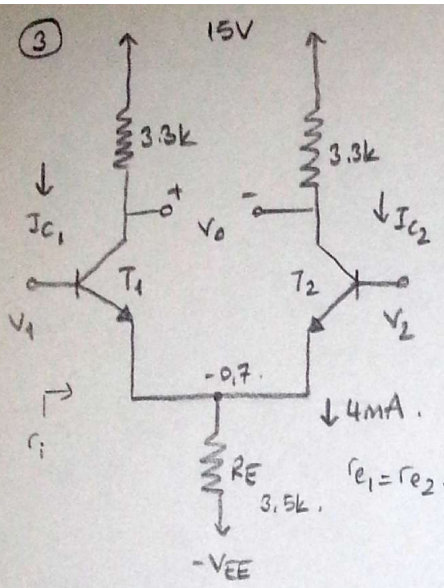
b) $R_{in} = 2.\beta.r_e$

$= 2.100.100 = \frac{20k}{5}$

$r_{e_1} = \frac{26m}{0,25m} = 100\Omega$

$r_{e_2} = 100\Omega$

③



$\beta = 250$

$V_T = 25\,mV$

$V_{BE} = 0.6V$

$r_{e_1} = r_{e_2} = \frac{25m}{I_C}$

a) $\frac{V_o}{V_1 - V_2} = K_d = +264 = \frac{+R_C}{r_e} = \frac{3300}{\frac{25m}{I_C}} = 264$

$\frac{3300 \cdot I_C}{25.10^{-3}} = 264$

$I_C = \frac{264 \cdot 25.10^{-3}}{3300} = 2mA$

b) $V_2 = 0 \Rightarrow r_i = 2.\beta.r_e$ $\quad r_e = 12,5\,\Omega$

$r_i = 2.250.\frac{25m}{1m} \Rightarrow r_i = 6,25k$

c) $CMRR = 20.\log_{10}\left|\frac{K_d}{K_c}\right| = \left|\frac{2R_E + r_e}{r_e}\right| = 55\,dB.$

$\left|\frac{K_d}{K_c}\right| = \left|\frac{2R_E + r_e}{r_e}\right| = 562.34$

$\frac{2R_E + 12,5}{12,5} = 562.34 \Rightarrow R_E \cong 3,5k$

$\frac{-0,7 - (-V_{EE})}{4mA} = 3,5k.$

$-0,7 + V_{EE} = 14V \Rightarrow -V_{EE} = -14.7V$

$V_{EE} = 14.7, \quad -V_{EE} = -14.7V$