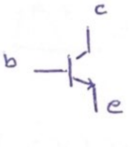
یا لطیف

رضا ادیب پور
۹۸۱۴۳۰۳
تمرین سری ۳ مدار مخابراتی

$\begin{cases} R_E = 0 & ① \\ R_E = 100 & ② \\ R_E = 4^k & ③ \end{cases}$

حالت 1 : if $R_E = 0$



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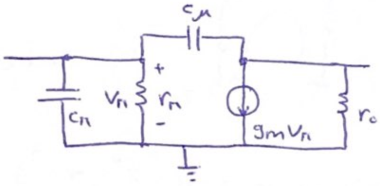

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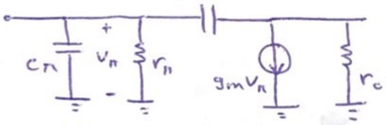


$$I_c = I_{ES}\, e^{\frac{V_{dc}}{V_T}} \cdot \left[I_0(x) + 2\sum_{n=1}^{\infty} I_n(x) \cos n\omega_0 t \right]$$ که

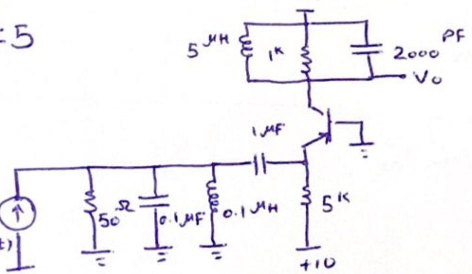
$$V_{dc} = V_T \ln \frac{I_{c_2}}{I_{ES} I_0(x)} = V_T \ln \frac{I_{c_2}}{I_{ES}} - V_T \ln I_0(x) \longrightarrow V_{be} = V_{dc}$$

با قرار دادن مقاومت R_E ، V_{be} زیاد می‌شود ⟵ I_c زیاد می‌شود

if $R_E = 100$: $V_{dc} = V_T \ln \dfrac{\frac{V_B - V_E}{R_E}}{I_{ES} I_0(x)} = V_T \ln \dfrac{\frac{V_B - V_E}{100}}{I_{ES} I_0(x)} = V_T \ln \dfrac{V_B - V_E}{100(I_{ES} I_0(x))}$

if $R_E = 4000$; $V_{dc} = V_T \ln \dfrac{\frac{V_B - V_E}{R_E}}{I_{ES} I_0(x)} = V_T \ln \dfrac{\frac{V_B - V_E}{4000}}{I_{ES} I_0(x)} = V_T \ln \dfrac{V_B - V_E}{4000(I_{ES} - I_0(x))}$

#5



$\beta = 100$

$i_i(t) = 4^{mA} \cos\omega t$

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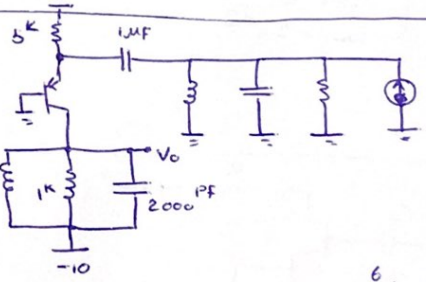
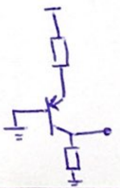
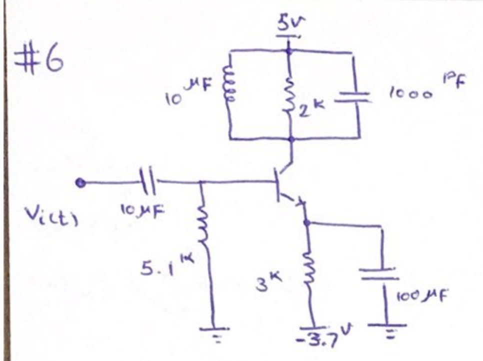


$$\left[0.1\times10^{-6}S \,||\, (0.1\times10^{-6}S)^{-1} \,||\, 50\right] + (1\times10^{-6}S)^{-1} = \frac{10^6 S}{0.1S^2 + 2\times10^4 S + 10^{13}} \,||\, 5^k = \frac{10^6 S}{0.1S^2 + 22\times10^4 S + 10^{13}}$$

$$5\times10^{-6}S \,||\, 1000 \,||\, \frac{1}{2\times10^3\times10^{-12}S} = \frac{1}{\frac{2\times10^3}{S} + \frac{S}{.5\times10^8} + 0.001}$$ =>



#6

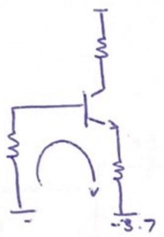


$V_i(t) = 260^{mv} \cdot \cos(10^7 t)$

$\alpha = \frac{98}{100} \Rightarrow 0.98 = \frac{\beta}{\beta+1} \Rightarrow 0.98(\beta+1) = \beta$

$\Rightarrow \beta = 49$

dc analysis :



KVL : $5.1^k\left(\frac{I_c}{49}\right) + 0.7 + 3^k I_c - 3.7 = 0$

$\Rightarrow I_c\left(\frac{5.1^k}{49} + 3^k\right) = 3.7 - 0.7$

$\Rightarrow I_c = \frac{3}{3.1} \simeq \boxed{1^{mA}} \Rightarrow g_m = 40^{mmho}$

$V_o(t) = V_{cc} - R_L g_m \bar{V} \cos\omega t = 5 - 2^k(40^m) \cdot 260^{mv} \cos(10^7 t) = -20.8 \cos(10^7 t)$

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$G = 6^{dB}$

$P_{in} = -4\,dBm$

$P_{(2\omega_1-\omega_2)} = -40\,dB$

$P_{(2\omega_1-\omega_2)} = 3P_o - 2P_{IP}$

$\Rightarrow P_o = \frac{1}{3}\left(P_{(2\omega_1-\omega_2)} + 2P_{IP}\right)$

$= \frac{1}{3}\left(-40^{dB} + 2(-$[illegible]$68)\right) = \boxed{-58}$

$P_{IP'} = P_{IP} - 9^{dBm} = -4 - 9 = -13^{dBm}$

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$B.W = 500^{KHZ}$

Noise Figure $= 8^{dB}$

$f = 900^{MHZ}$

$R_{in} = 50^{\Omega}$

$P_{IP} = 10^{dBm}$

بهره $= 50^{dB}$

$N_o = \overset{\checkmark}{K} T_o \overset{\checkmark}{B} \overset{\checkmark}{G} \overset{\checkmark}{F}$

$DR(dB) = \frac{2}{3}\left[P_{IP} + 1{,}74^{dBm} - 10\log B - G^{dB} - F^{dB}\right]$

$= \frac{2}{3}\left[10 + 174 - 10\log(500 \times 10^3) - 50 - 8\right]$

$= 46.00^{dBm}$

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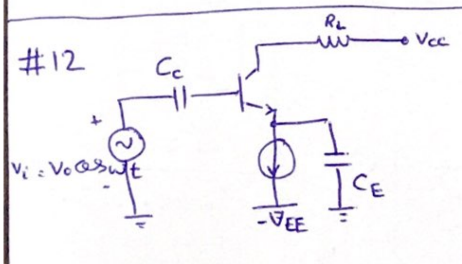

$I_c = a_0 + a_1 V_{BE} + a_2 V_{BE}^2 + a_3 V_{BE}^3$