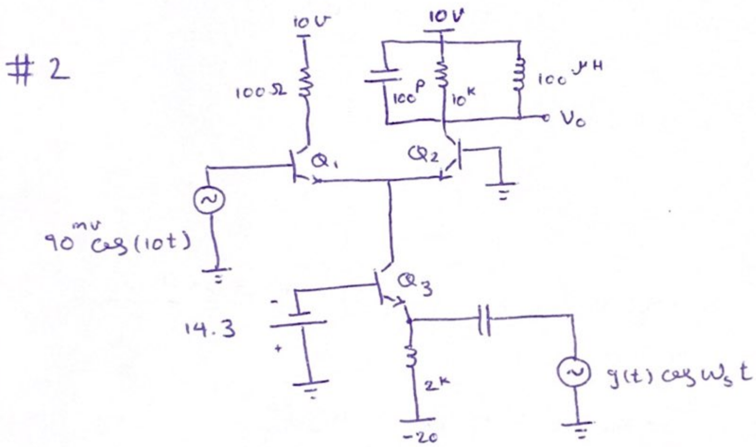
یا لطیف

رضا ادیبی پور

۹۸۱۴۳۰۳

تمرین سری 5 مدار مخابراتی

#2



$g(t) = 1^{mv}\left(1 + m f(t)\right)$

$W_s = 9 \times 10^7 \ \frac{Rad}{S}$

$\alpha \approx 1$

$$I_k(t) = I_{ko} + i(t) \quad , \quad I_{ko} = \frac{V_{EE} - 0.7}{R_b} \quad , \quad i(t) = \frac{V_{Lo}}{R_b}\cos(W_{Lo} t)$$

$$i_1(t) , i_2(t) = \frac{I_k(t)}{2} + I_k(t)\sum_{n=1}^{\infty} a_{2n-1}(x)\cos\left[(2n-1)W_{RF}\, t\right] \quad ; \quad x = \frac{V_{RF}}{V_T}$$

$$i_1(t) , i_2(t) = \frac{I_{ko}}{2} + \frac{V_{Lo}}{2R_b}\cos W_{Lo} t \pm I_{ko}\sum_{n=1}^{\infty}\left[a_{2n-1}(x)\cos(2n-1)W_{RF}\, t\right] \pm \frac{V_{Lo}}{2R_b}$$

$$\sum_{n=1}^{\infty} a_{2n-1}(x)\cos\left((2n-1)W_{RF} \pm W_{Lo}\right)t$$

$$\begin{cases} G_c = \dfrac{I_c(W_{Lo} \pm W_{RF})}{V_{RF}} = \dfrac{V_{Lo}}{2R_b V_T} = \dfrac{a_1(x)}{x} \\ a_1(x) \approx \dfrac{x}{4}\left(1 - \dfrac{x^2}{16}\right) \end{cases} \xRightarrow{x \leq 1} \frac{a_1(x)}{x} \approx \frac{1}{4} \Rightarrow G_c = \frac{V_{Lo}}{8 V_T R_b}$$

$$\begin{cases} i_2(t) = G_c V_{RF}\cos(W_{Lo} \pm W_{RF})t \\ V_o(t) = V_{cc} \pm G_c R_L V_{RF}\cos(W_{Lo} \pm W_{RF})t \end{cases}$$

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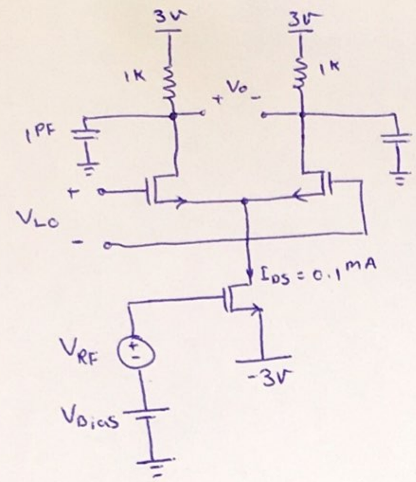

$k' = 250 \ \frac{\mu A}{V^2}$

$V_T = 0.5 \ V$

$\frac{W}{L} = 200$

$\lambda = \gamma = 0$

$V_{gs} = V_{gs,Q} \quad , \quad V_i(t) = V_{RF}(t) + V_{LO} = V_{RF} \cos W_{RF} + V_{LO} \cos W_{LO} t$

$$I_D = I_{DQ} + g_{mQ} V_i(t)$$

$$G_c = \frac{I_D(W_{RF} \pm W_{LO})}{V_{RF}} = \frac{g_m}{2V_T} V_{LO}$$

$$g_m(t) = \frac{2I_D}{V_T}\left(1 - \frac{V_{GS}}{V_T}\right) = g_{mQ}\left(1 - \frac{V_{gs} + V_{LO}(t)}{V_T}\right) = g_m\left(1 - \frac{V_{gsQ} + V_{LO}\cos(W_{LO}t)}{V_T}\right)$$

$$\begin{cases} i_D(t) = g_m(t) + V_{RF}(t) = g_m V_{RF} \cos W_{RF} t + \frac{g_m}{V_T} V_{RF} \cos W_{RF} t \ V_{LO} \cos(W_{LO} t) \\ i_D(t) = g_{mQ} V_{RF} \cos(W_{RF} t) + \frac{g_{mo}}{2V_T} V_{RF} V_{LO} \cos(W_{RF} \pm W_{LO}) t \end{cases}$$

$$G_c = \frac{12}{36} \times 2 = 0.66 \ \text{mmho}$$

$$\begin{cases} I_D = G_c V_2 \cos(W_2 - W_1) t = (6.66^{mA}) \cos(2\pi 455^{kHz}) t \\ V_o(t) = V_{cc} - (26.64^{mV}) \cos(2\pi . 455^{kHz}) t \end{cases}$$

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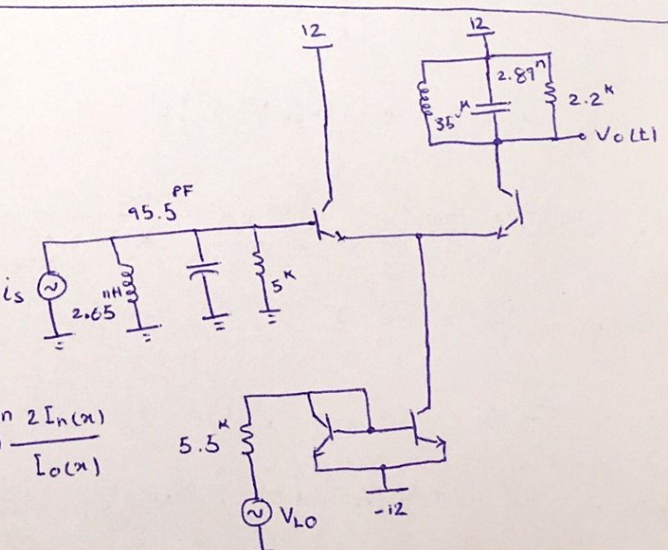
$i_s = I_1 (1 + m f(t)) \cos W_s t$

$I_1 = 2 \ \mu A$

$W_s = 2\pi \times 10^7 \ \frac{rad}{s}$

$V_{LO} = 5.5 \cos(2.1\pi \times 10^7 t)$



$V_{be} = V_{dc} + V_{RF} \cos(W_{RF} t) - x V_T \cos(W_{Lc} t)$

$x = \frac{V_{LO}}{V_T} = 4$

$$I_c(t) = I_{CQ}\left[1 + \frac{V_{RF}}{V_T}\cos(W_{RF} t)\right] \cdot \left[1 + \sum_{n=1}^{\infty} (-1)^n \frac{2I_n(x)}{I_0(x)} \cdot \cos(n W_{LO} t)\right]$$

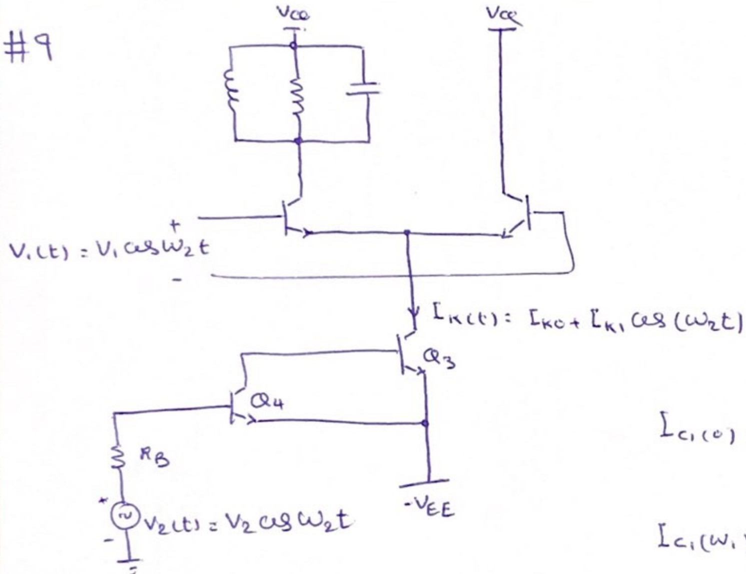
$$\begin{cases} V_i(t) = (95.5^{p} \times 5^{k}) \cdot \left[1 + m\cos(W_{RF} t)\right] = (477n) \cdot \left[1 + m\cos(W_m t)\right] \cdot \cos(W_{RF} t) \\ V_{RF}(t) = n V_i(t) \end{cases}$$

$$G_c = g_{mQ} \frac{I_1(s)}{I_0(s)} = \frac{2.6^{mA}}{26^{mA}} \times \frac{1.768}{2} = 88.4^{\text{mmho}}$$

$$i_c(\omega_{RF}-\omega_{LO}) = G_C V_{RF} = (884^{\mu A})\cdot\left[1+m\cos(\omega_m t)\right]\cos(\omega_{RF} t)$$

$$\omega_m = \frac{1}{R_L C_L} \Rightarrow V_o(t) = V_{CC} + (4.4.2)\cdot\left[1+\frac{m}{2}\cos(\omega_m t - 45^\circ)\right]\cos(\omega_{IF} t)$$

#9



$$I_{RL} = \frac{V_{CC}-V_{CE1}}{R_L||LS||\frac{1}{CS}} - \frac{I_{K0}+I_{K1}\cos\omega_2 t}{2}$$

$$I_{RB} = (I_{K0}+I_{K1}\cos\omega_2 t)\times\frac{1}{\beta_2}\times\frac{1}{\beta_3}$$

$$= \frac{I_{K0}+I_{K1}\cos\omega_2 t}{\beta_2\beta_3}$$

$$I_{C1}(0) = \frac{V_{CC}-V_{CE}}{2R_{eq}}(I_{K1}+I_{K0})$$

$$I_{C1}(\omega_1) = \frac{V_{CC}-V_{CE}(I_1\cos\omega_1 t)}{2R_{eq}}$$

$$I_{C2}(\omega_2-\omega_1) = \frac{V_{CC}-V_{CE}(I_2\cos(\omega_2-\omega_1)t)}{2R_{eq}}$$

$$G_2 = \frac{I_{C1}(\omega_2)}{V_2} = \frac{\kappa(I_0+I_K\cos(\omega_2 t))}{V_2\cos\omega_2 t}, \quad G_1 = \frac{I_{C1}(\omega_1)}{V_1} = \frac{\kappa(I_{K1}+I_{K0})}{V_1\cos\omega_2 t}$$