

ياسين

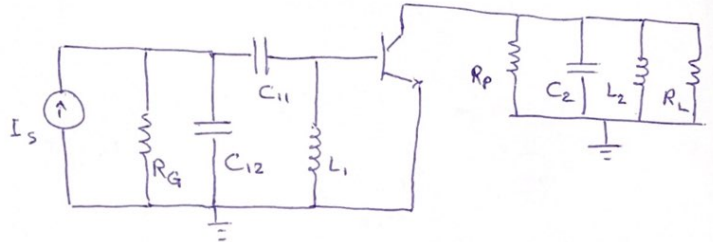
مستشار دسني

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تصميم سر ٢ مدار ساراي

#1

$$\begin{cases} r_n = 330 \Omega \\ C_n = 15 \text{ PF} \\ C_{\mu} = 0.5 \text{ PF} \\ g_m = 200 \text{ mS} \\ C_o = 0.8 \text{ PF}, g_o = 0.3 \text{ mS} \\ R_L = 50 \Omega \end{cases}$$



$$f_o = 200 \text{ MHz}, BW = 8 \text{ MHz}, R_G = 50 \Omega, K = 5,$$

$$Y_{tr} = \begin{bmatrix} \frac{1}{r_n} + j\omega(C_n + C_{\mu}) & -j\omega C_{\mu} \\ g_m - j\omega C_{\mu} & \frac{1}{r_o} + j\omega(C_o + C_{\mu}) \end{bmatrix} = \begin{bmatrix} \frac{1}{330} + j\omega(15.5 \text{ PF}) & -j\omega(0.5 \text{ PF}) \\ 200 - j\omega(0.5 \text{ PF}) & 0.3 + j\omega(0.8 + 0.5 \text{ PF}) \end{bmatrix} \xrightarrow{\omega = 2\pi(200 \text{ MHz})}$$

$$Y_{tr} = \begin{bmatrix} \frac{1}{330} + j(200 \text{ MHz})(15.5 \text{ PF}) & -j(200 \text{ MHz})(0.5 \text{ PF}) \\ 200 - j(200 \text{ MHz})(0.5 \text{ PF}) & 0.3 + j(200 \text{ MHz})(0.8 + 0.5 \text{ PF}) \end{bmatrix} = \begin{bmatrix} 0.003 + j0.2 & -0.0006j \\ 0.2 - j0.0006 & 0.3 + j0.001 \end{bmatrix}$$

$$Q_{tin} = \frac{\omega_c}{BW} = \frac{2\pi f_o}{BW} = \frac{2\pi(200 \times 10^6)}{8 \times 10^6} = 157$$

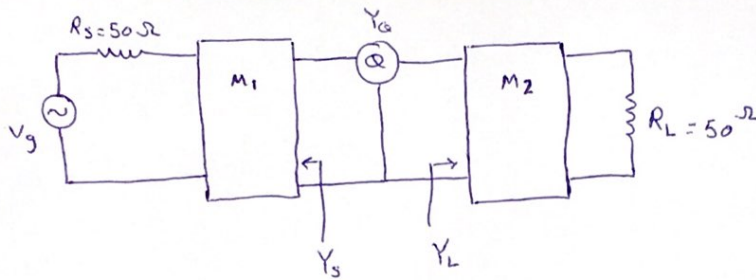
$$Y_s = 0.003 - j0.2 \Rightarrow G_t = \frac{1}{R_t} = G_s + G_{in} = \text{Re}\{Y_s\} + \text{Re}\left\{Y_i - \frac{Y_F Y_r}{Y_o + Y_L}\right\} = 0.003 + (-0.013)$$

$$= -0.01 \Rightarrow Q_{tin} = R_t C_t \omega_c \Rightarrow C_t = \frac{Q_{tin}}{R_t \omega_c} = \frac{157}{100 \times 2\pi \times 200 \times 10^6} = 1.24 \times 10^{-9}$$

$$= 1.24 \text{ nF} \Rightarrow L_1 = \frac{1}{C_t \omega_c^2} = 5.106 \times 10^{-10}$$

$$G_{t,max} = \frac{|Y_F|^2}{\sqrt{(2g_o - \text{Re}\{Y_F Y_r\})^2 - \text{Re}\{Y_F Y_r\}^2 + g_o g_o - \text{Re}\{Y_F Y_r\}}} = \frac{0.04}{0.04 + j0.011} = 0.86 - j0.23$$

#2



$$G_t = \frac{4 G_s G_L |Y_{21}|^2}{|(Y_{11} + Y_s)(Y_{22} + Y_L) - Y_{12} Y_{21}|^2}, \quad Y = \begin{bmatrix} Y_{11} & Y_{12} \\ Y_{21} & Y_{22} \end{bmatrix}, \quad Y_s = G_s + jB_s, \quad Y_L = G_L + jB_L$$

$$\Rightarrow G_t = \frac{P_o}{P_{avs}} = \frac{P_o}{\frac{1}{8} |I_s|^2} \Rightarrow G_t = 4 G_s G_L \left| \frac{V_2}{I_s} \right|^2 = \frac{4 G_s G_L |Y_{21}|^2}{|(Y_{11} + Y_s)(Y_{22} + Y_L) - Y_{12} Y_{21}|^2}$$

$$\Rightarrow f_0 = 100 \text{ MHz}, \quad I_c = 3 \text{ mA}, \quad V_{CE} = 4 \text{ V} \rightarrow$$

$$\begin{cases} F_{min} = 3 \text{ dB} \\ R_n = 30 \Omega \\ Y_{s,opt} = (25 + j25)^{-1} \end{cases}$$

$$\begin{aligned} g_n &= 1 \text{ mS} \\ g_o &= 100 \text{ mS} \\ g_m &= 30 \text{ mS} \\ C_n &= 20 \text{ pF} \\ C_o &= 2 \text{ pF} \end{aligned}$$

$$\begin{aligned} Y_{11} &= g_n + j\omega C_n \\ Y_{12} &= 0 \\ Y_{21} &= g_m \\ Y_{22} &= g_o + j\omega C_o \end{aligned}$$

$$F = 3.5 \text{ dB}, \quad g_{t,max} = ?$$

$$C = |Y_r Y_f| / (2 g_i g_o - \text{Re}\{Y_r Y_f\}) = 0 \rightarrow$$

$$Y_h = \begin{bmatrix} -0.1j & 0.1j \\ 0.1j & -0.1j \end{bmatrix} \text{ (mS)} \Rightarrow Y = Y_e + Y_h =$$

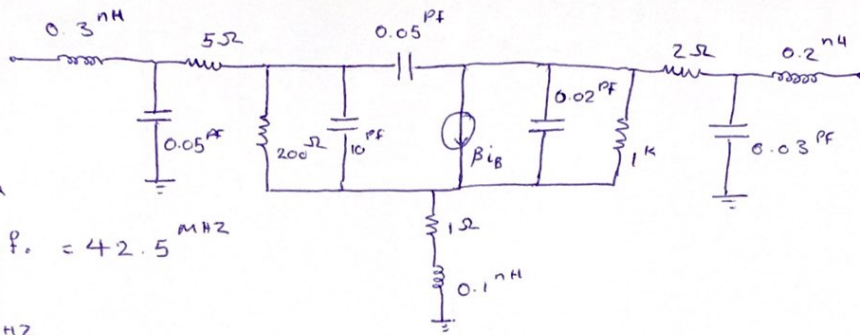
$$Y = \begin{bmatrix} Y_i & Y_r = 0 \\ Y_f & Y_o \end{bmatrix} \Rightarrow \alpha = \frac{F - F_{min}}{2 R_n} = \frac{3.5 - 3}{30} = 0.016$$

$$\Rightarrow (G_{s1} - g_{s,opt} - \alpha)^2 + (B_{s1} - B_{s,opt})^2 = \alpha (\alpha + 2 G_{s,opt})$$

$$\begin{cases} \text{I)} & (G_{s1} - 0.02 - 0.016)^2 + (B_{s1} + 0.02)^2 = 0.016 (0.016 + 2(0.02)) \\ \text{II)} & (G_{s2} - 0.02 - 0.016)^2 + (B_{s2} + 0.02)^2 = 0.016 (0.016 + 0.04) \end{cases}$$

$$\Rightarrow (G_{s1} - 0.036)^2 + (B_{s1} + 0.02)^2 = 8.96 \times 10^{-4} \Rightarrow \begin{cases} G_{s1}^2 + B_{s1}^2 - 0.036 G_{s1} + 0.02 B_{s1} = -7.04 \times 10^{-4} \\ G_{s2}^2 + B_{s2}^2 - 0.036 G_{s2} + 0.02 B_{s2} = -7.04 \times 10^{-4} \end{cases}$$

#6



$$I_C = 2.5 \text{ mA}$$

$$B.W. = 1.5 f_0 = 42.5 \text{ MHz}$$

$$\beta = 40$$

$$f_0 = 850 \text{ MHz}$$

$$F = 1 + \frac{C_{22}^A(f) - 2 \operatorname{Re}\{Y_S(f) C_{21}^A(f)\} + |Y_S(f)|^2 C_{11}^A(f)}{2kT \cdot \operatorname{Re}\{Y_S(f)\}}$$

$$\frac{\overline{I_{nb}^2}}{\Delta f} = 2qI_B + \frac{\alpha_0}{f} + \frac{\alpha_1}{\alpha_2 + \alpha_3 f^2}$$

$$\frac{\overline{I_{nc}^2}}{\Delta f} = 2qI_C, \quad \frac{\overline{V_{ni}^2}}{\Delta f} = 4kT r_i$$

$$= \begin{bmatrix} \overline{V_n^2} & \overline{V_n I_n^*} \\ \overline{V_n^* I_n} & \overline{I_n^2} \end{bmatrix}$$

$$\Rightarrow C_n^A = \bar{V} L_n \bar{V} L_n^* = \begin{bmatrix} V_n \\ I_n \end{bmatrix} \cdot \begin{bmatrix} V_n^* & I_n \end{bmatrix}$$

#8

$$f_0 = 70 \text{ MHz}$$

$$F = 5 \text{ dB}$$

$$(G_S - 19.167)^2 + (B_S + 5)^2 = 361.12$$