7.4 (1) $\omega_0 = \frac{1}{\sqrt{LC}} = 2.9\times10^6\ rad/s = \omega_{LO} - \omega_{RF}$ 提取下混频

$\beta = \frac{\alpha}{1-\alpha} = 49 \qquad g_{mQ} = g_0 = \frac{\alpha I_{E0}}{U_T} = \frac{\alpha I_K}{U_T} = 75.38\ ms$ (恒流源偏置)

$g_{in} = \frac{g_0}{\beta} = 1.538\ ms \quad , x = \frac{U_{L0}}{U_T} = 8 \quad . \ g_1 = g_0 \frac{2I_1(x)}{I_0(x)} = 141\ ms$

$g_c = \frac{1}{2} g_1 = 70.5\ ms$

(2) $A_{v,c} = g_c R_L = 352.5 = 25.47\ dB \quad (10\lg 352.5)$

$$A_{p,c} = \frac{A_{v,c}^2}{g_{in}R_L} = \frac{352.5^2}{1.538\times5} = 16158.16 = 42.08\ dB$$

7.5 (1) $u_{RF}(t) = 20\times10^{-6}\times10\times10^3\times\frac{1}{2}\cos 6\times10^6 t = 0.1\cos 6\times10^6 t\ V$

$\omega_{IF} = \omega_{LO} - \omega_{RF} = 3\times10^6\ rad/s$

自生负偏压 $u_{GS} = -U_{L0} + U_{L0}\cos\omega_{L0}t + u_{RF}$

$\because |U_{L0}| \le \frac{1}{2}|U_P| \ . \ \therefore$ MOS管工作于完全平方区

$g_1 = \frac{2I_{DSS}U_{L0}}{U_P^2} = 4\ ms , \quad g_c = \frac{1}{2}g_1 = 2\ ms$

$u_0(t) = 12 - R_L g_c U_{RF}\cos\omega_0 t = 12 - 2\cos 3\times10^6 t\ V$

7.10 (2) $\omega_0 = \frac{1}{\sqrt{LC}} = 2\times10^7\ rad/s , \ BW = \frac{1}{R_L C} = 2\times10^6\ rad/s$

对于 $2\times10^7 \pm 10^6\ rad/s$ 的频率成分，呈现阻抗 $|Z| = \frac{R_L}{\sqrt{2}}$，相移 $\mp\frac{\pi}{4}$

$0 + u_{RF} - 1.5I_C - 0.7 - I_E\times0.5 = -10 \quad . \ I_C = I_E \ (\alpha = 1)$

$$\Rightarrow I_K = I_E = \frac{6(1+0.8\cos10^6 t)\cos8\times10^7 t + 9.3}{2}\ mA$$

当 $u_{L0} = 2.6\cos10^8 t\ (V)$ 时，$\frac{u_1 - u_2}{U_T} \ge 4$，差分对具有开关特性

$$\therefore i_C = I_K K^-(10^8 t) = \frac{6(1+0.8\cos10^6 t)\cos10^7\times8t + 9.3}{2} \times \left(\frac{1}{2} - \frac{2}{\pi}\cos10^8 t + \cdots\right)$$

$$\therefore u_0(t) = 10 - \frac{1}{2}\times\left(-\frac{2}{\pi}\right)\times5\times\frac{6\left(1+(0.8/\sqrt{2})\cos\left(10^6 t - \frac{\pi}{4}\right)\right)}{2}\cos(2\times10^7 t)\ V$$

$$= 10 + 4.777\left(1 + 0.5657\cos\left(10^6 t - \frac{\pi}{4}\right)\right)\cos(2\times10^7 t)\ V$$

7.12 (a) 只有在 $u_{LO}(t)$ 的正半周时，VD_1 和 VD_2 导通

$$\begin{cases} u_{LO} = i_{D1} R_D - u_{RF} + u_o \\ u_{LO} = i_{D2} R_D + u_{RF} - u_o \end{cases}$$

相减

$$\Rightarrow \quad u_o = (i_{D1} - i_{D2}) \frac{R_D}{2} + u_{RF}$$

$$u_o = (i_{D1} - i_{D2}) R_L$$

$$\Rightarrow \quad i_{D1} - i_{D2} = \frac{2u_{RF}}{2R_L + R_D}$$

$$\therefore u_o(t) = \frac{2R_L u_{RF}}{2R_L + R_D} K^+(\omega_{LO} t)$$