1) LNA Design Common source:

Let $f_T = 12GHz$

$$f_T = \frac{50}{\omega_T L_S} \Rightarrow L_S = 650pF$$

for $W = 2\mu m$ & $V_g = 0.5V$

$\Rightarrow I_D = 217\mu A$, $g_m = 1.6mS$

designing for $I_D = 6.9mA$

we require $W = 64\mu m$

scaling factor = 32

$g_m = 57.6mS$

$C_{gs} = 700pF$

$$\Rightarrow L_g = \frac{1}{\omega_0^2 C_{gs}} = 8.8nH \approx 9nH$$

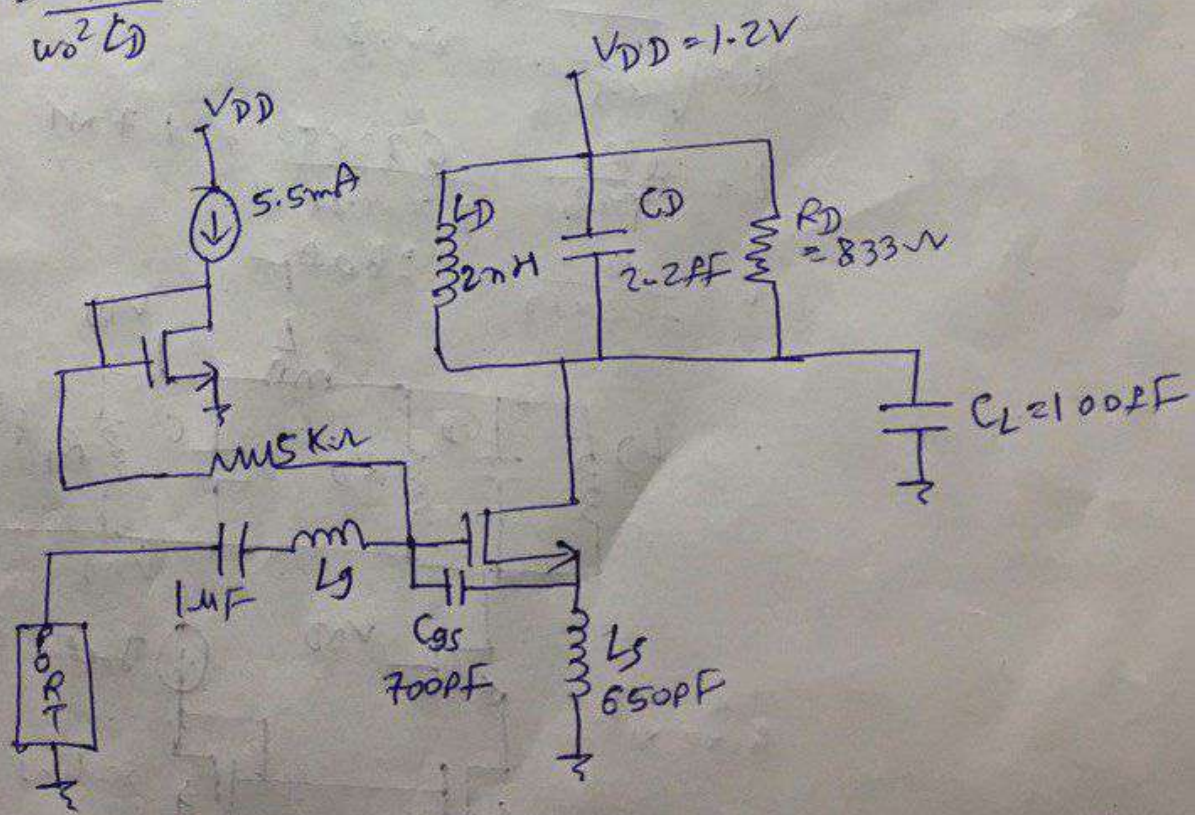
$$Q_{in} = \frac{\omega_0 (L_g + L_s)}{R_s + \omega_T L_s} = 1.042$$

Choosing gain = 50

$$R_D = \frac{50}{Q_{in}\, g_m} = \frac{50}{1.042 \times 60mS} = 833\Omega$$

$L_D = 2nH$

$$C_D = \frac{1}{\omega_0^2 L_D} = 2.2fF$$



2) LNA Design Common Gate: (CONTD)

$\frac{1}{g_m} = R_S = 50\Omega \Rightarrow$ Desired $g_m = 20\,mS$

$V_G = 0.5V \Rightarrow I_D = 217\,\mu A$

$\Rightarrow g_m = 1.8\,mS$

Scaling it by 12 factor

$I_D = 2.6\,mA$ & $g_m = 21.6\,mA$

Let gain $A_V = 20$

For CG Gain $A_V = \frac{R_D}{2R_S}$

$\Rightarrow 20 = \frac{R_D}{2 \times 50}$

$\Rightarrow R_D = 2K\Omega$

Let $L_D = 2nH$

$C_D = \frac{1}{\omega_0^2 L_D}$ (so L_D & C_D will resonanat each other at $f_0 = 1.8\,GHz$)

$\Rightarrow C_D = 4pF$

For matching N/W

$R_L = 2K\Omega$ $R_S = 50\Omega$

$Q = \sqrt{\frac{R_L}{R_S} - 1} = 6.32$

$L = \frac{Q R_S}{2\pi f_0} = \frac{6.32 \times 50}{2\pi \times 1.8 \times 10^9} = 1.7nH$

$C = \frac{Q}{2\pi f_0 \times R_D} = 280fF$