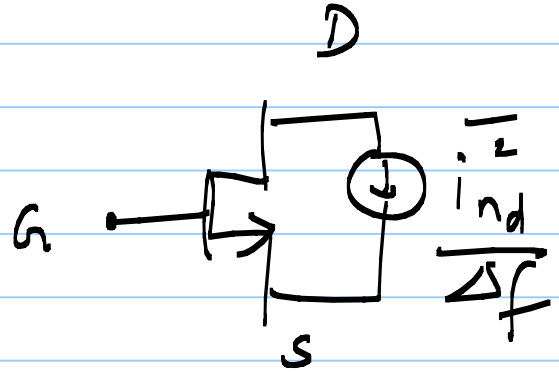
06/02/20

Lec 11

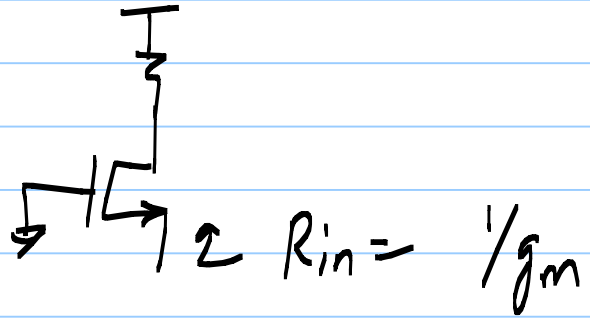


$$\frac{\overline{i_{nd}^2}}{\Delta f} = 4kT\gamma g_m$$

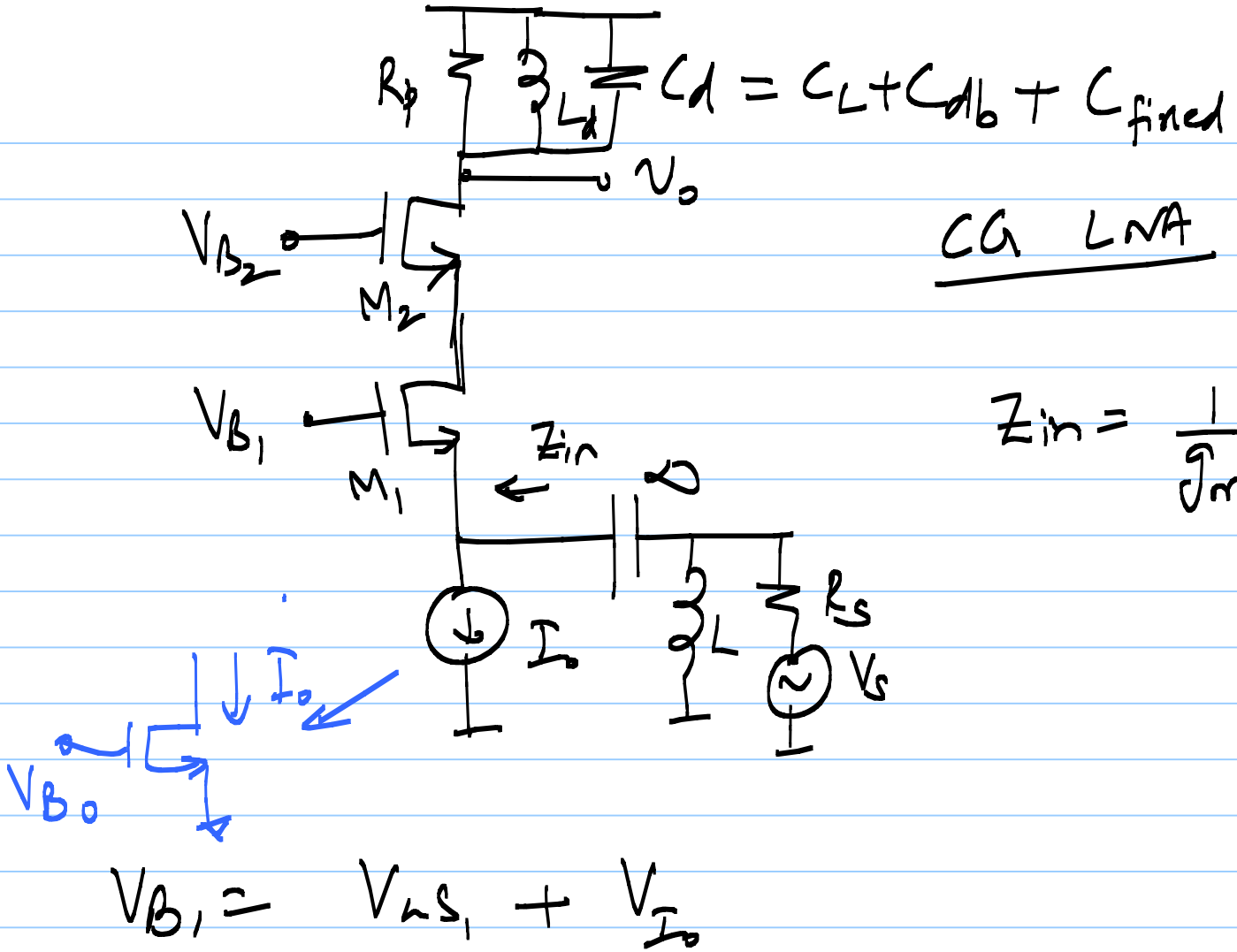
$\gamma = \frac{2}{3}$ for a long channel MOSFET @ low freq.

$\gamma > \frac{2}{3}$ for short channel devices @ high freq.

CG LNA



ver 1



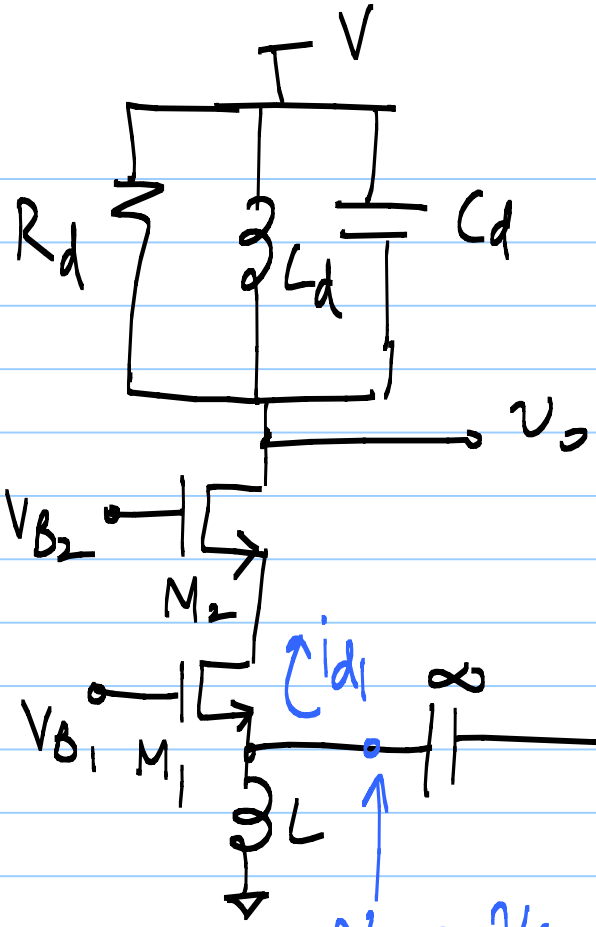
CG LNA

$$Z_{in} = \frac{1}{g_m} \,||\, \frac{1}{sC_{gs_1}}$$

$$V_{B_1} = V_{GS_1} + V_{I_o}$$

Ver 2

$V_{B_1} = V_{GS_1}$



$$f_o = \frac{1}{2\pi\sqrt{L C_{gs_1}}}$$

$$f_o = \frac{1}{2\pi\sqrt{L_d C_d}}$$

$$Z_{in} = \frac{1}{g_{m_1}}$$

Set $g_{m_1} = 20mS$

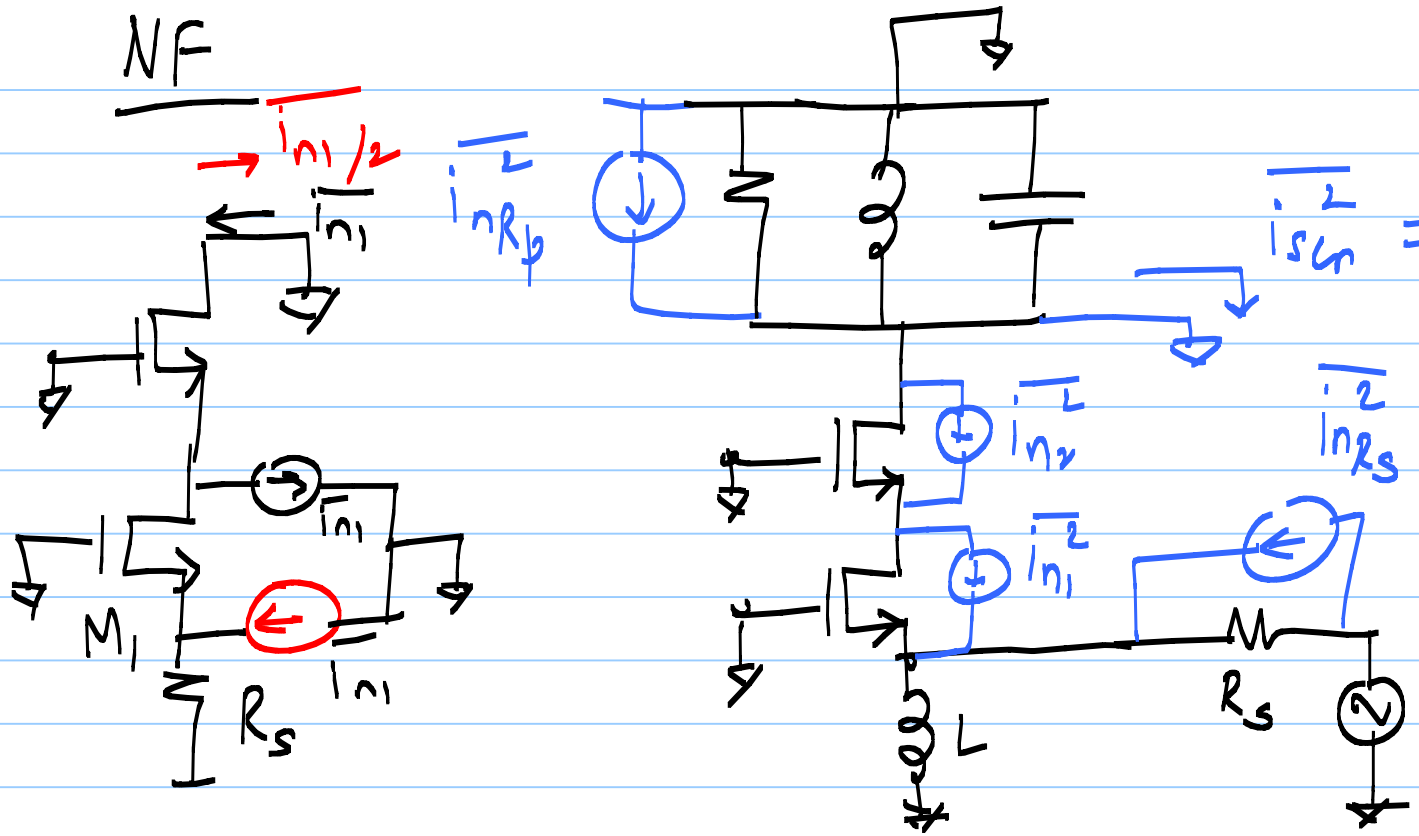
$M_1 \equiv M_2$

$$i_{d_1} = g_{m_1} \cdot \frac{v_s}{2}$$

$$v_o = i_{d_1} \cdot R_p = g_{m_1} R_p \cdot \frac{v_s}{2}$$

$$gain = \frac{g_{m_1} R_p}{2}$$

NF



$$F = 1 + \frac{\frac{4kT\gamma g_{m1}}{4} + \frac{4kT}{R_p}}{\frac{4kT}{4R_s}} = 1 + 4\frac{R_s}{R_p} + \gamma$$

$$\boxed{F = 1 + \gamma + 4R_s/R_p}$$

e.g. $R_p = \infty$, $\gamma = 2/3$ $\Rightarrow$ $F = 1.62$, $NF = 2.2\,dB$