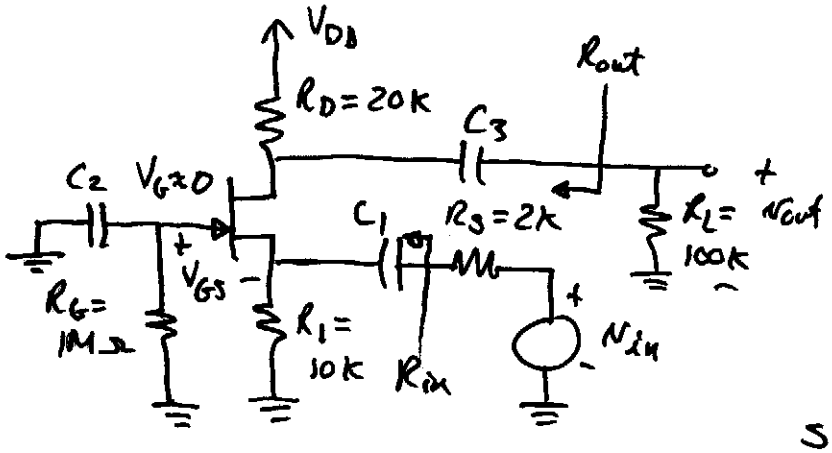
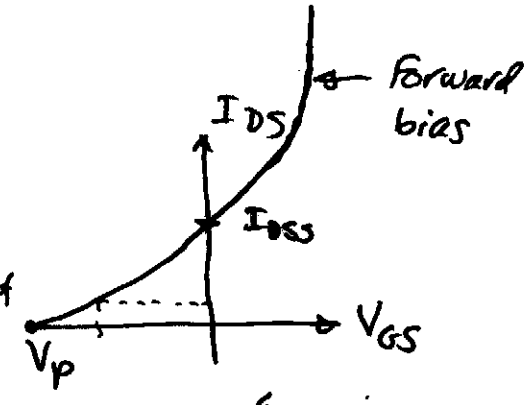
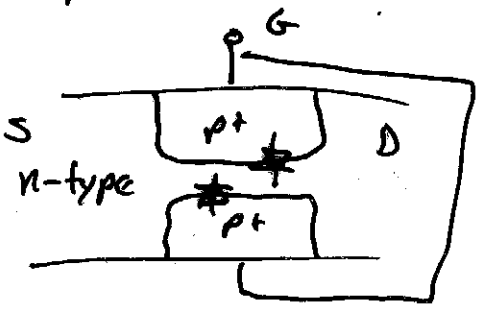
Common Gate JFET Amplifier







DC conditions:

$I_{DS} = 1mA$, $I_{DSS} = 5mA$

$V_p = -2V$, $\lambda = 0 \Rightarrow r_o = \infty$

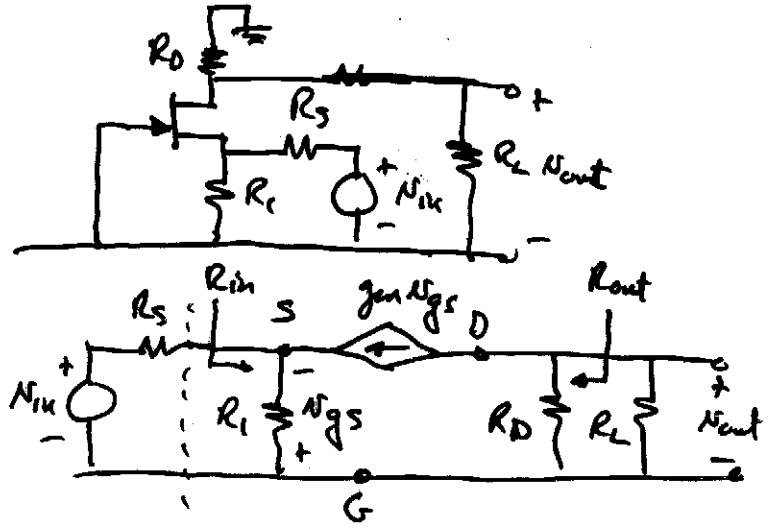
1.) Small-signal model parameters

$$g_m = \sqrt{2 I_{DS} K_n (1+\lambda V_{DS})} \qquad K_n(JFET) = \frac{2 I_{DSS}}{|V_p|^2}$$

$$g_m = \frac{2}{|V_p|}\sqrt{I_{DSS} I_{DS}} \qquad I_{DS} = I_{DSS}\left(1 - \frac{v_{GS}}{V_p}\right)^2$$

$$= \frac{2}{2}\sqrt{5 \cdot 1}\ mS = 2.236\ mS \qquad r_o = \infty$$

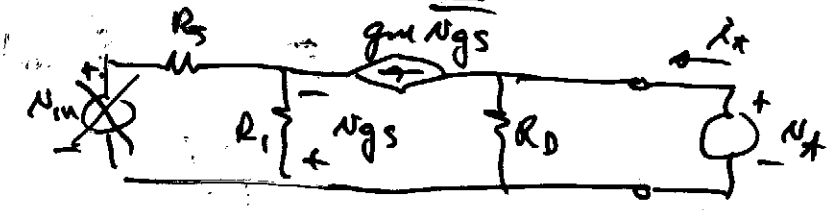
2.) Small-signal model



CG-JFET Amplifier - Cont'd

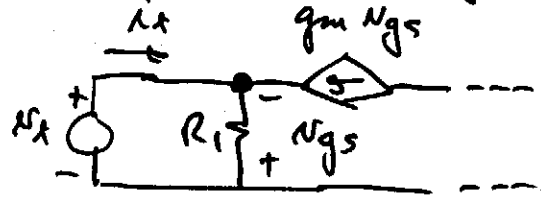
3.) SS Analysis -

$R_{out} = R_D = 20K$



$R_{out} = \left.\frac{v_x}{i_x}\right|_{v_{in}=0}$

$v_{in} = 0 \rightarrow v_{gs} = 0 \rightarrow R_{out} = R_D$



$i_x + g_m v_{gs} = \frac{v_x}{R_1}$

but $v_{gs} = -v_x$

$\therefore\ i_x = \frac{v_x}{R_1} + g_m v_x = v_x\left(g_m + \frac{1}{R_1}\right)$

$R_{in} = \frac{1}{g_m + \frac{1}{R_1}} = \underline{\underline{428\,\Omega}}$

$\frac{v_{out}}{v_{in}} = \left(\frac{v_{out}}{v_{gs}}\right)\left(\frac{v_{gs}}{v_{in}}\right) = \left(-g_m R_D \| R_L\right)\left(\frac{-R_1}{R_1 + R_S}\right)$

$= 31.06\ V/V$