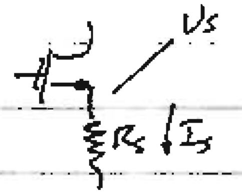
11/14/07



Calculate I_s > compare
measure I_s

don't do this

I_s from simulation
I from calculation by taking V_s from simulation
& dividing by R_s.

Calculation same as exams.

r_o, g_m, C_{GD}, C_{GS}

β, r_π, r_o

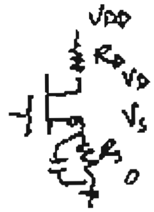
Cutoff ω for CAD #3

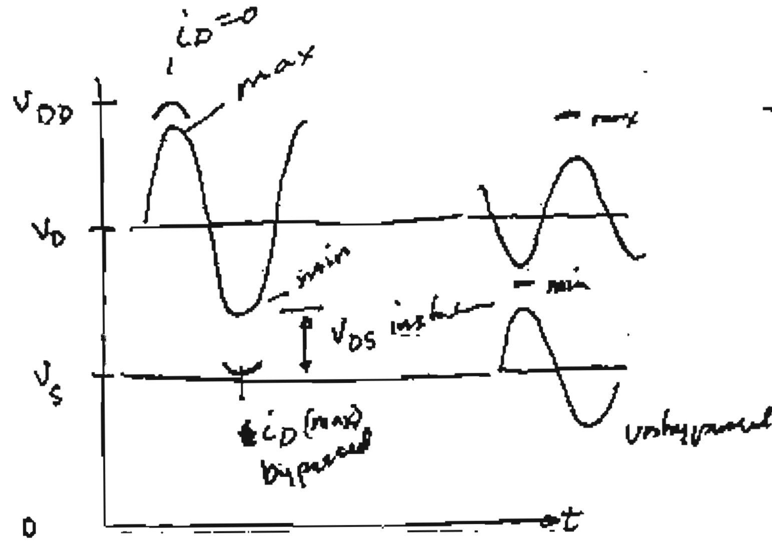
$$\Rightarrow \frac{1}{(R_{sig}+R_G)C_{eq}} = \text{HF Cutoff}$$

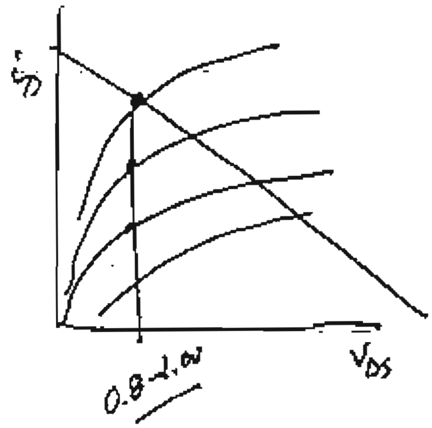
Good prediction?

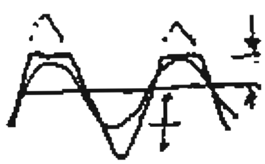
compare ⇒ simulation data

$$C_{eq} = C_{GS} + C_{GD}(1+g_m R_L')$$









Suppose $V_{DD}=12$, $V_D=9$, $V_S=3$

max = 12 or $V_D+3=12$

peak = 3

min = $V_D-3=6$ ~~[illegible]~~

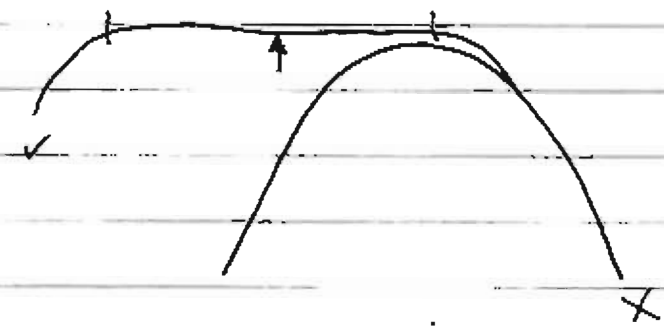
~~[illegible]~~ leaves 6-3 = 3v usable

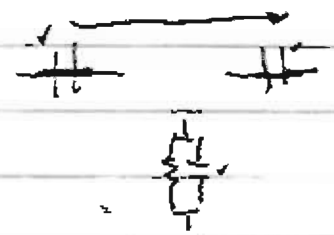
8.2pp
full upside
V_D = 12-4.1
7.9v

$V_{DD}=12$, $V_D=6$, $V_S=3$

min = 3.8, peak = 6-3.8 = 2.2

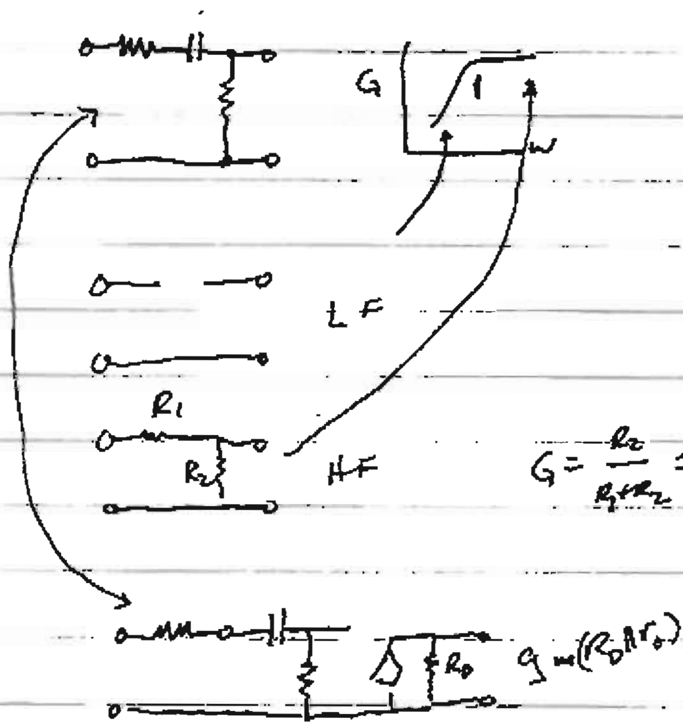
max = 6+2.2 = 8.2





$\omega = 1, 2, 3$ LF
50-500 another 100 ... ω

$\omega = 1000$ HF



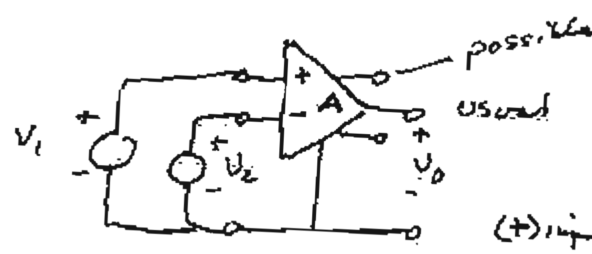
$$G = \frac{R_2}{R_1 + R_2} = \frac{V_o}{V_i}$$

$$\left(\frac{R_2}{R_1 + R_2}\right)\left(g_m(r_o \| R_D)\right) = G_v$$

Operational Amplifier

Very High Gain Differential Input Amplifier

Integrator Operation => Operational Amplifier

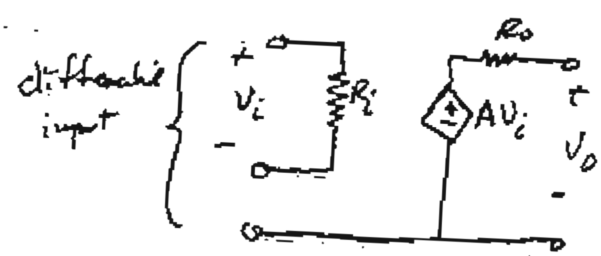


(+) input non-inverting (NI)

(−) input inverting (I)

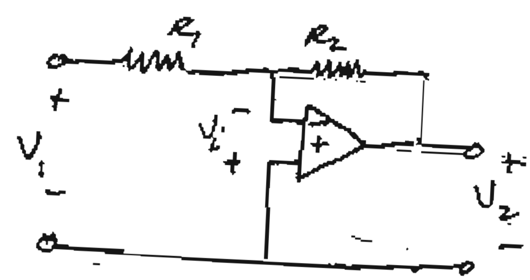
$$V_0 = A(V_1 - V_2) = \underbrace{AV_1}_{NI} - \underbrace{AV_2}_{I} \quad \text{with } A \to \infty$$

741 Series Op Amps $A = 2\times10^5$



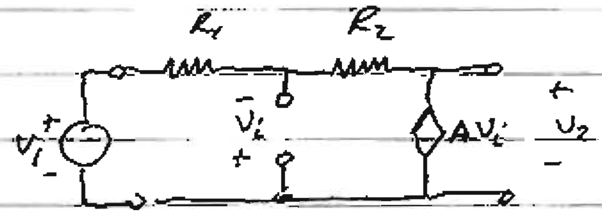
R_i is large, often ignored
R_o is not so small, often ignored } watch out

Simple circuit



p69

ignore R_i, R_o



Using superposition

$$V_i = -V_1\left(\frac{R_2}{R_1+R_2}\right) - V_2\left(\frac{R_1}{R_1+R_2}\right)$$

$$AV_i = V_2 = -AV_1\left(\frac{R_2}{R_1+R_2}\right) - AV_2\left(\frac{R_1}{R_1+R_2}\right)$$

$$V_2\left[1 + A\left(\frac{R_1}{R_1+R_2}\right)\right] = -AV_1\left(\frac{R_2}{R_1+R_2}\right)$$

$$\text{Gain} = \frac{V_2}{V_1} = -\frac{A\left(\frac{R_2}{R_1+R_2}\right)}{1 + A\left(\frac{R_1}{R_1+R_2}\right)}$$

limit $A \to \infty$

$$\text{Gain} \to \frac{-A\left(\frac{R_2}{R_1+R_2}\right)}{A\left(\frac{R_1}{R_1+R_2}\right)} = -\frac{R_2}{R_1}$$

inverting connection