Question A31.2

$$A_{CL} = \frac{A_{OL}}{1 + \beta A_{OL}}$$

ideal $A_{CL} = 2 = \frac{1}{\beta} \Rightarrow \beta = 0.5$

$$A_{CL}\Big| = 2^{\pm\varepsilon} = \frac{A_{OL}}{1 + 0.5 \cdot A_{OL}} = \frac{1}{\frac{1}{A_{OL}} + \frac{1}{2}}$$

$.001 = 0.1\%$ |Actual
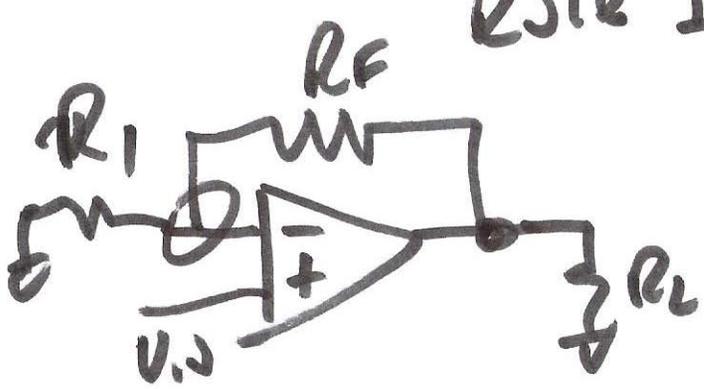
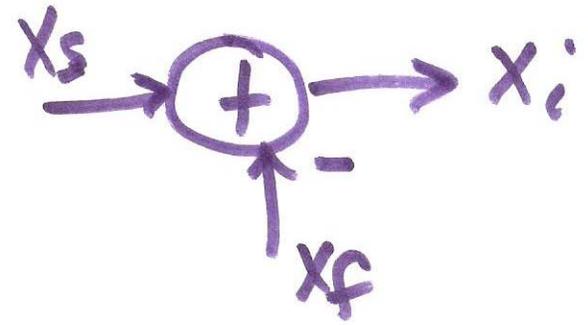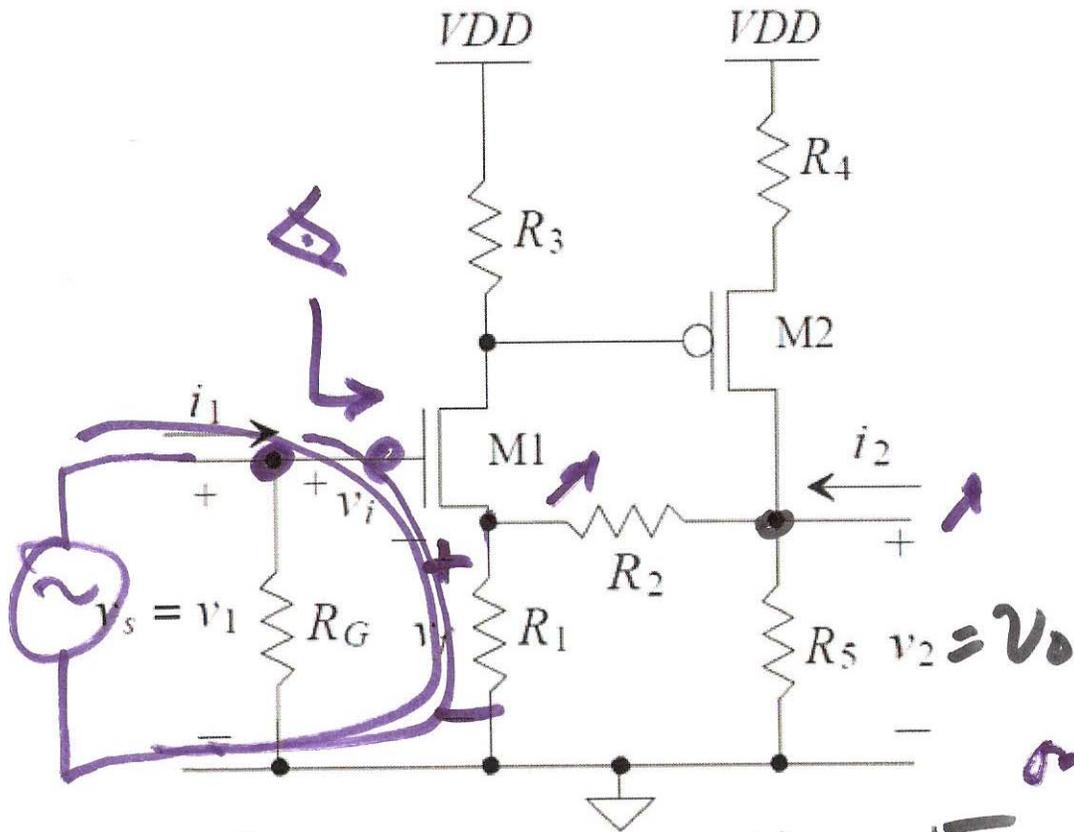$$2 - 0.002 \lessgtr \frac{1}{\frac{1}{A_{OL}} + \frac{1}{2}}$$

1.998

1)

$$\frac{5 \cdot 10^3}{\left(1 + j\frac{f}{100K}\right)\left(1 + j\frac{f}{1MHz}\right)}$$

P1107   OUTPUT   SAMPLING

Rule 1: ONE terminal is connected to the load And the other to feedback Network → series (current)

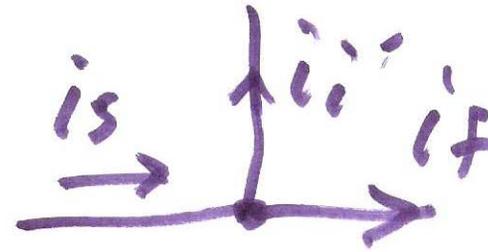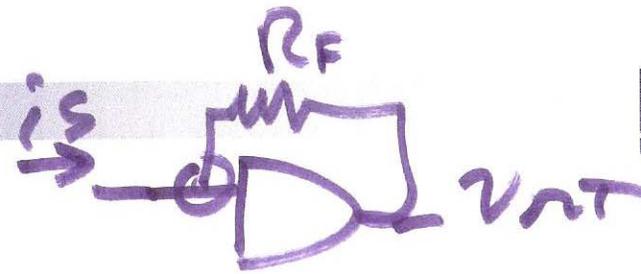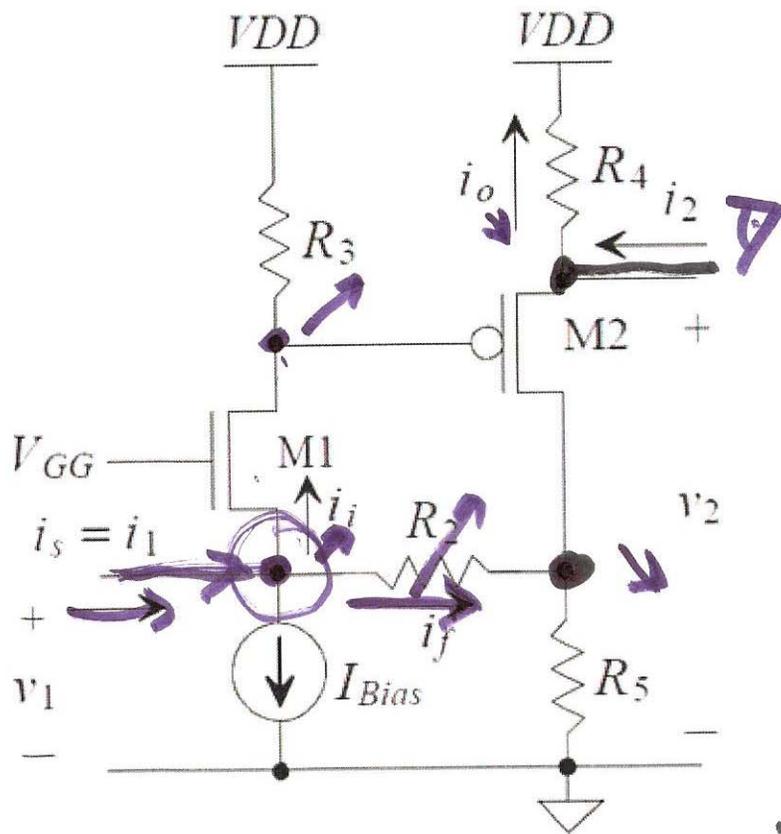Rule 2: load f.b. Network connected to sme load
— shunt (voltage)

2)

$$x_s \rightarrow \boxed{+} \rightarrow x_i$$
$$\downarrow -$$
$$x_f$$

$$v_i = v_s - v_f$$

Series   Shunt   f.b.
                output

Voltage   —   Voltage

Series - Shunt

3)

R_F

i_s

v_{out}

VDD

VDD

R_3

i_o

R_4 i_2

M2 +

V_{GG} — M1

$i_s = i_1$

+

v_1

i_i

R_2

i_f

I_{Bias}

v_2

R_5

$-$

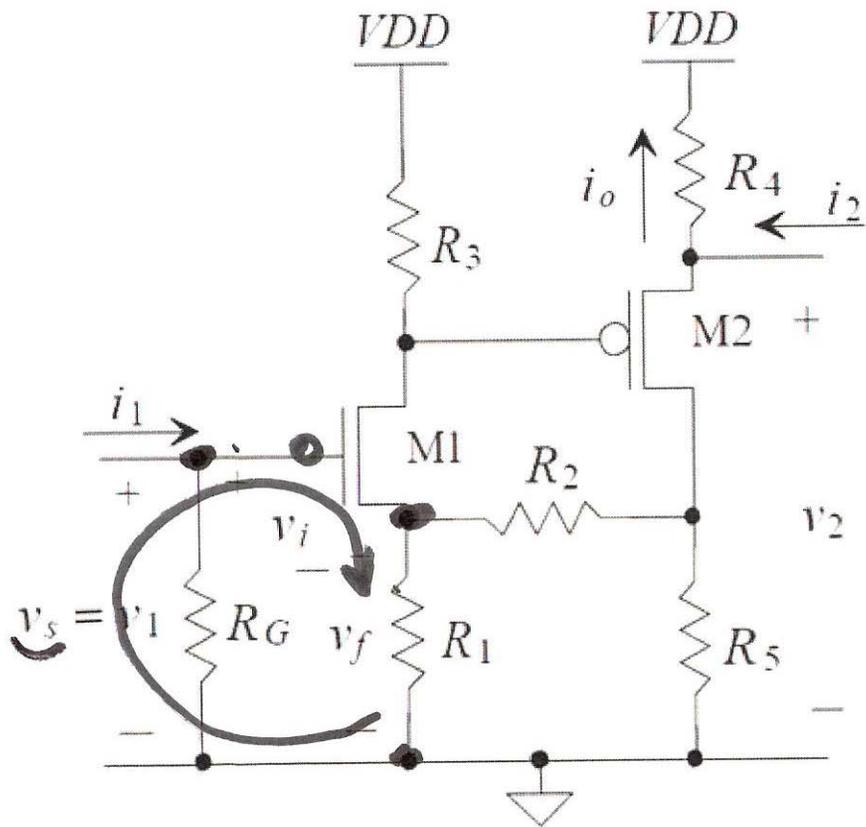i_s $\quad i_i$ $\quad i_f$

$i_s = i_i + i_f$

10m $\quad i_i = i_s - i_f$

$x_i = x_s - x_f$

Shunt — series f.b.

current — current
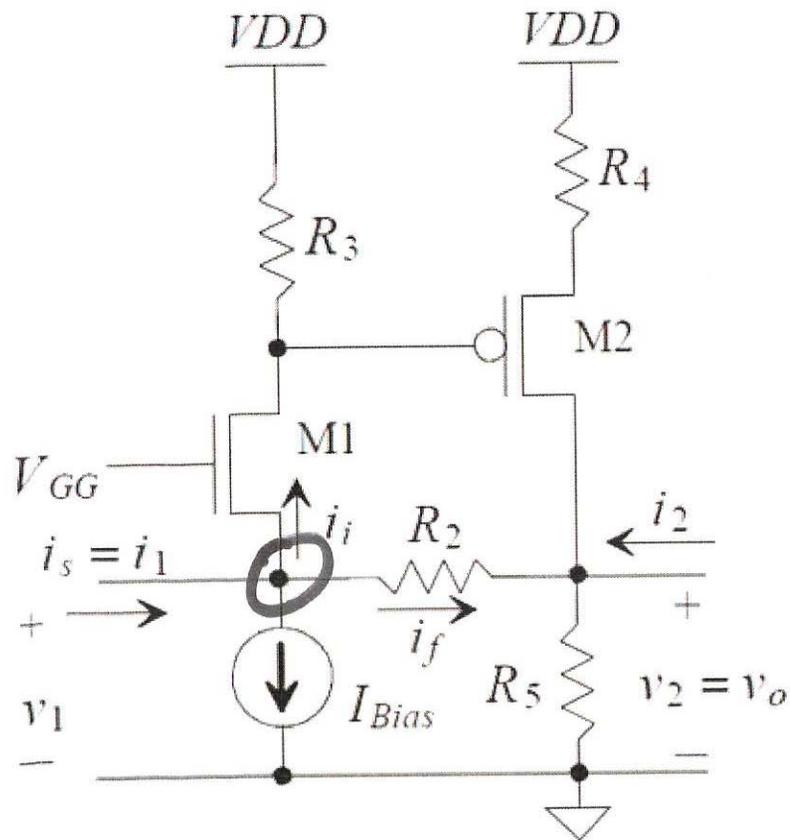
$R_i = \dfrac{1}{g-1}$
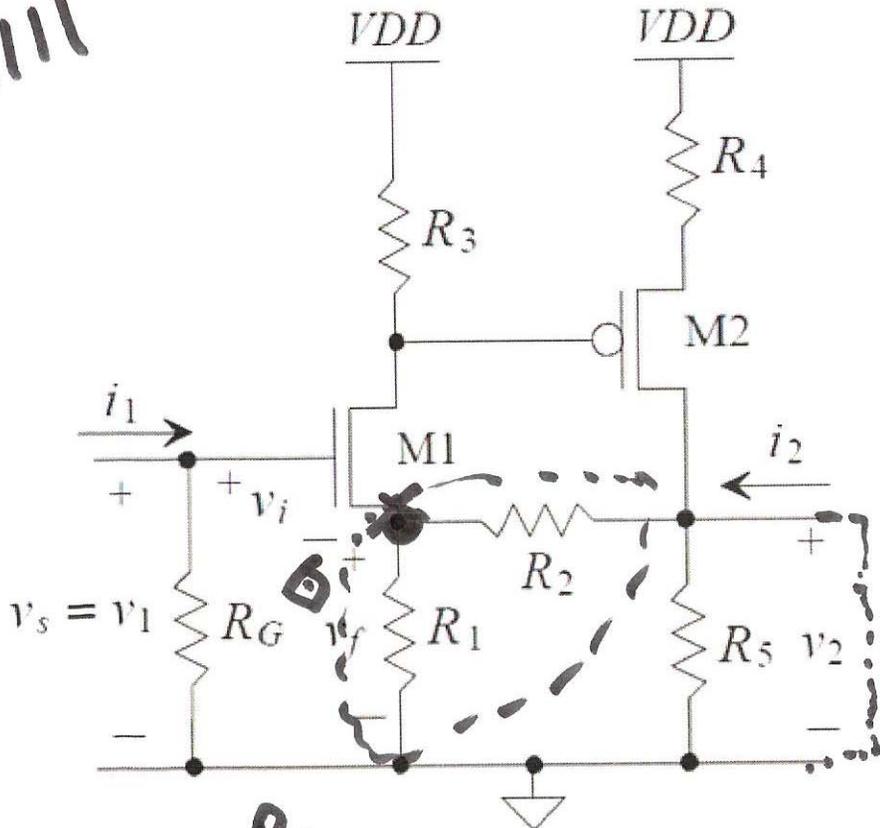
4)

Series – Series

Voltage – Current

trans conductance

5)

shunt - shunt

current - voltage

transimpedance (TIA)
resistance

6)

P11111

VDD   VDD

R_3 R_4

M2

M1

i_1 i_2

$+v_i$
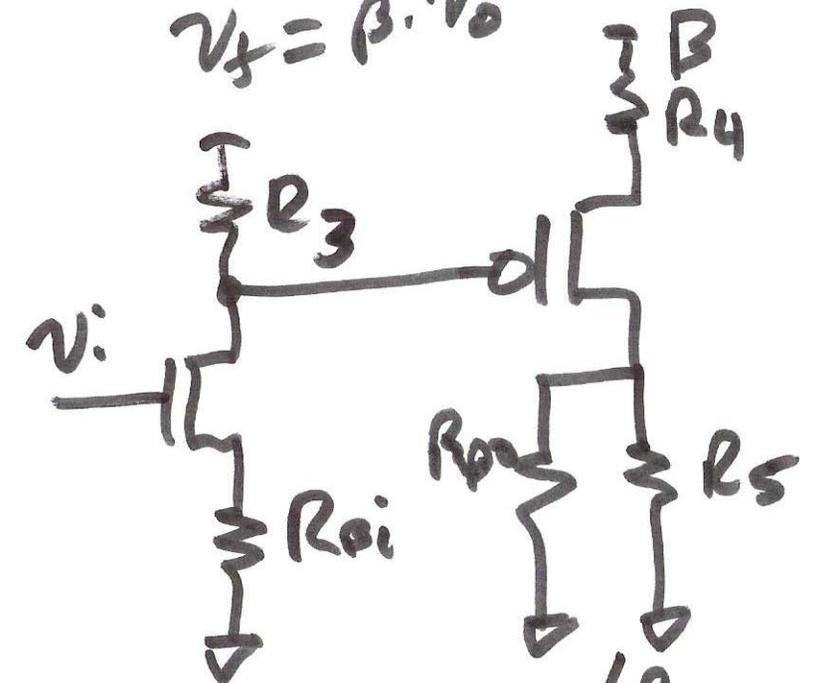
$v_s = v_1$ R_G R_1 R_2 R_5 v_2

v_f

$$v_f = v_0 \cdot \frac{R_1}{R_1 + R_2}$$

$$v_f = \beta \cdot v_0$$

$$\beta = \frac{R_1}{R_1 + R_2}$$ Series-shunt

$$v_0 = v_2 = v_f \cdot \frac{R_1 + R_2}{R_1}$$

$$R_{oi} = R_1 \| R_2$$

$$R_{\beta o} = R_1 + R_2$$

v_i

R_3

$R_{\beta o}$ R_5

R_{oi}

$$A_{oL} = \left(\frac{-R_3}{\frac{1}{g_{m1}} + R_{oi}} \right) \cdot \left(\frac{-R_5 \| R_{\beta o}}{R_4 + \frac{1}{g_{m2}}} \right)$$

7)

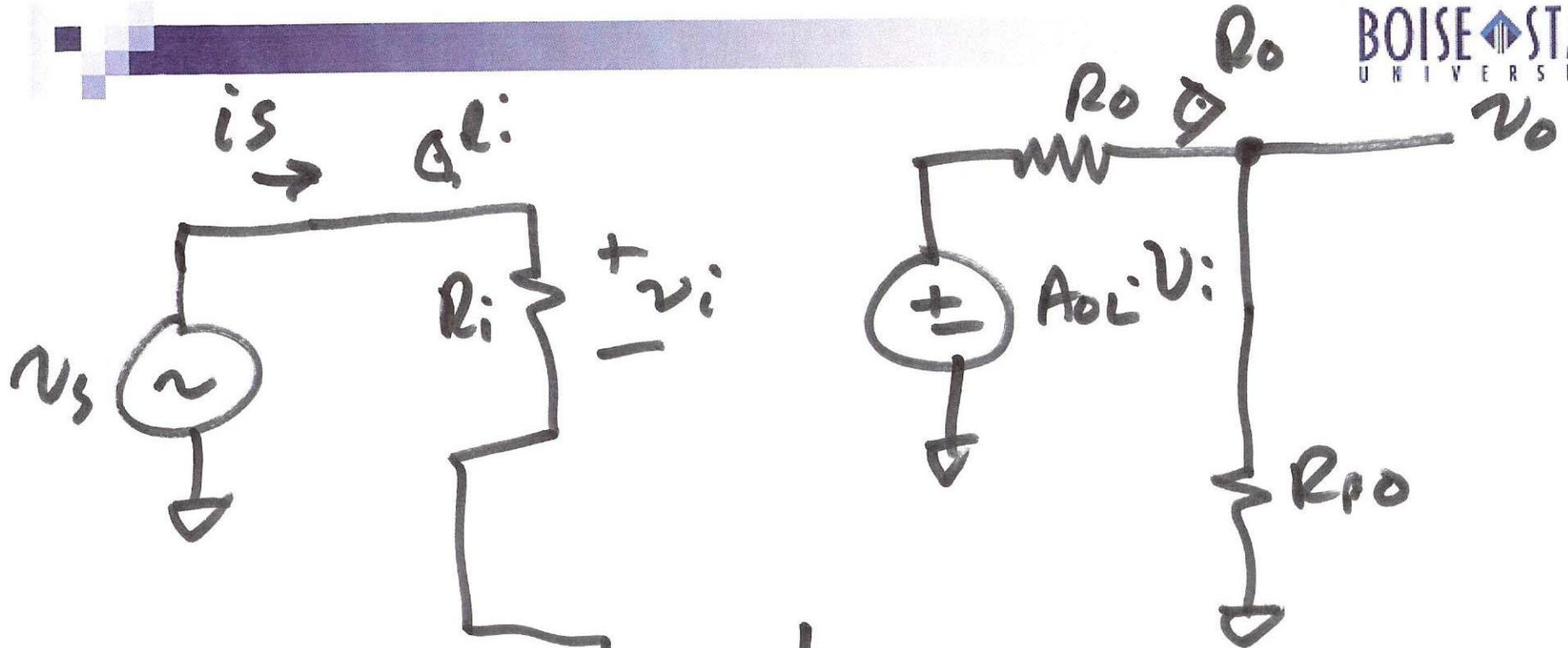$$I R_1 \ll r_0$$
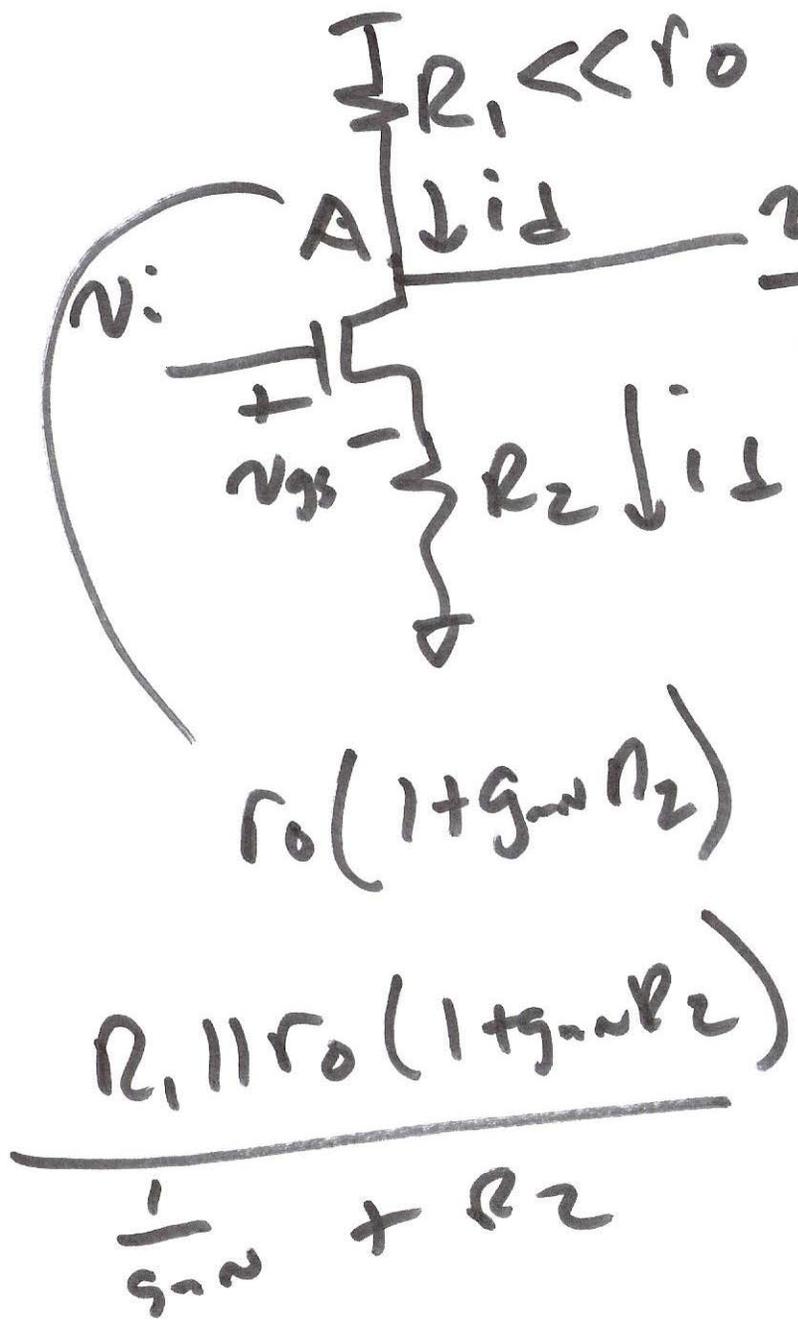
$$\frac{v_0}{v_i} = \frac{-i_d \cdot R_1}{v_{gs} + i_d \cdot R_2}$$

$$v_{gs} = \frac{i_d}{g_m}$$

$$r_0 (1 + g_m R_2)$$

$$\frac{R_1 \| r_0 (1 + g_m R_2)}{\frac{1}{g_m} + R_2} = \frac{-R_1}{\frac{1}{g_m} + R_2}$$

8)

i_s, αi_i

R_i , $+v_i-$

v_s (source)

R_o, R_o, v_o

$A_{OL} \cdot v_i$

R_{po}

$R_{inf} = \dfrac{v_s}{i_s}$

$i_s \downarrow \quad R_{oi} \quad +v_f = \beta \cdot v_o -$

v_f

$\dfrac{v_o}{v_s} = \dfrac{A_{OL}}{1 + \beta A_{OL}}$

$v_s = i_s \cdot R_i + i_s \cdot R_{oi}$

$i_s = \dfrac{v_i}{R_i} + \dfrac{v_f}{R_{oi}} =$

$R_{inf} = R_i(1 + \beta A_{OL})$

9)