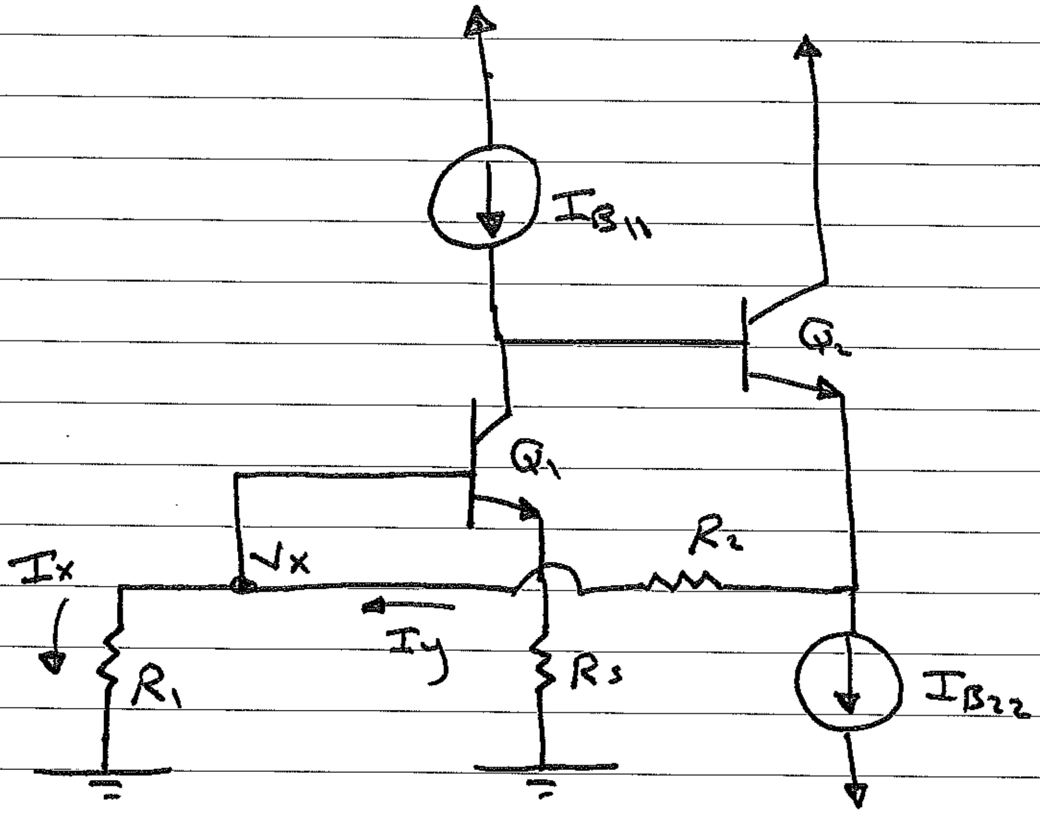
8.32

Dc Analysis :



$$I_{B11} = I_{C1} + I_{B2}$$

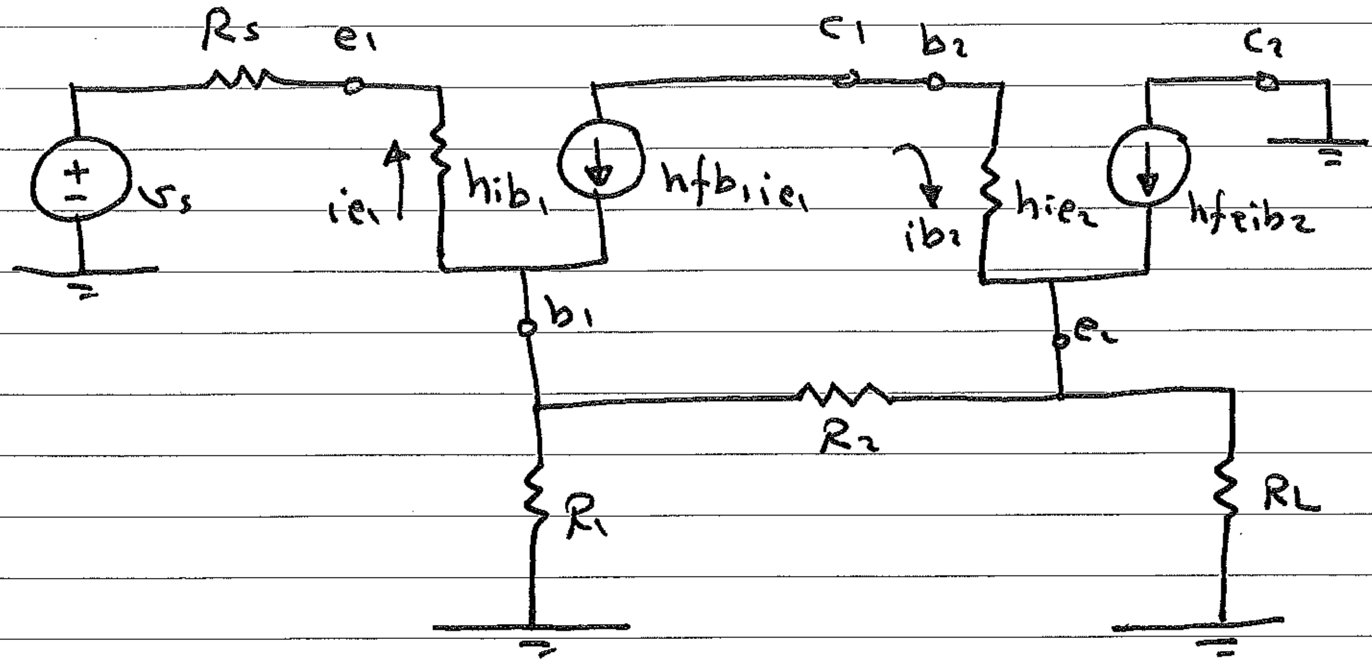
$$I_y = I_x + I_{B1} = I_{E2} - I_{B22}$$

$$I_x = \frac{V_x}{R_1}$$

$$V_x = V_{BE_1} + R_s I_{E1}$$

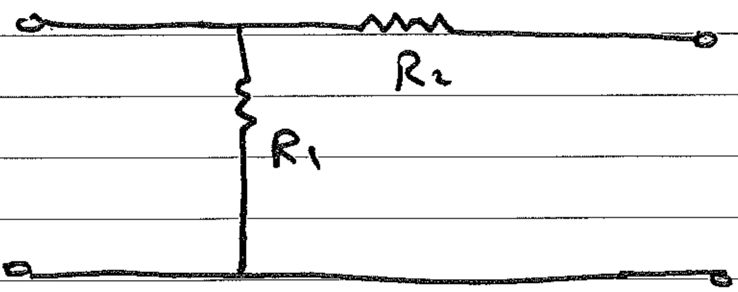
$$\therefore \quad I_{E2} = 1.708\,mA$$
$$I_{E1} = 83.08\,\mu A$$

Ac small Signal Equivalent CKT



Series - shunt feedback

The feedback network :



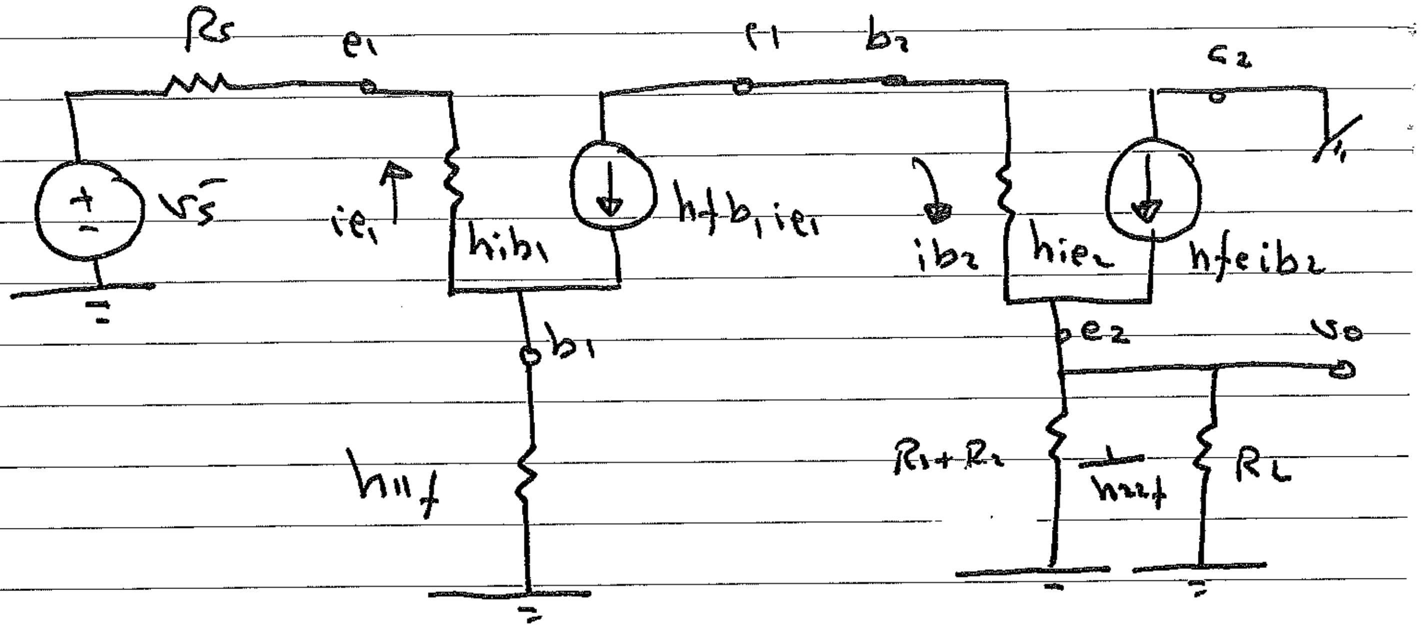
$h_{11f} = R_1 \parallel R_2 = 0.91\,k\Omega$

$h_{22f} = \dfrac{1}{R_1 + R_2} = 0.091\,m\mho$

$h_{12f} = \dfrac{R_1}{R_1 + R_2} = 0.091$

$\therefore \beta = 0.091$

The new basic amplifier



$$hib_1 = \frac{V_T}{I_{E1}} = 309.2\ \Omega$$

$$A = \frac{v_o}{v_s}$$

$$v_o = (1K \| 11K)\, ie_2$$

$$ie_2 = (hfe+1)\, ib_2$$

$$ib_2 = -hfb\, ie_1$$

$$ie_1 = \frac{-v_s}{R_s + hib_1 + \frac{h_{11f}}{hfe+1}}$$

$$\therefore\ A = 219.57$$

$$AB = 19.98$$

$$A_f = \frac{A}{1+AB} = 10.46\ ;\ \frac{1}{B} = 11$$

$Z_{if} = R_i(1+AB)$

$R_i = h_{ib_1} + R_s + \frac{h_{11f}}{h_{fe}+1} = 418\ \Omega$

$\therefore Z_{if} = 8.77\ K\Omega$

$Z_{if} = R_s + R_{in}$

$\therefore R_{in} = 8.67\ K\Omega$

$$Z_{of} = \frac{R_o}{1+AB}$$

$R_o = R_L \parallel \frac{1}{h_{22f}} = 0.9167\ K\Omega$

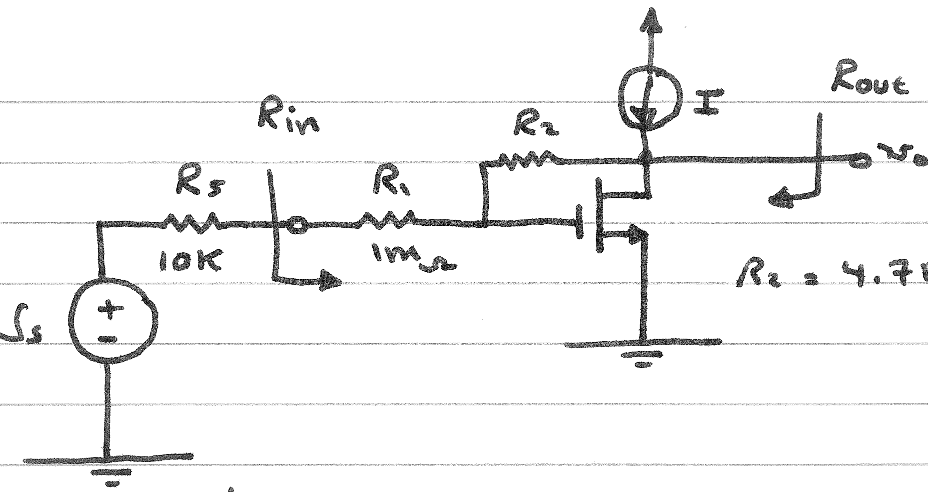
$Z_{of} = 43.69\ \Omega$

$Z_{of} = R_L \parallel R_{ou}$

$\therefore R_{ou} = 45.69\ \Omega$

$R_o = R_L \parallel \frac{1}{h_{22f}} = 0.9167\ K\Omega$

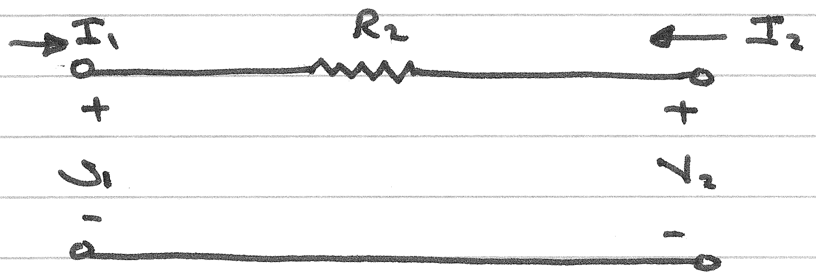
8.42 :



$R_2 = 4.7 M\Omega$

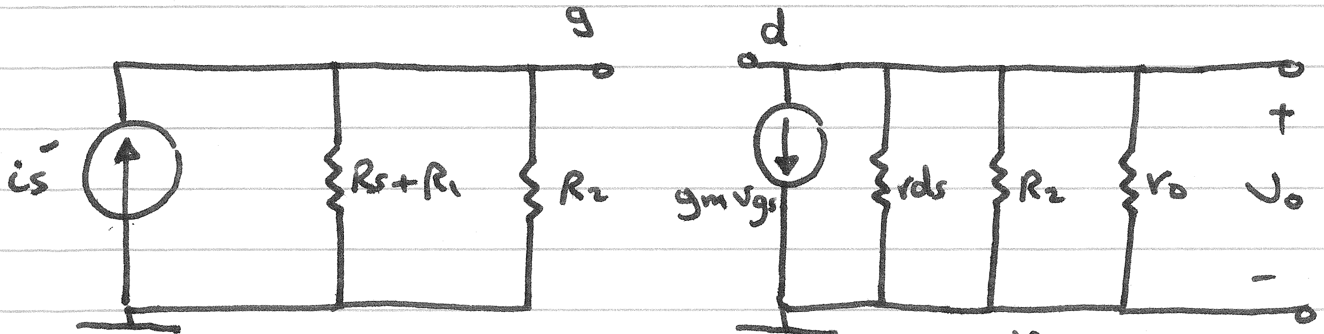
$I = 1mA$, $V_{GS} = 0.8V$, $V_T = 0.6V$, $V_A = 30V$

Shunt-shunt feedback



$y_{11} = \frac{1}{R_2}$; $y_{22} = \frac{1}{R_2}$; $y_{12} = \beta = -\frac{1}{R_2}$

To find A



$r_o = \infty$

$v_o = -g_m v_{gs}(r_{ds} \| r_o \| R_2) = -g_m v_{gs}(r_{ds} \| R_2)$

$v_{gs} = v_g = i_s(R_2 \| (R_s + R_1))$

$g_m = \frac{2 I_{DS}}{V_{GS} - V_T} = 10 m℧$, $r_{ds} = \frac{V_A}{I_{DS}} = 30K$

$A = \frac{v_o}{i_s} = -24100 \, K\Omega$

$$A_f = \frac{A}{1+AB} = -3931\ K\Omega$$

$$A_v = \frac{v_o}{v_s} = \frac{v_o}{i_s} \cdot \frac{i_s}{v_s} = (A_f) \cdot \left(\frac{1}{R_s+R_1}\right)$$

$\therefore A_v = -3.9$

$$Z_{of} = \frac{R_o}{1+AB}$$

$R_o = R_2 \| r_{ds} = 4.7M \| 30K = 29.8K$

$\therefore Z_{of} = 4.86\ K\Omega = R_{out}$

$$Z_{if} = \frac{R_i}{1+AB}$$

$R_i = (R_s + R_1) \| R_2 = 0.83\ M\Omega$

$\therefore Z_{if} = 136K$