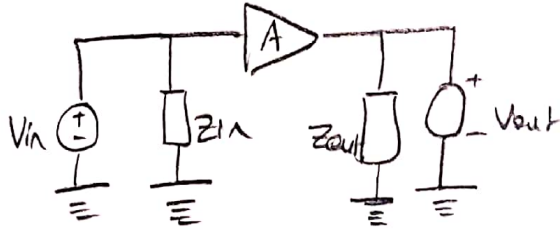


Q1) Miller approximation genl olarak aşağıdaki gibidir.



$$Z_{in} = \frac{Z}{1-A} \text{ ise}$$

$$Z_{out} = \frac{Z}{1-\frac{1}{A}} \text{ olur}$$

Burada özel bir durum ortaya çıkıyor.

$Z$  kapasitörün empedansı ise ve  $A < 0$  ise  $\rightarrow$  şart 1

$$Z_{in} = \frac{1}{j\omega C \cdot (1-A)} \quad Z_{out} = \frac{1}{j\omega C \left[1 - \frac{1}{A}\right]} \text{ olur. Ancak önemli olan}$$

kısım  $\rightarrow$  şart 1 sağlandığında Miller Approximation capacitor multiplication effect ile eşdeğer olur.

$A < 0$  şartı sağlanıyorsa devre için inverting amplifier'dir. Soruda common source olarak belirtilmiştir. Common source inverting amplifier olduğundan Miller approximation capacitor multiplication effect devresindedir.

$$A < 0 \text{ ve } |A| > 1 \text{ ise } Z_{in} = \frac{1}{j\omega C [1-A]} \rightarrow 1-A > 2 \text{ olur}$$

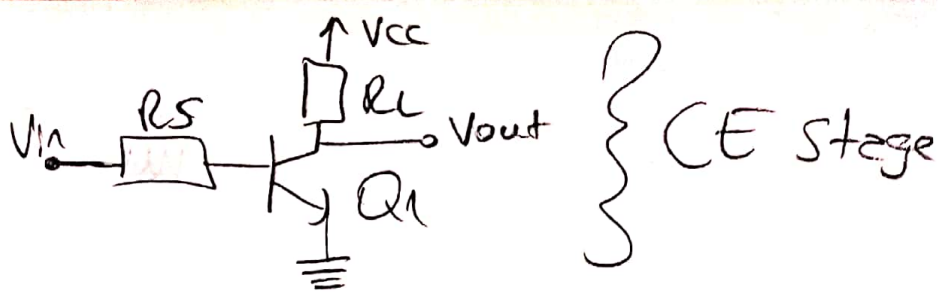
Böylece girişte iki katından daha büyük bir kapasitans elde edildi

$A < -1$  olduğundan

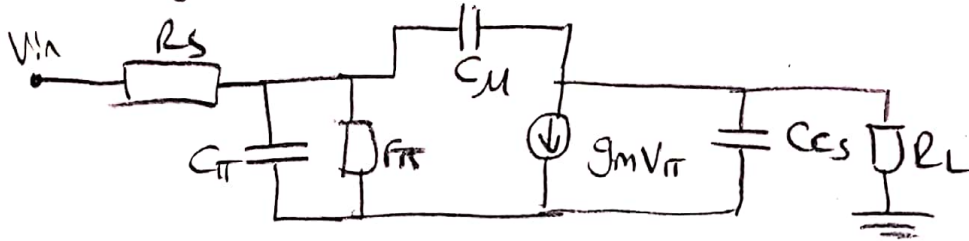
$$\text{Çıkışta ise } Z_{out} = \frac{1}{j\omega C \left(1 - \frac{1}{A}\right)} \text{ ise } |A| < 1 \text{ ise}$$

çıkışta direkt kapasitörün  $1/2 \times 2$  olan  $1 < 1 - \frac{1}{A} < 2$  bir  $x$  ile çarpılmış halini elde ediyoruz (yaklaşık olarak)

Q2



Small signal equivalent

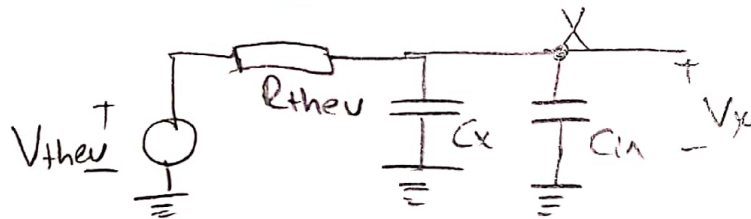


Miller Theorem

$$C_x = (1 + g_m R_L) C_{xy}$$

$$C_y = \left(1 + \frac{1}{g_m R_L}\right) C_{xy}$$

$$g_m R_L \gg 1 \text{ ise } C_o \approx C_{out} + C_{xy}$$



CE Stage

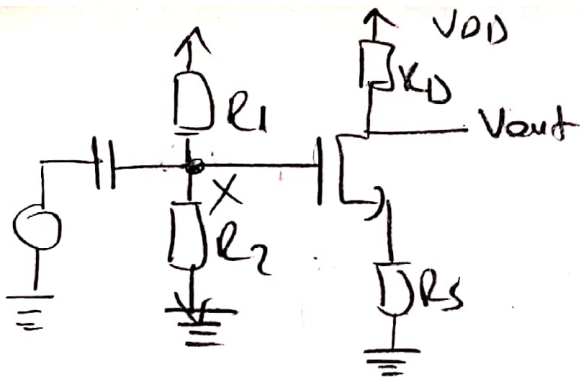
$$V_{thetv} = V_{in} \frac{r_{\pi}}{r_{\pi} + R_s}$$

$$R_{thetv} = R_s \parallel r_{\pi}$$

$$C_x = C_{\mu} (1 + g_m R_L)$$

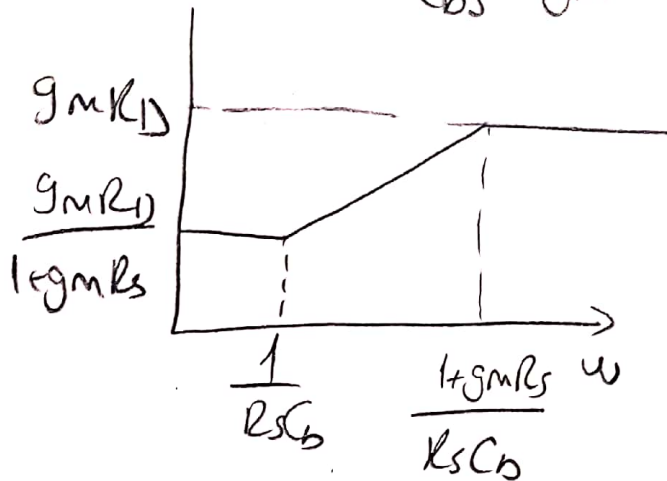
$$C_y = C_{\mu} \left(1 + \frac{1}{g_m R_L}\right)$$

Q3



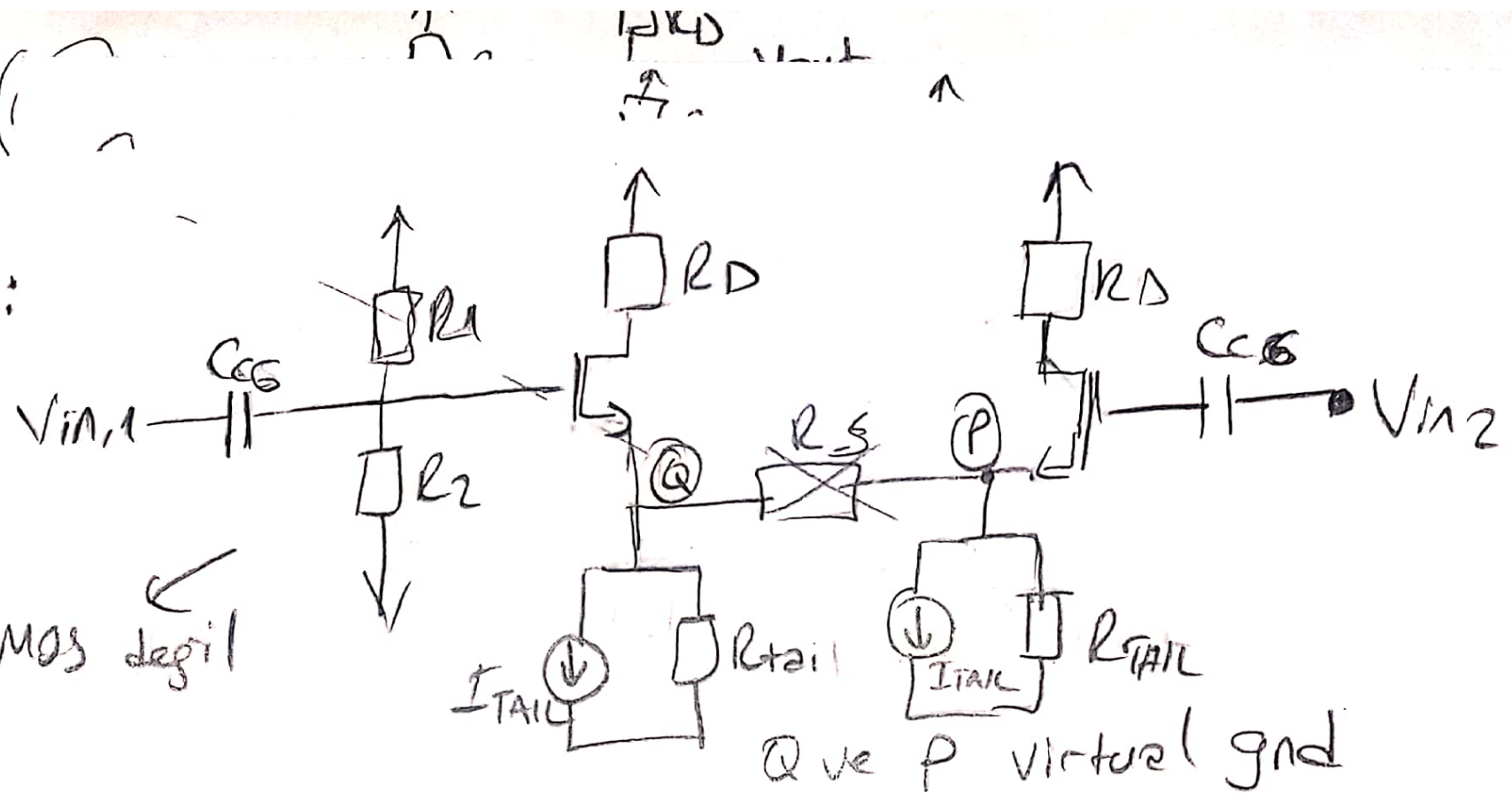
$$\frac{V_x}{V_{in}}(s) = \frac{R_1 \parallel R_2}{R_1 \parallel R_2 + \frac{1}{C_{is}}} = \frac{R_1 \parallel R_2 \cdot C_{is}}{R_1 \parallel R_2 \cdot C_{is} + 1}$$

$$\frac{V_{out}}{V_x}(s) = \frac{-R_D}{R_S \parallel \frac{1}{C_{bs}} + \frac{1}{g_m}} = \frac{-g_m R_D (R_S C_{bs} + 1)}{R_S C_{bs} + g_m R_S + 1}$$



Q4:

NMOS degil



ide