●不可使用電子計算機

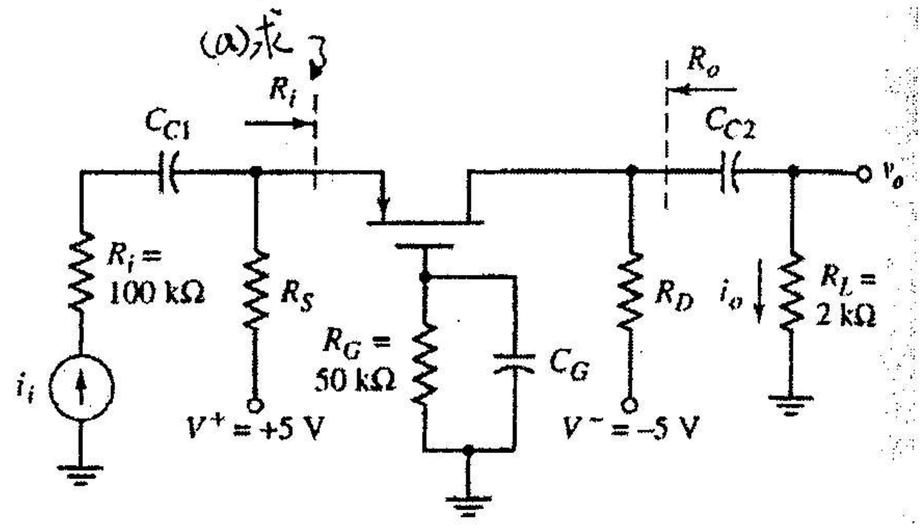
1. **(10%)** 解釋名詞：

channel length modulation effect, body effect (以 n-channel depletion-mode MOSFET 為例)

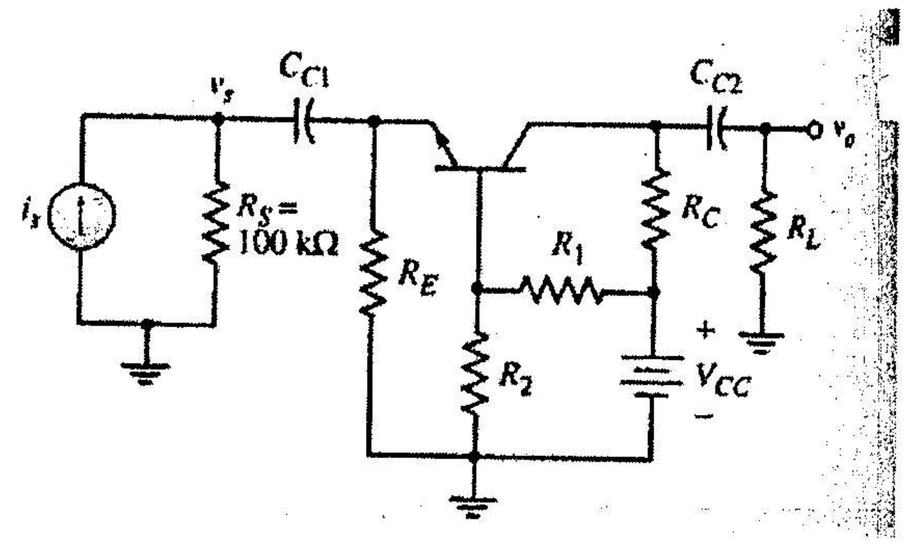
2. **(20%)** Consider the common-gate circuit in the following figure, V_{TP}= -1V, K_p=0.5 mA/V^2, λ=0, R_S = 3.71k, R_D =1.62k, I_{DQ} = 0.75mA, and V_{SDQ} = 6V.

(a) Draw the small-signal equivalent circuit and determine the input resistance R_i. (10%)

(b) Draw the small-signal equivalent circuit and determine the output resistance R_o. (10%)



3. **(20%)**For the circuit in the following figure, β=125, V_A=∞, I_{CQ}=1.46 mA, R_L=4kΩ, R_E=3kΩ, R_C=4kΩ, R_1=25.6kΩ, and R_2=10.4kΩ. (a) Determine g_m and r_π; (4%) (b) draw the small-signal equivalent circuit; (4%) and (c) determine the trans-resistance $R_{in} = v_o/i_s$. (12%)



●不可使用電子計算機

4. **(10%)** (a) Would you characterize the following circuit in Fig. P4(a) as being **inverting** or **noninverting**? Explain your answer. (5%) (b) Write an approximated equation describing the differential voltage gain (in terms of component values) for a differential pair circuit as shown in Fig. P4(b). (5%)

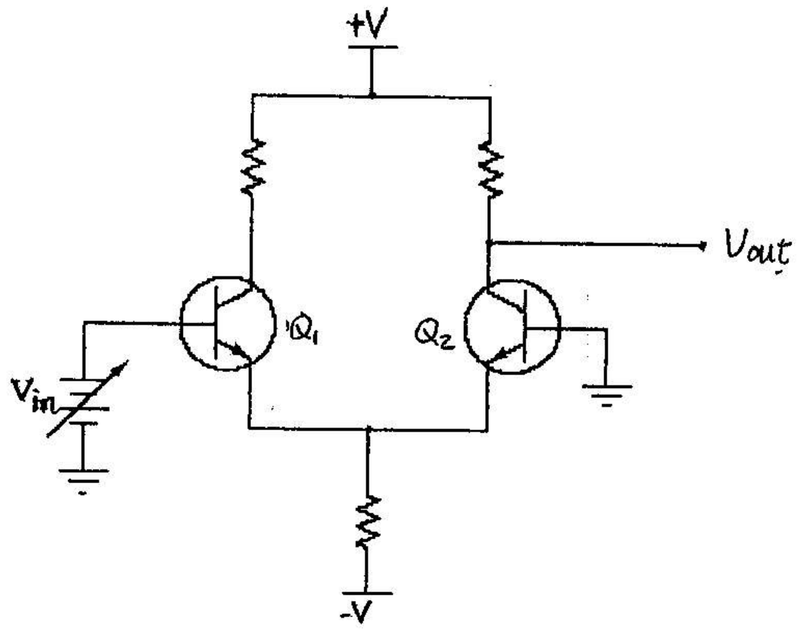


Figure P4(a)

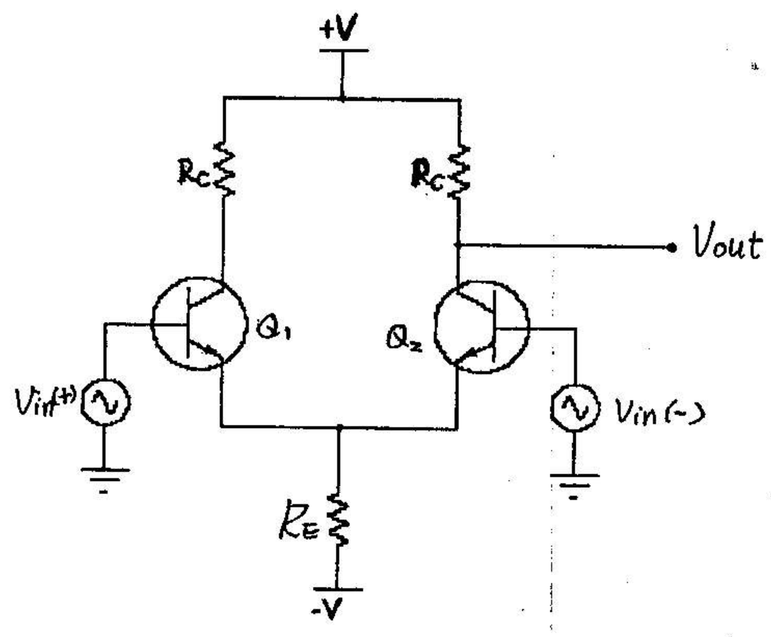
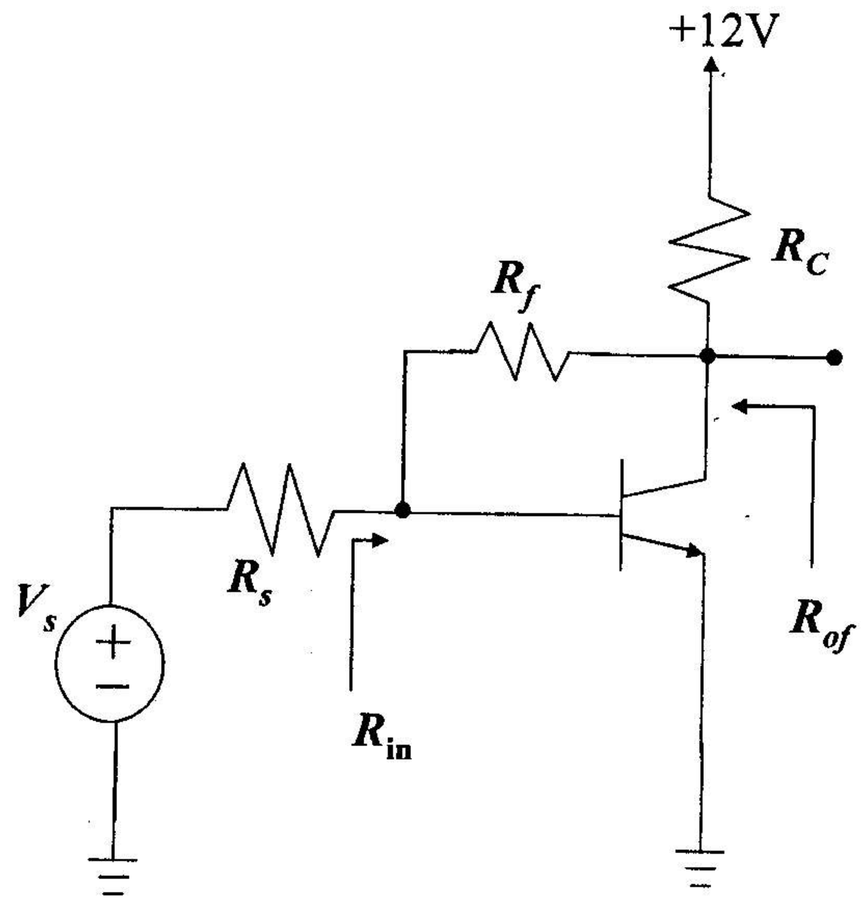


Figure P4(b)

5. **(20%)** (a) Using a common source amplifier circuit to explain the "Miller effect". (10%) (b) Consider an ideal voltage amplifier with a gain of 0.95 V/V and a resistance R=100kΩ connected in the feedback path, that is, between the output and input terminals. Use Miller's theorem to find the input resistance of this circuit. (10%)

6. **(20%)** Use the feedback theorem to analyze the following circuit with R_C=4.7kΩ, R_f=47kΩ, and R_s=10kΩ. The feedback is provided by R_f. In addition, the transistor has β=100. **(a)** Determine the small signal voltage gain V_o/V_s. (10%) **(b)** Determine the input resistance R_{in} and output resistance R_{out}. (10%)



(命題請用黑色鋼筆、原子筆繕寫或電腦打字；試題字體務求清晰，並一律以正面單頁書寫，背面請勿書寫。)