

國立臺北科技大學 105 學年度碩士班招生考試

系所組別：1111 機械工程系機電整合碩士班甲組

第三節 電子學 試題 (選考)

第一頁 共二頁

注意事項：

1. 本試題共 5 題，每題 20 分，共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. The BiCMOS circuit is shown in Fig. 1. The bias current is $I_Q = 0.5\text{mA}$. The MOS parameters are $V_{TP} = -0.5\text{ V}$, $K_P = 0.7\text{ mA/V}^2$, and $\lambda = 0$, and the BJT parameters are $\beta = 150$, $V_{BE(\text{on})} = 0.7\text{ V}$, and $V_A = \infty$. (a) Determine the small-signal voltage gain $A_v = v_o/v_i$ for $R_L = 20\text{K}\Omega$. (b) Find the small-signal output resistance R_o . (Total 20%, each item 10%)

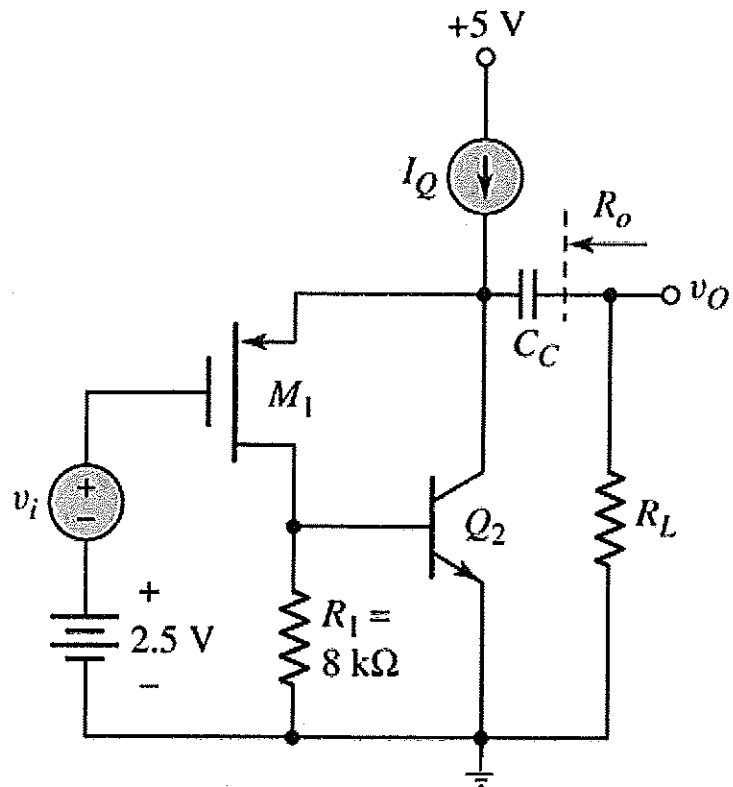
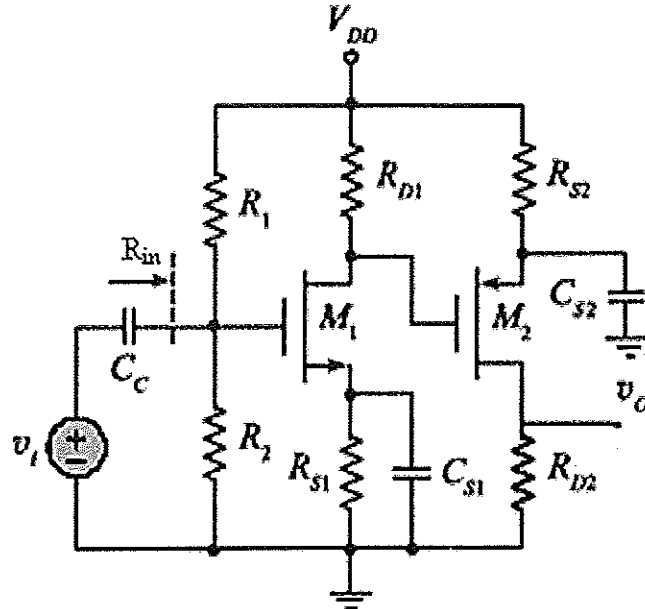


Fig. 1

2. A two stage CMOS amplifier circuit is shown in Fig. 2. The transistor parameters are $K_{n1} = 0.1 \text{ mA/V}^2$, $K_{p2} = 0.5 \text{ mA/V}^2$, $V_{TN1} = +2 \text{ V}$, $V_{TP2} = -2 \text{ V}$ and $\lambda_1 = \lambda_2 = 0$; the circuit parameters are $V_{DD} = 10 \text{ V}$, $R_{S1} = 4 \text{ k}\Omega$ and $R_{in} = 200 \text{ k}\Omega$. (a) Design the circuit to get $I_{DQ1} = 0.4 \text{ mA}$, $I_{DQ2} = 2 \text{ mA}$, $V_{DSQ1} = 4 \text{ V}$ and $V_{SDQ2} = 4 \text{ V}$; (b) Determine the small-signal voltage gain $A_v = v_o/v_i$.



(Total 20%, each item 10%)

Fig. 2

3. An OP- amplifier circuit is shown in Fig. 3. (a) the output current of OP-amplifier is 2 mA and $\beta = 99$; Determine the value of resistance R. (b) If the resistance R is in parallel with a load resistance $R_L = 100\Omega$, find the output current of OP-amplifier. (Total 20%, each item 10%)

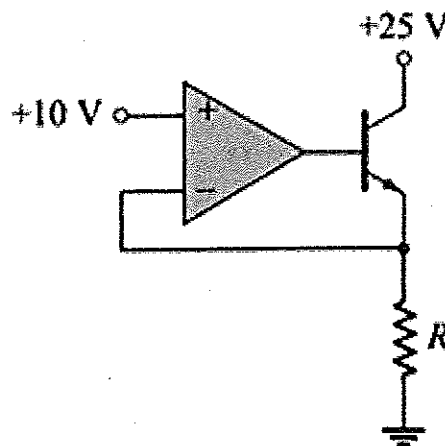


Fig. 3

注意：背面尚有試題

4. As shown in Fig. 4, $\beta = 100$ and $V_A = \infty$. (a) Determine the small-signal voltage gain $A_v = v_o / v_s$; (b) Find the input and output resistances R_{ib} and R_o . (20%, each item 10%)

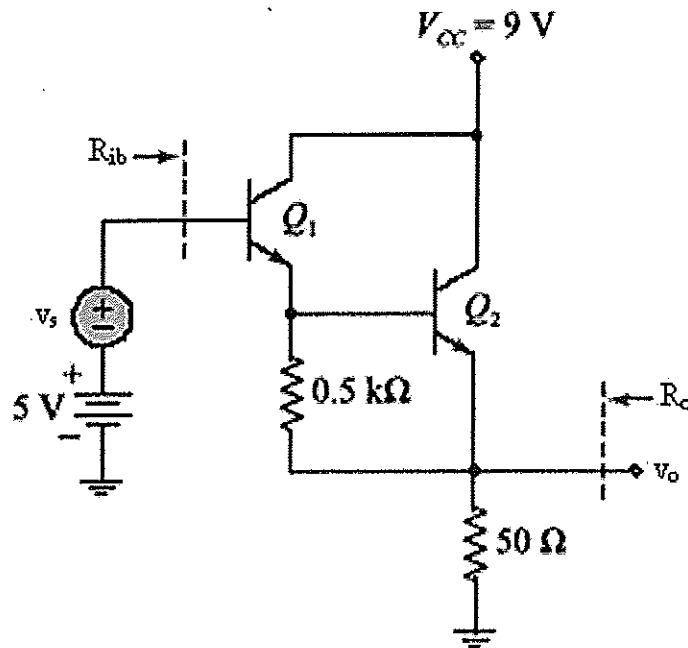


Fig. 4

5. The OP-amplifiers in the circuit shown in Fig. 5 are idea. Please use the input voltage v_i , R and R_L to express: (a) the output current i_o and (b) output voltage V_o . (20%, each item 10%)

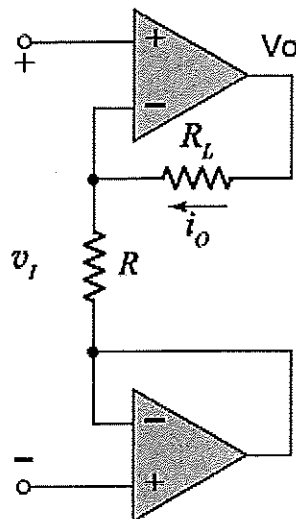


Fig. 5