國立臺北科技大學

九十六學年度電資碩士在職專班招生考試

電子學 試題

填准考證號碼

注意事項：

1. 本試題共【6】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

I. What is the correct answer? (25%)

(1). If the width of an NMOS transistor increases, the current will
(a). increase (b). decrease (c) not change

(2). If the supply voltage of a chip increases, the gate capacitance of each transistor will
(a). increase (b). decrease (c) not change

(3). In active region of MOSFET, the drain current will be increased slightly, why?
(a). Channel charge (b). Early effect (c) Channel length modulation

(4). If the temperature increases, the magnitude of the threshold voltage will
(a). increase (b). decrease (c) not change

(5). If an NMOS is used to be a switch, the larger the input voltage is, the impedance will
(a). increase (b). decrease (c) not change

2. For the circuit in Fig. 2, find the voltage gain v_o/v_I, and the power gain P_L/P_I. (15%)

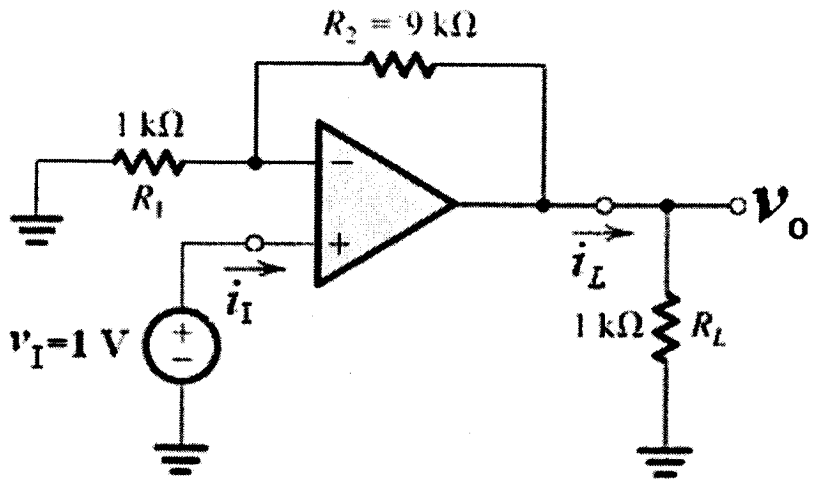

Figure 2

3. Assume that the coupling capacitors, C_{C1}, C_{C2}, and C_E, are sufficiently large. Find the input resistance R_{in}, the voltage gain A_v ($\alpha \approx 1$), the output resistance R_{out}, the overall voltage gain G_v, and the short-circuit current gain A_{is}, respectively. (15%)

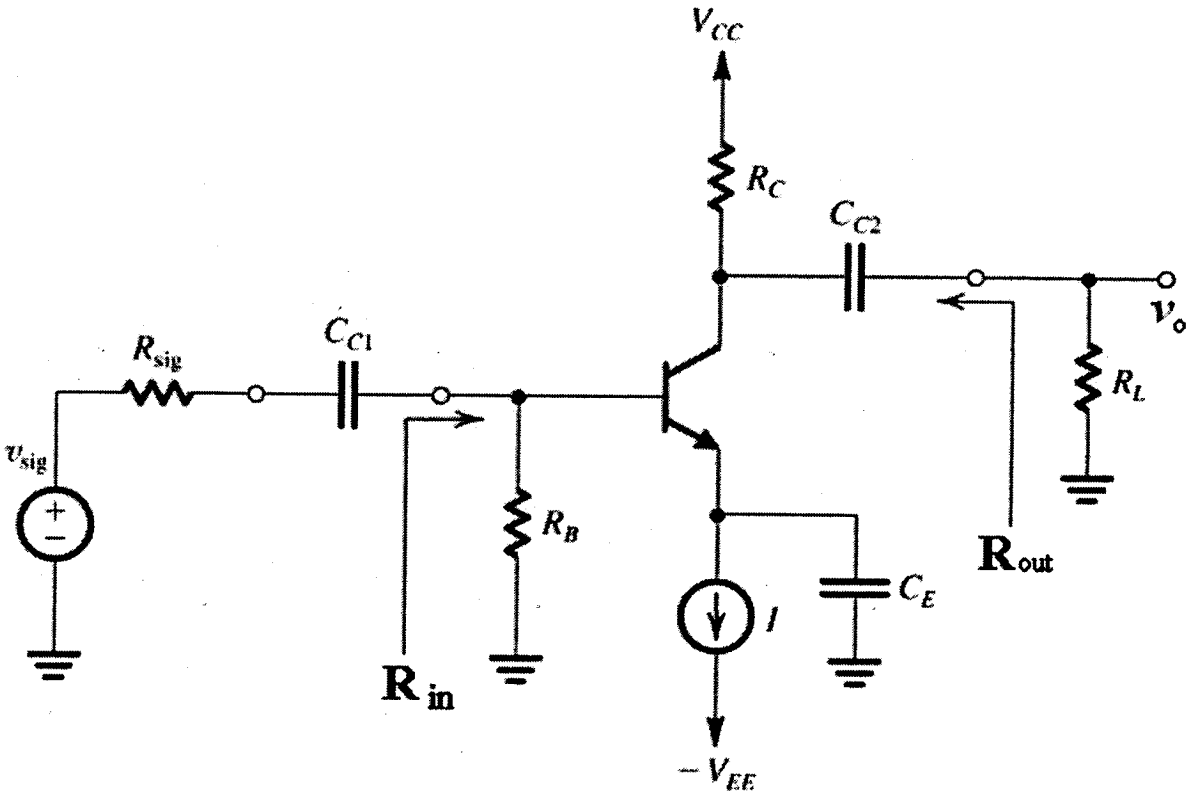

Figure 3

注意：背面尚有試題

4. A simplified small-signal equivalent circuit is shown in Fig. 4. Find the amplifier transfer function V_o/V_{id}, the zero s_Z, the dominant pole ω_{p1}, the nondominant pole ω_{p2}, and the unity-gain frequency ω_t, respectively. (15%)

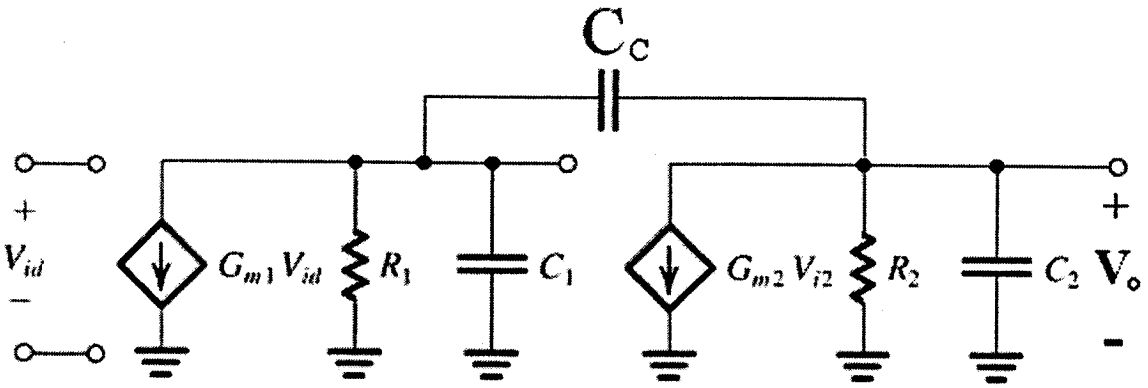

Figure 4

5. For the circuit of Fig. 5, let $V_{DD} = V_{SS} = 1.5$ V, $V_{tn} = 0.6$ V, $V_{tp} = -0.6$ V, all channel lengths = 1 μm. $K'_n = 200\ \mu A/V^2$, $k'_p = 80\ \mu A/V^2$, and $\lambda = 0$. For $I_{REF} = 10\ \mu A$, find the widths of all transistors to obtain $I_2 = 60\ \mu A$, $I_3 = 20\ \mu A$, and $I_5 = 80\ \mu A$. It is further required the voltage at the drain of Q_2 be allowed to go down to within 0.2 V of the negative supply and that the voltage at the drain of Q_5 be allowed to go up to within 0.2 V of the positive supply. (15%)

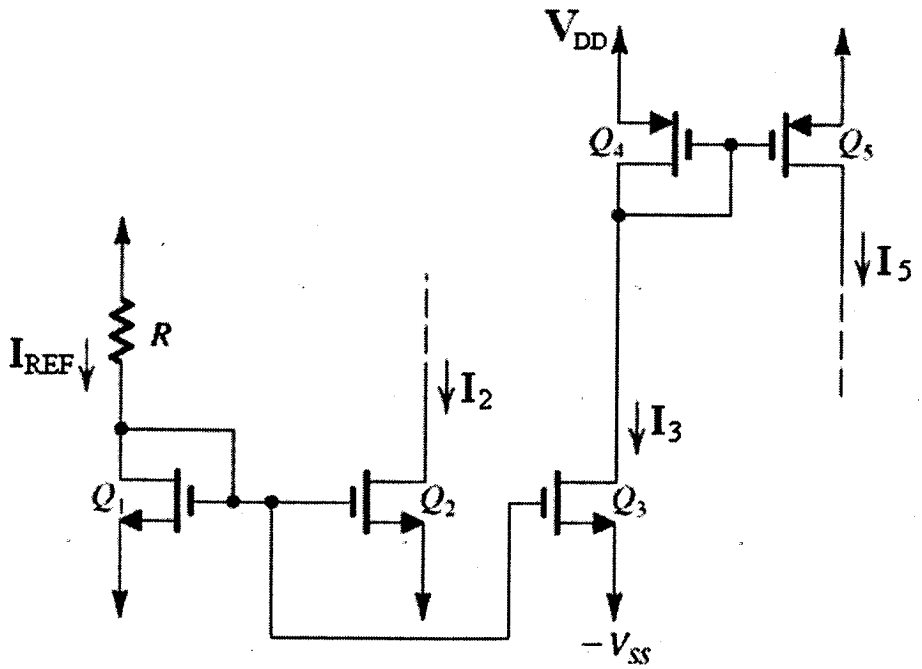

Figure 5

6. The shunt-shunt feedback amplifier in Fig. 6 has I = 1 mA and V_{GS} = 0.8 V. The MOSFET has V_t = 0.6 V and V_A = 30 V. For R_S = 10 kΩ, R_1 = 1 MΩ, and R_2 = 4.7 MΩ, find the voltage gain v_o/v_S, the input resistance R_{in}, and the output resistance R_{out}. (15%)

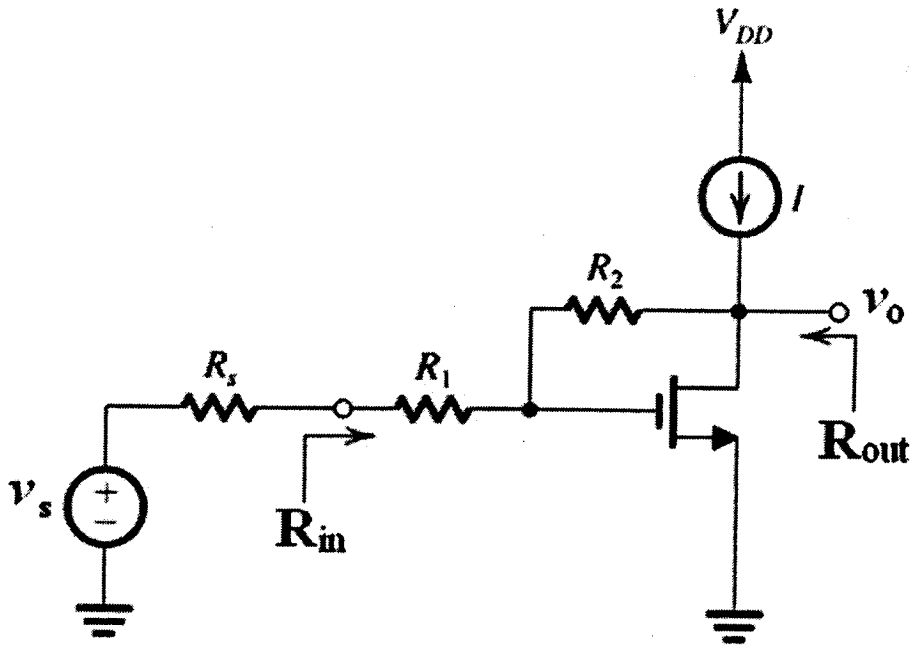

Figure 6