

# 國立臺灣師範大學 106 學年度碩士班招生考試試題

科目：電子學

適用系所：光電科技研究所

注意：1.本試題共 2 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則依規定扣分。

1. Please find the differential voltage gain  $A_V = (V_{o2} - V_{o1}) / (V_{i1} - V_{i2})$  of a differential amplifier shown in the figure 1. Each transistor is with the transconductance of 2 mA/V and output resistance of 10 k $\Omega$ . (15 分)
2. Please find (a) the voltage gain  $V_o / V_s$  (5 分), (b) the input resistance  $R_{in}$  (5 分), (c) the output resistance  $R_{out}$  (5 分) in the figure 2 by using the feedback method. (Assume the op amp has open-loop gain  $\mu = 10^4$ ,  $R_{id} = 1 \text{ M}\Omega$ ,  $R_{icm} \rightarrow \infty$ , and  $r_o = 1 \text{ k}\Omega$ )

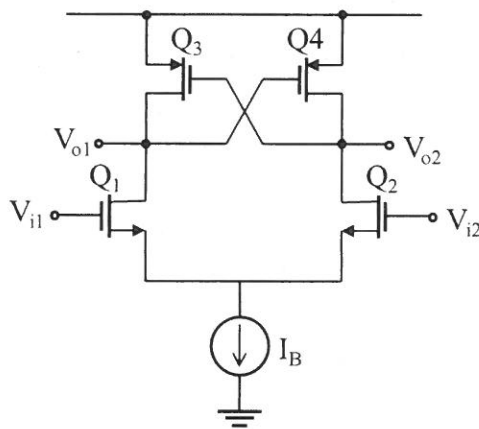


Figure 1

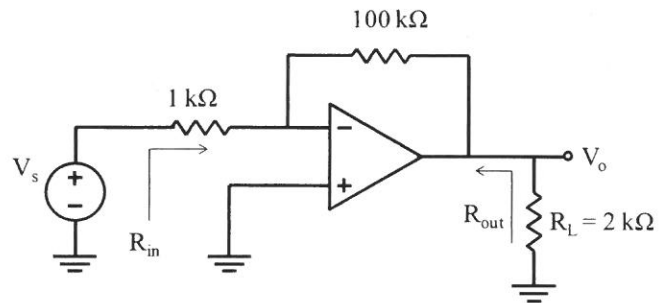


Figure 2

3. For the circuits shown in figure 3, assuming the diodes to be ideal diodes, find the values of “I” in figure 3(a) (5 分) and “V” in figure 3(b) (5 分).

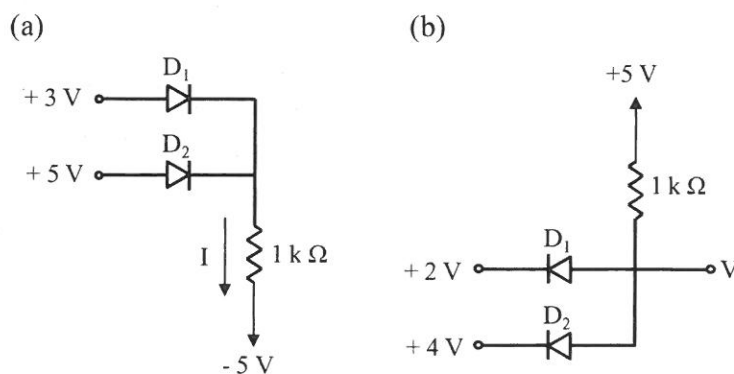


Figure 3

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4. In the circuit shown in the figure 4, the transistor has  $\beta = 40$ . Please find the values of  $V_B$  (5 分) and  $V_C$  (5 分).
5. A circuit for generating a constant current  $I_o = 20 \mu\text{A}$  as shown in the figure 5.  $Q_1$  and  $Q_2$  are matched devices. Given  $I_{\text{ref}} = 5 \text{ mA}$  and  $V_{\text{BE1}} = 0.7 \text{ V}$ . The base current can be neglected. Please find  $R_2$ . (10 分)
6. Please find the  $V_o$  of the circuit shown in the figure 6. (10 分)

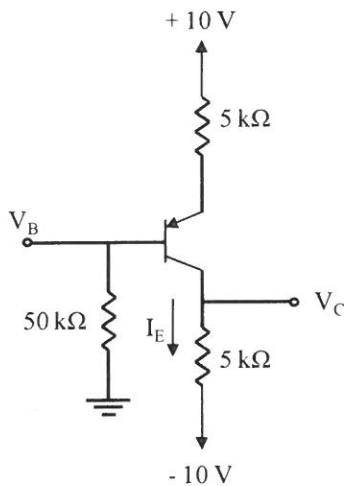


Figure 4

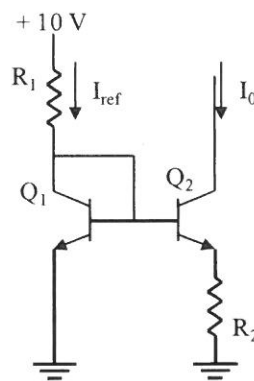


Figure 5

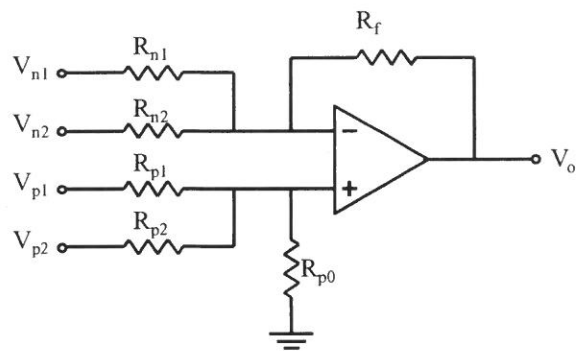


Figure 6

7. Please describe the main applications of transistor in the electronics circuit. (10 分)
8. Please plot the circuit symbol (a) Schottky diode (5 分); (b) p-MOSFET (5 分).
9. Please select the correct one(s) about the characteristics of the idea OP amp. (10 分)  
(選擇題，複選 每個選項得 5 分)
- |                               |                               |
|-------------------------------|-------------------------------|
| (A) Infinite output impedance | (B) Infinite open-loop gain   |
| (C) Infinite bandwidth        | (D) Infinite closed-loop gain |
| (E) Zero input impedance      |                               |