

# 國立臺北科技大學九十九學年度碩士班招生考試

系所組別：1521 自動化科技研究所乙組

## 第二節 電子學 試題 (選考)

第一頁 共二頁

### 注意事項：

1. 本試題共 5 題，配分共 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. Consider the circuit in Figure 1, in which  $R_1 = R_2 = R_3 = R_4 = R_5 = R_6 = 10k\Omega$ ,  $V_{DD} = 5V$  and  $V_1 = 3V$ .
  - (1) Assume the Op Amps have infinite gain. What are the values of current  $I_1$  and  $I_2$ ? (10%)
  - (2) Find the current  $I_1$  and  $I_2$  again using Op Amps with a finite gain ( $A=10$ ) for the same circuit. (10%)

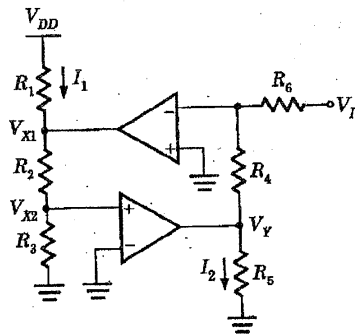


Figure 1.

2. As the circuit shown in Figure 2, let  $\beta = 100$ ,  $C_\mu = 2pF$ , and  $f_T = 400MHz$ . Calculate the midband gain and the upper 3-dB frequency. (15%)

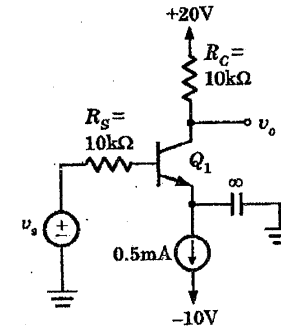


Figure 2

3. Design the circuit shown in Figure 3. (i.e. find the values for  $R_C$  and  $R_E$ ) to establish a collector current of 1mA and a reverse bias on the collector-base junction of 4V. Assume  $\alpha = 1$  and  $V_E = 0.7V$ . (20%)

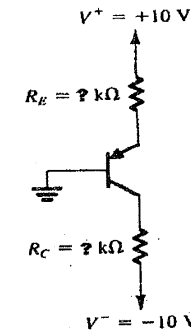


Figure 3

4. For the circuit shown in Figure 4,  $R_1 = R_2 = 10k\Omega$  and  $C_1 = C_2 = 100pF$ . Find the upper 3-dB frequency exactly. (25%)

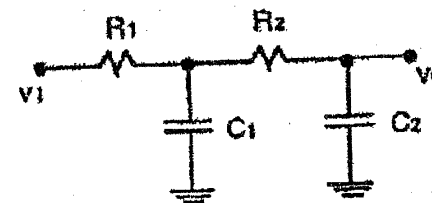


Figure 4.

注意：背面尚有試題

5. Figure 5 shows a folded cascade amplifier. The base of  $Q_2$  is fixed at  $V_{BIAS}$ .  $V_A$  (Early voltage),  $\beta$ ,  $C_\pi$ , and  $C_\mu$  of all transistors are identical. In the circuit,  $R_s = 2.5k\Omega$ ,  $I = 1mA$ ,  $V_T = 25mV$  (Thermal voltage),  $V_A = 50V$ ,  $\beta = 50$ ,  $C_\pi = 12pF$ , and  $C_\mu = 2pF$ .

- (1) Assume the output resistances of the two current sources are infinity. Find the output resistance  $R_o$  and the mid-band voltage gain  $v_o/v_i$  of this amplifier. (10%)
- (2) The common emitter stage of the amplifier uses a PNP BJT, i.e.,  $Q_1$ . Calculate the pole frequency (in Hz) at the input side of  $Q_1$ . (5%)
- (3) The total capacitance at the output node is  $C_L = 20pF$ . Find the pole frequency (in Hz) at the output node. (5%)

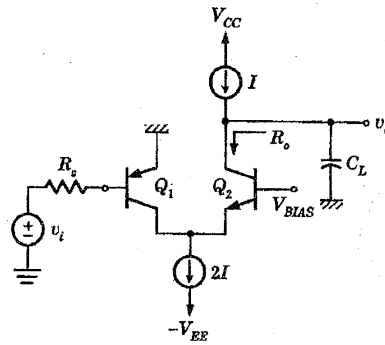


Figure 5