

# 國立臺北科技大學

## 九十七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

第一頁 共二頁

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#### 注意事項：

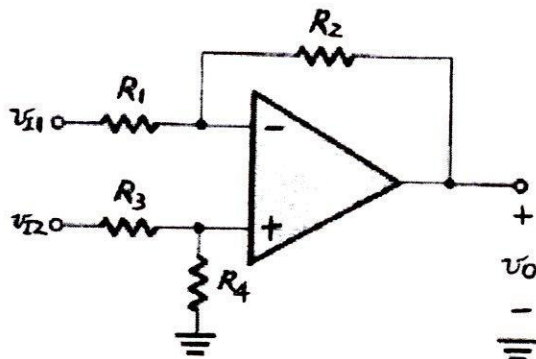
1. 本試題共【10】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

1. Please sketch the circuit of operational amplifier-based unity-gain buffer (voltage follower) and briefly describe the function of this circuit. (10 分)

2. The following circuit is the so-called difference amplifier, assume the operational amplifier used in the circuit is ideal and let  $R_3 = R_1$  and  $R_4 = R_2$ , please

(a) Calculate its differential gain  $A_d$  ( $A_d \equiv V_o / (V_{i2} - V_{i1})$ ). (5分)

(b) Calculate the input resistance of this difference amplifier. (5分)



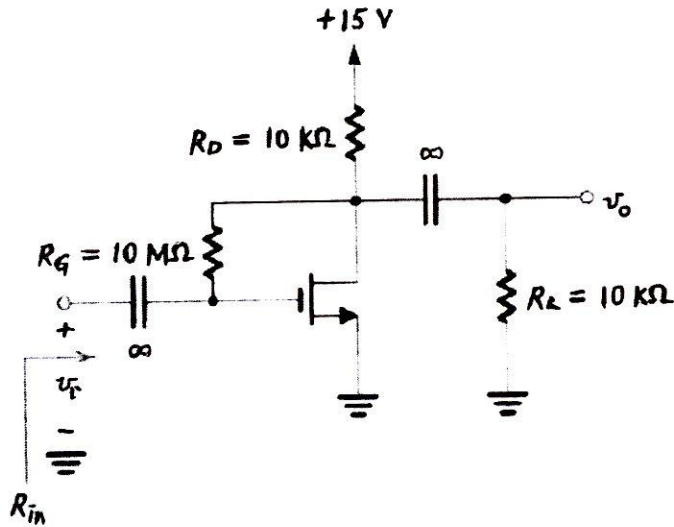
3. The weighted summer is one of the most important applications of operational amplifier. Please use two operational amplifiers to design a weighted summer that provides  $V_o = 6V_1 + 4V_2 - 9V_3$ . (10 分)

4. Please sketch the basic building block of DC power supply structure and briefly describe the function and waveform of this structure. (10 分)

5. In the following figure, the transistor has  $V_t = 1.5V$ ,  $K_n'(W/L) = 0.25 \text{ mA/V}^2$  and  $\lambda = 0$ . Determine

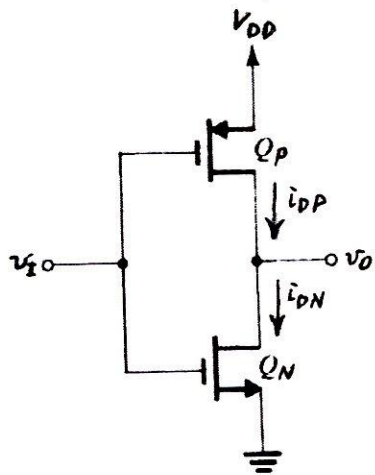
(a) The small-signal voltage gain ( $v_o/v_i$ ). (5分)

(b) The input resistance ( $R_{in}$ ). (5分)



6. Please sketch the cross-section of a CMOS integrated circuit with p-substrate. (10分)

7. In the following figure, the length of NMOS and PMOS is the same, and  $\mu_N = 3 \mu_P$ . If we want to have the same rise time and fall time for the inverter, how to design the width of NMOS and PMOS? (10分)



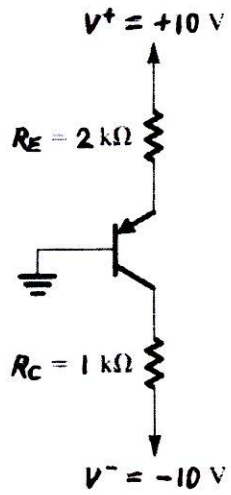
8. Explain why the two back-to-back diodes can not be used as a bipolar transistor. (10 分)

注意：背面尚有試題

9. If  $\beta = 100$ , determine

(a) The current of  $I_C$ . (5分)

(b) The voltage of  $V_{CE}$ . (5分)



10. Compare the features of three various MOS amplifiers including common-source(CS), common-gate(CG) and common-drain(CD). (10 分)