

所別：電機工程學系碩士班 固態組(一般生)

科目：電子學

共 2 頁 第 / 頁

電機工程學系碩士班 系統與生醫組(一般生)

電機工程學系碩士班 電波組(一般生)

本科考試禁用計算器

*請在試卷答案卷(卡)內作答

1 問答題 (21 分)

1-1 Consider the BJT circuits in Fig. 1, please specify the corresponding configuration for each circuit (common-emitter, common-base, or emitter-follower?) (6 分)

1-2 Which of the following statements are true? (15 分)

- (a) Fig. 1.1 A amplifier has a voltage gain $|A_v| > 1$,
- (b) Fig. 1.1 B amplifier has a current gain $|A_i| > 1$,
- (c) Fig. 1.1 C amplifier has a voltage gain $|A_v| < 1$.
- (d) Fig. 1.1 B amplifier has the highest R_{in} ,
- (e) Fig. 1.1 amplifier C has the lowest R_o

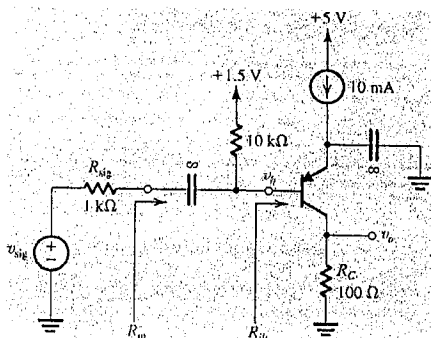
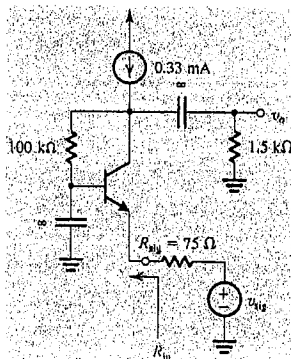
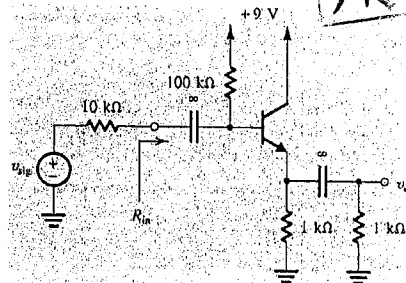


Fig. 1.1 (A)



(B)



(C)

參考原

2. 計算題 (16 分)

For the circuits in Fig. 2, $\mu_n C_{ox} = 2.5 \mu_p C_{ox} = 20 \mu A/V^2$, $|V_{TH}| = 1 V$, $\lambda = 0$ (or $V_A = \infty$), and $L = 1 \mu m$ and $W = 4 \mu m$ for all MOSFETs. Find the labeled currents and voltages, I_1 , V_2 , I_3 , and V_4 .

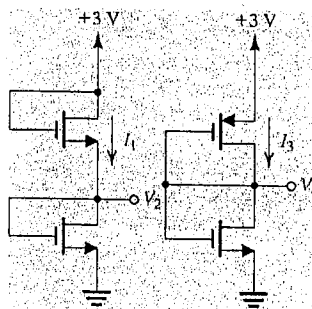


Fig. 2

3. 計算題與問答題 (16 分)

A second-order filter is shown in Fig. 3.

3-1 Please derive the transfer function $T(s) = V_o(s) / V_i(s)$ in terms of R , L , and C . (12 分)

3-2 What is the filter type of this circuit? (4 分)

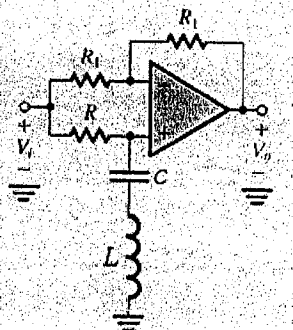


Fig. 3

注意：背面有試題

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4. 計算題 (14分)

Fig. 4 shows a current-steering circuit. The reference current $I_{REF} = 10 \mu A$ and the device (W/L) ratios of NMOS and PMOS are $(W/L)_1:(W/L)_2 = 1:2$, $(W/L)_3:(W/L)_4 = 1:2$, respectively. Neglect the channel length modulation effect, find I_O .

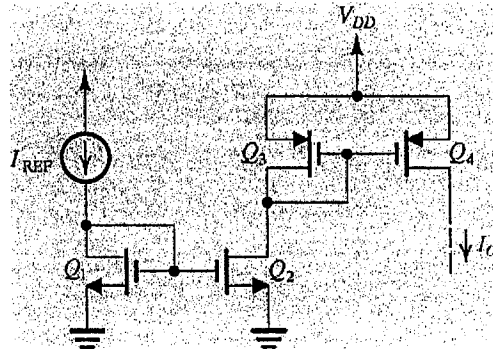


Fig. 4

5. 計算題 (18分)

Fig. 5 shows an inverting op-amp with shunt-shunt feedback configuration. Let the op-amp have open-loop gain $\mu = 10^4 V/V$, differential input resistance $R_{id} = 100 k\Omega$, and output resistance $r_o = 1 k\Omega$.

5-1 Find the voltage gain V_o/V_s . (6分)

5-2 Find the input resistance R_{in} . (6分)

5-3 Find the output resistance R_{out} . (6分)

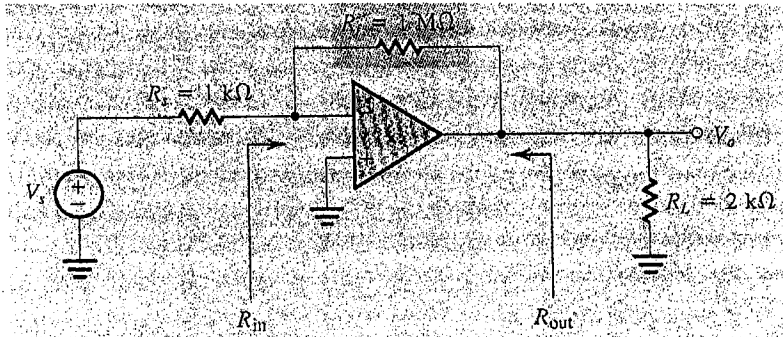


Fig. 5

6. 計算題 (15分)

Fig. 6 shows a CMOS logic-gate OR circuit with six input variables. Assume that the transistors in circuit are properly sized to provide each gate with a current-driving capability equal to that of a matched inverter, and the basic transistors have a $(W/L)_n$ ratio of $1.2 \mu m/0.8 \mu m$ and a $(W/L)_p$ ratio of $3.6 \mu m/0.8 \mu m$.

6-1 Find the number of transistors. (10分)

6-2 Find the total area of the circuit. (5分)

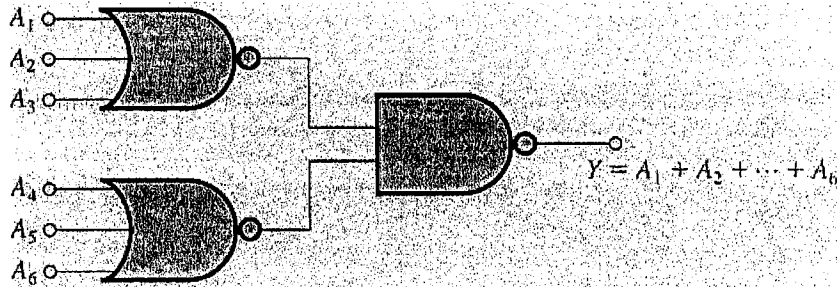


Fig. 6

參考用

注意：背面有試題