

國立中央大學98學年度碩士班考試入學試題卷

所別：電機工程學系碩士班 系統與生醫組(一般生) 科目：電子學 共 2 頁 第 1 頁
 系統與生醫組(學位在職生)
 電波組(一般生)
 *請在試卷答案卷(卡)內作答

1. 簡答與計算題 (15 分)

Consider the MOSFET circuits in Fig. 1, $R_1 = R_2 = 500 \text{ k}\Omega$, $R_L = 1 \text{ k}\Omega$, and $g_m = 5 \text{ mA/V}$.

1-1 (6 分) please specify the corresponding configuration for each circuit (Common-Source (CS), Common-Gate (CG), or Common-Drain (CD))?

1-2 (9 分) which R_{in} is larger (Fig. 1(a) or Fig. 1(b))? Please calculate its value.

2. 計算題 (15 分)

For the transistors in the circuit shown in Fig. 2, the parameters are: $V_{BE(on)} = V_{EB(on)} = 0.7 \text{ V}$, $V_{CE(sat)} = V_{EC(sat)} = 0.2 \text{ V}$.

2-1 (8 分) find the voltages V_1 and V_2 if $\beta_F = 100$.

2-2 (7 分) find the voltages V_1 and V_2 if the voltage feeding the bases changed from +5 V to +10 V and $\beta_F = 30$.

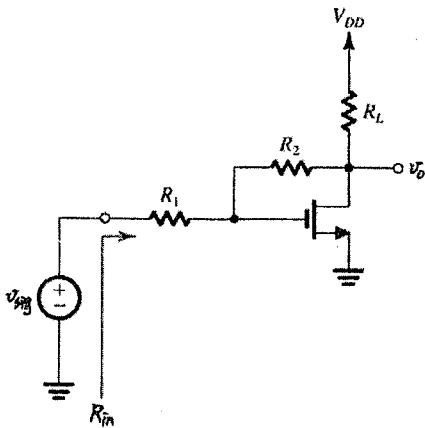


Fig. 1(a)

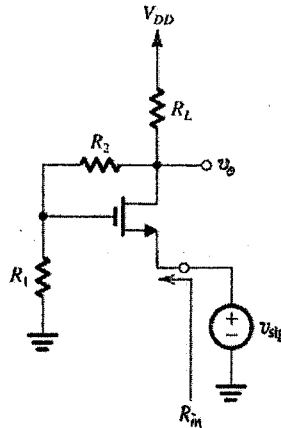


Fig. 1(b)

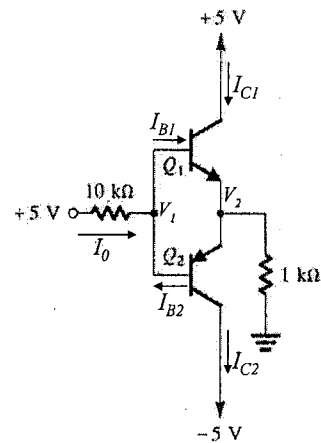


Fig. 2

3. 計算題 (8 分)

The basic op amp in Fig. 3 is ideal. Find an expression of v_o in terms of v_1 and v_2 performed by the circuit.

4. 選擇與計算題 (19 分)

Figure 4 shows an amplifier with $g_m = 5 \text{ mA/V}$, $R_{sig} = R_L = 20 \text{ k}\Omega$, $C_{gs} = 2 \text{ pF}$, $C_{gd} = 0.1 \text{ pF}$, and C_L (at the output node) = 1 pF. Neglect r_o and body effect.

4-1 (3 分) (選擇題) identify the circuit configuration. (1) CS-CG (2) CS-CD (3) CD-CS (4) CD-CG cascade configuration.

4-2 (8 分) find the midband gain, $A_M = V_o/V_i$.

4-3 (8 分) find the higher 3 dB frequency, f_H .

參考用

注意：背面有試題

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5. 選擇與計算題 (13 分)

For the feedback circuit in Fig. 5, the design parameters are listed as follows: $g_{m1} = 4 \text{ mA/V}$, $g_{m2} = 2 \text{ mA/V}$, $R_S = R_F = R_{D1} = R_{D2} = 2 \text{ k}\Omega$. Neglect r_o and body effect.

5-1 (3 分) (選擇題) identify the feedback configuration. (1) series-series (2) series-shunt (3) shunt-series (4) shunt-shunt configuration.

5-2 (10 分) calculate the close-loop voltage gain, $A_f = v_o/v_i$.

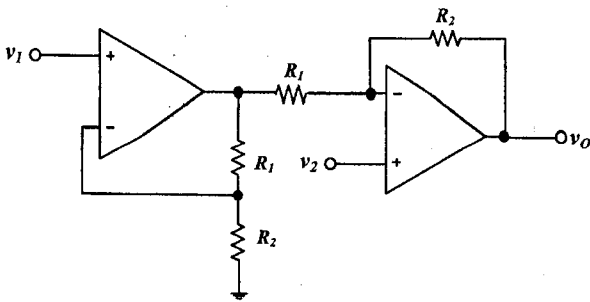


Fig. 3

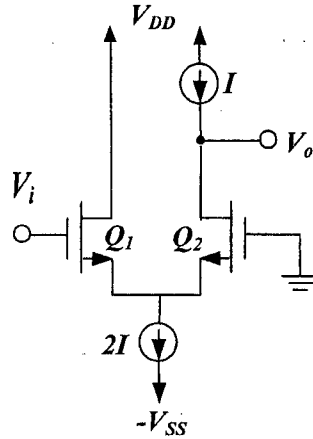


Fig. 4

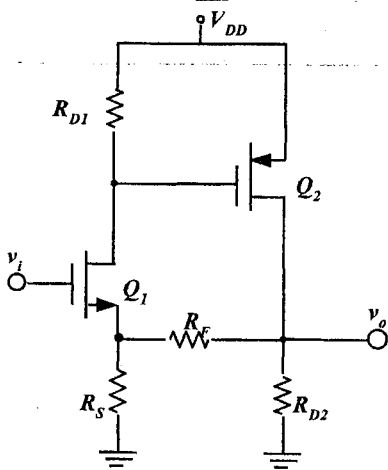


Fig. 5

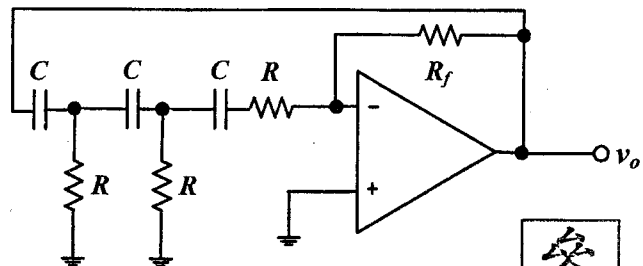


Fig. 6

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6. 計算題 (12 分)

Consider a CMOS inverter for which the MOSFET threshold voltages and $\mu C_{ox}(W/L)$ factors are matched. The MOSFET nominal $|V_t| = 1 \text{ V}$, and the inverter operates from a nominal $V_{DD} = 5 \text{ V}$.

For possible variation of both V_t (of both MOSFETs) and V_{DD} by $\pm 25\%$,

6-1 (8 分) what ranges of V_{IL} , V_{IH} , V_{OL} , and V_{OH} result?

6-2 (4 分) what ranges of NM_H and NM_L result between various pairs of these inverter?

7. 計算題 (18 分)

For the following phase-shift oscillator, as shown in Fig. 6, without a limiter for amplitude stabilization, assuming the op amp is an ideal one,

7-1 (12 分) find the frequency of oscillation f_0 .

7-2 (6 分) find the minimum required value of R_f for oscillations to start in the circuit.