

國立中央大學九十八學年度電機系碩士在職專班招生試題

筆試科目：基礎電子學

考試時間：100 分鐘

共 1 頁，第 1 頁

1. 計算題 (15 分)

For the circuit shown in Fig. 1, assuming an ideal op amp, find an expression for the output v_O in terms of input v_1 and v_2 .

2. 計算題 (15 分)

For the circuit shown in Fig. 2, assuming the diodes are ideal ones, calculate the currents in each of the diodes. What v_O results?

3. 計算題 (20 分)

The MOSFETs in the circuit of Fig. 3 are matched, with $\mu_n C_{ox}(W/L)_1 = \mu_p C_{ox}(W/L)_2 = 50 \mu\text{A}/\text{V}^2$ and $|V_t| = 2 \text{ V}$. Feedback resistor $R_F = 10 \text{ M}\Omega$.

3-1 (10 分) For G and D open, what are the drain currents I_{D1} and I_{D2} ?

3-2 (10 分) For $r_O = \infty$, what is the voltage gain of the amplifier from G to D?

4. 計算題 (24 分)

For the NMOS transistor with gate length of $L = 0.4 \mu\text{m}$, $\mu_n C_{ox}(W/L) = 267 \mu\text{A}/\text{V}^2$ and $|V'_{An}| = 5 \text{ V}/\mu\text{m}$. Let the transistor be operated at overdrive voltage of $V_{OV} = V_{GS} - V_t = 0.25 \text{ V}$ and drain current of $I_D = 1 \text{ mA}$. The capacitances of the NMOS transistor are $C_{gs} = 100 \text{ fF}$ and $C_{gd} = 30 \text{ fF}$. Find the following design parameters.

4-1 (4 分) Find W/L ratio that required to obtain $I_D = 1 \text{ mA}$.

4-2 (4 分) transconductance g_m (mA/V).

4-3 (4 分) output resistance r_O (k Ω).

4-4 (4 分) intrinsic voltage gain A_O (V/V).

4-5 (4 分) unity gain frequency f_T (GHz).

4-6 (4 分) gain-bandwidth product f_i of loaded by a 1-pF capacitance (GHz).

5. 計算題 (14 分)

For a practical amplifier modeled by the circuit of Fig. 4, $g_m = 5 \text{ mA}/\text{V}$, $R_{sig} = 150 \text{ k}\Omega$, $R_{in} = 0.65 \text{ M}\Omega$, $R_L' = 10 \text{ k}\Omega$, $C_{gs} = 2 \text{ pF}$, and $C_{gd} = 0.5 \text{ pF}$.

There is also an output wiring capacitance of $C_L = 3 \text{ pF}$. Find the following values:

5-1 (5 分) corresponding midband voltage gain.

5-2 (6 分) each open-circuit time constant, τ_{gs} , τ_{gd} , and τ_L .

5-3 (3 分) and estimate of the 3-dB frequency.

6. 選擇題 (12 分)

Figures 5-8 show four feedback amplifiers. Identify their feedback type.

6-1 (3 分) The circuit in Fig. 5 is a (1) series-series (2) series-shunt (3) shunt-shunt (4) shunt-series feedback topology.

6-2 (3 分) The circuit in Fig. 6 is a (1) series-series (2) series-shunt (3) shunt-shunt (4) shunt-series feedback topology.

6-3 (3 分) The circuit in Fig. 7 is a (1) series-series (2) series-shunt (3) shunt-shunt (4) shunt-series feedback topology.

6-4 (3 分) The circuit in Fig. 8 is a (1) series-series (2) series-shunt (3) shunt-shunt (4) shunt-series feedback topology.

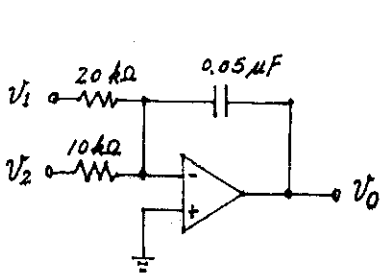


Fig. 1

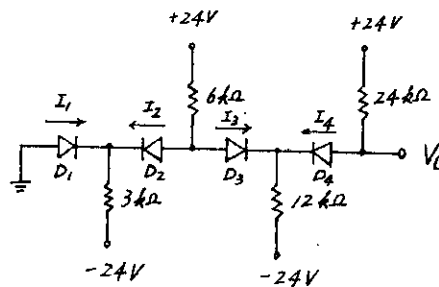


Fig. 2

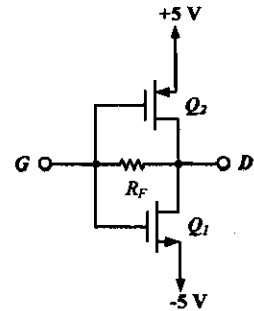


Fig. 3

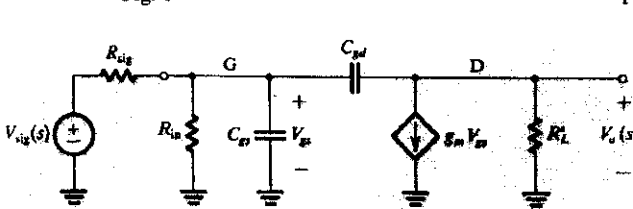


Fig. 4

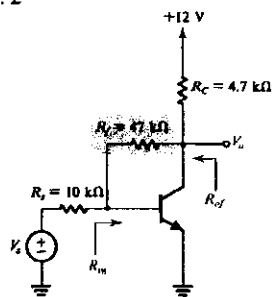


Fig. 5

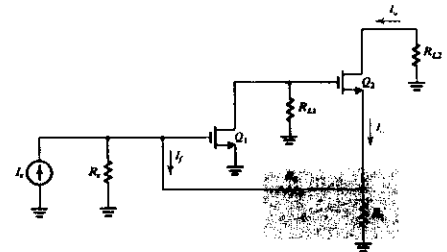


Fig. 6

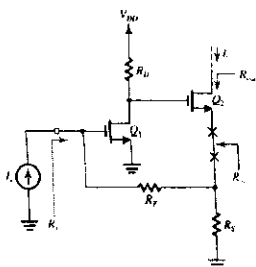


Fig. 7

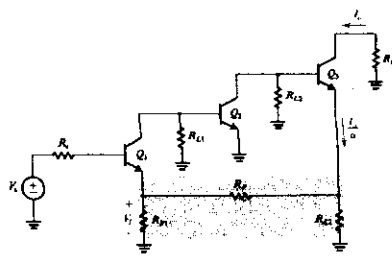


Fig. 8