國立臺北大學 106 學年度碩士班一般入學考試試題

系（所）組別：電機工程學系甲組(晶片設計組)

科　　目：電子學 B

☐可 ☑不可使用計算機

1. For **Fig. 1**, determine (a) common-mode voltage gain, (b) different mode gain, and (c) CMRR ratio, assuming $g_{mn}=g_{mp}=g_m$ and $r_{on}=r_{op}=r_o$ (15%)

2. **Fig. 2** shows the high-frequency model of a common-source amplifier.

   (a) Derive dc gain $A_M=V_o/V_i$ of this circuit shown in **Fig. 2(a)**. (5%)

   (b) Apply Miller's theorem to C_{gd}, find C_{gd1} and C_{gd2} as shown in **Fig. 2(b).** (10%)

   (c) Calculate its 3-dB high-frequency of f_H. (5%)

3. Compute the closed-loop gain ($A_V=V_{out}/V_{in}$) of the amplifier shown in **Fig. 3**.

   (a) Assuming the open-loop amplifier gain A_0 is 20, R_1=1kΩ, R_2=100kΩ. (5%)

   (b) Assuming the open-loop amplifier gain A_0 is infinite, R_1=1kΩ, R_2=100kΩ. (5%)

4. Derive dc gain of the circuit shown in **Fig. 4**, ignoring body effect but including channel length modulation? (5%)

5. The common-source stage of **Fig. 5** must provide a voltage gain of 10V/V with a bias current of 0.5mA, assuming $\lambda_1=\lambda_2=0.1V^{-1}$, $|V_{tp}|=|V_{tn}|=0.4V$, $\mu_nC_{ox}=200\mu A/V^2$, and $\mu_pC_{ox}=100\mu A/V^2$.

   (a) Compute the required value of $(W/L)_1$. (5%)

   (b) If $(W/L)_2 = 10$ and $V_{DD} = 1.8V$, calculate the required value of V_b. (5%)

6. **Fig. 6** shows the Common-emitter (CE) stage amplifier without considering the Early effect of Q_1.

   (a) Draw the small-signal model. (5%)

   (b) Find voltage gain of ($A_V=V_{out}/V_{in}$) and input impedance (R_{in}). (10%)

   (c) Explain the reasons to have capacitor C_1. (5%)

7. The open-loop amplifier gain A_0 is infinite, compute the output voltage V_{out} of the circuit shown in **Fig. 7**. (5%)

8. An amplifier with the low-frequency response of $L(s)=\dfrac{s(s+10)}{(s+100)(s+14)}$

   (a) Find each location of poles (ω_{p1}, ω_{p2}) and zeros (ω_{z1}, ω_{z2}). (10%)

   (b) Find the 3-dB low-frequency ω_L of the amplifier. (5%)

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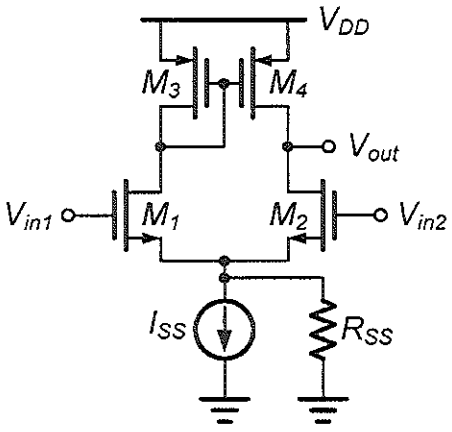

Fig. 1

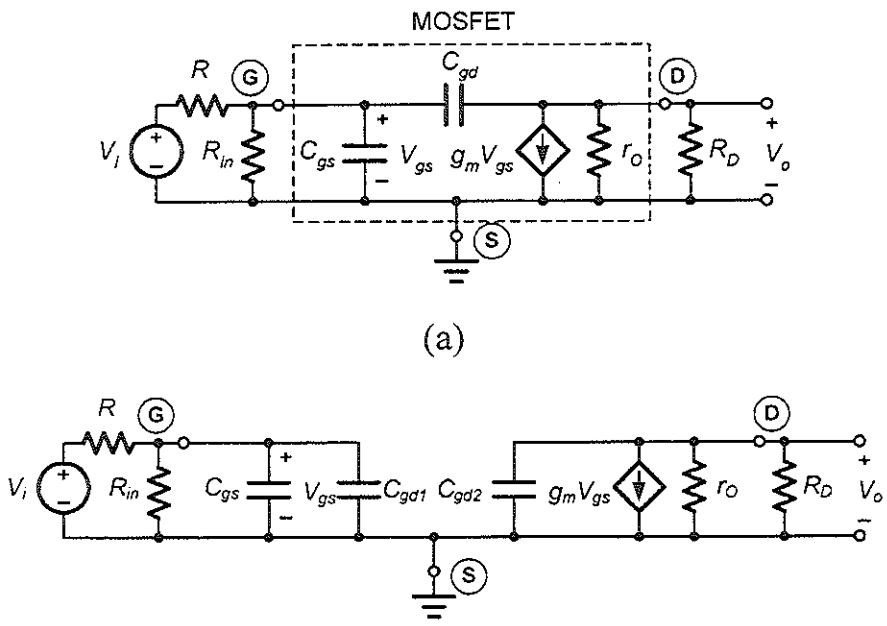

Fig. 2

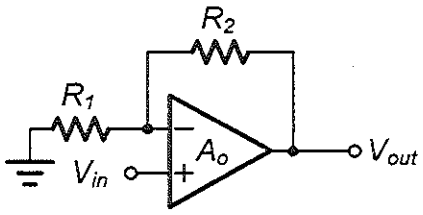

Fig. 3

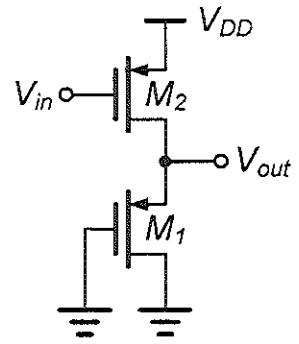

Fig. 4

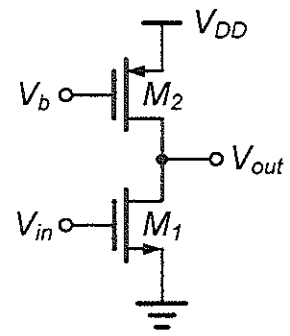

Fig. 5

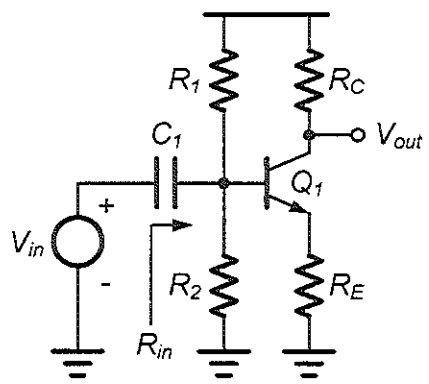

Fig. 6

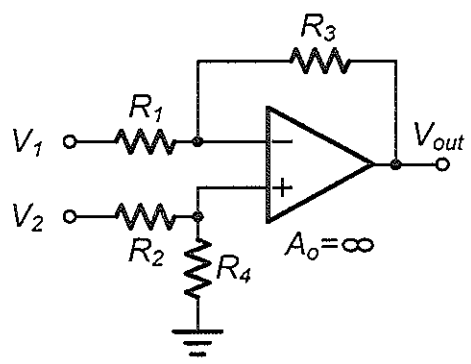

Fig. 7

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