國立雲林科技大學
101 學年度碩士班暨碩士在職專班招生考試試題

系所：電子光電所
科目：電子學(2)

1. (a)(5%)

Figure 1(a) shows the equivalent circuit of an amplifier. Please derive the voltage gain V_o/V_s of amplifier as a function of frequency.

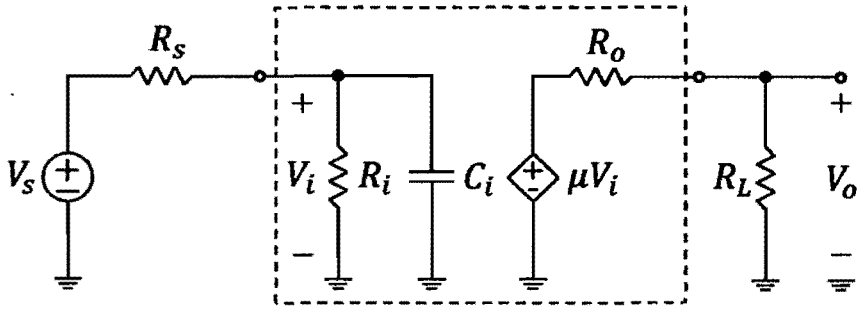

Fig. 1(a)

(b)(10%)

Figure 1(b) shows the bias circuit. Please derive DC voltage V_{REF}.

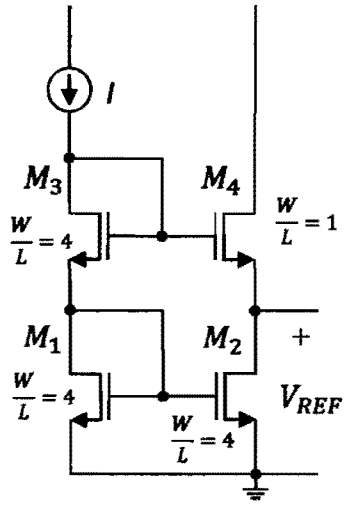

Fig. 1(b)

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2. Figure 2 illustrates an application of op-amp. Assume that the op-amp is ideal.
   (a)(5%) Find the resistances looking into node 1 to node 4, R_1 to R_4.
   (b)(5%) Find the currents I_1, I_2, I_3, and I_4 in terms of the input current I.

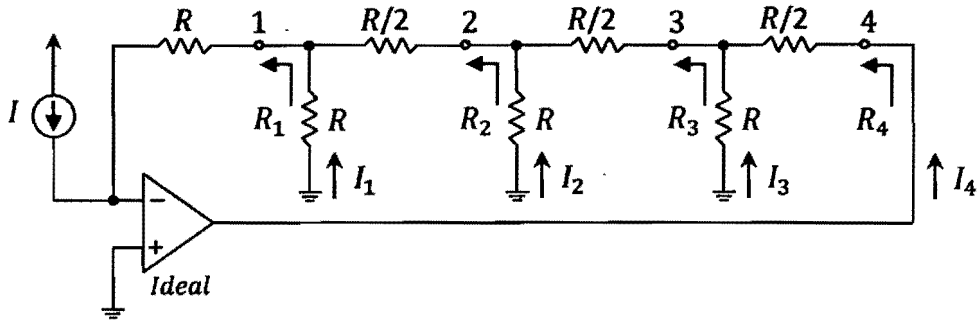

Fig. 2

3. Figure 3 shows an output amplifier. Assume that v_{IN} sweeps from -2.5V to +2.5V. Let $K_p' = 50\mu A/V^2$, $V_{tp} = -0.7V$, and $\lambda_p = 0.05V^{-1}$. Ignore bulk effects.
   (a)(5%) Find the maximum value of v_{OUT}.
   (b)(10%) Find the minimum value of v_{OUT}.
   (c)(10%) Find the positive and negative slew rate, SR+ and SR-, when v_{OUT}=0V.

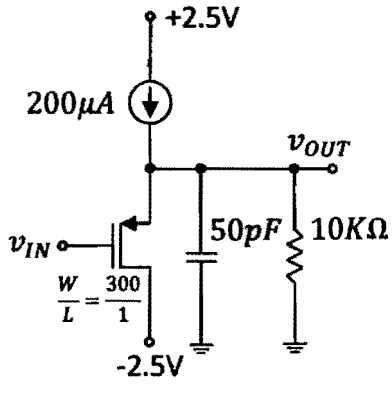

Fig. 3

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4. For the circuits in Fig. 4, $\mu_n Cox = 2.5\ \mu_p Cox = 20\ \mu A/V^2$, $|V_t| = 1$ V, $\lambda = 0$, $\gamma = 0$, $L = 10\ \mu m$ and $W = 30\ \mu m$.

(a)(10%) Find I_a and V_a in Fig. 4 (a).

(b)(10%) Find I_b and V_b in Fig. 4 (b).

(c)(10%) Find I_c and V_c in Fig. 4 (c) with $L = 10\ \mu m$ and $W = 75\ \mu m$ for M_5.

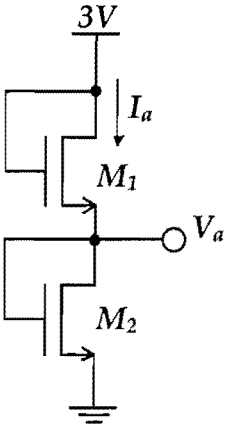

Fig. 4(a)

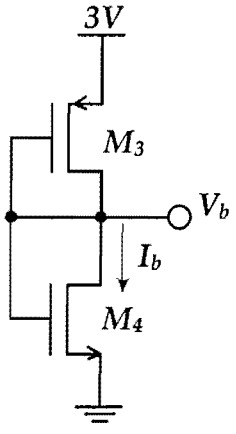

Fig. 4(b)

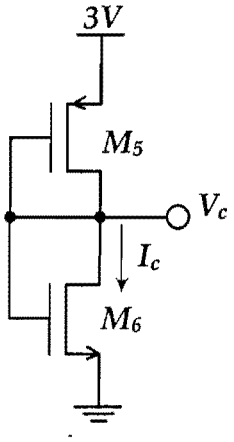

Fig. 4(c)

5. In the circuit of Fig. 5, transistor M_1 and M_2 have $V_t = 0.5$ V, and the process transconductance parameter $k_n' = 50\ \mu A/V^2$. Assuming $\lambda = 0$, find V_1, V_2 , and V_3 for each of the following cases:

(a)(4%) $(W/L)_1 = (W/L)_2 = 20$

(b)(4%) $(W/L)_1 = 2\ (W/L)_2 = 10$

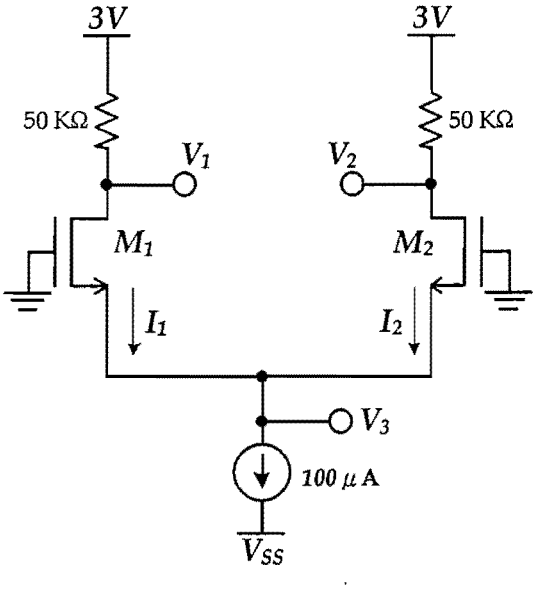

Fig. 5

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6. The shunt-shunt feedback amplifier in Fig. 6 has I = 1 mA and V_{GS} = 0.8 V. The MOSFET has V_t = 0.6 V and V_A = 30 V. For R_s = 10 KΩ, R_1 = 1 MΩ, and R_2 = 4.7 MΩ,

(a)(4%) find the voltage gain v_O/v_s.

(b)(4%) find the input resistance R_{in}.

(c)(4%) find the output resistance R_{out}.

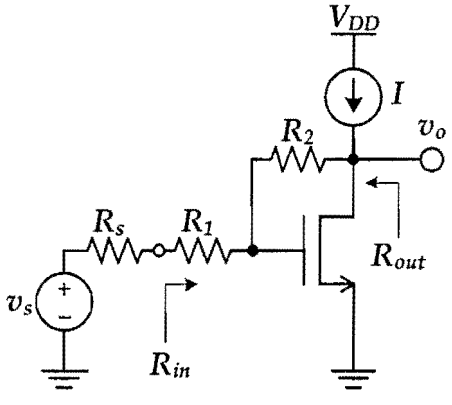

Fig. 6