Midterm Exam I Microelectronics NCKUEE 10/21/2008

系級班別：_____ 學號：_____ 姓名：_____

(20%) 1. (a) With less than 25 words to list the name of the four feedback amplifiers (e.g. Trans… amplifier) and their corresponding topologies (e.g. series-shunt). (12%) (b) Show how to derive A circuit and β circuit for a voltage amplifier. Please give detailed procedure from two-port feedback network to A circuit and β circuit. (8%)

(15%) 2. The noninverting op-amp configuration is shown in Fig. P2. (a) Assume that the OPAMP has infinite input resistance and zero output resistance. Find an expression for the feedback factor β. (5%) (b) If the open-loop voltage gain $A = 10^3$, find R_2/R_1 to obtain a close-loop voltage gain A_f of 10. (5%) (c) If A decreases by 30%, what is the corresponding decrease in A_f? (5%)

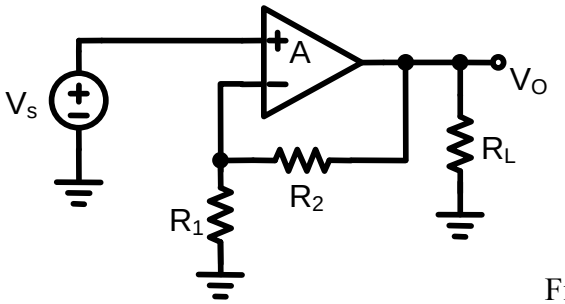

Fig. P2

(15%) 3. With illustrations, please give definitions for the following items of a two-pole OPAMP.

(a) -3dB bandwidth (5%)

(b) Unity-gain bandwidth (5%)

(c) Gain-bandwidth product (5%)

(20%) 4. A cascode current mirror is shown in Fig. P4(a) and a wide-swing current mirror is shown in Fig. P4(b). The $|V_{OV}|$ for all transistors is 0.3 V and the $|V_t|$ is 0.7 V. All transistors are identical.

(a) Please calculate V_{bias1} voltage, V_{bias2} voltage and the minimum voltage of V_O swing in Fig. P4(a). (10%)

(b) Please calculate V_{bias3} voltage, V_{bias4} voltage and the minimum voltage of V_O swing in Fig. P4(b). (10%)

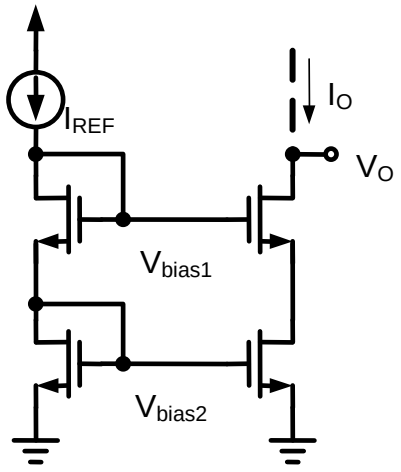

Fig. P4(a)

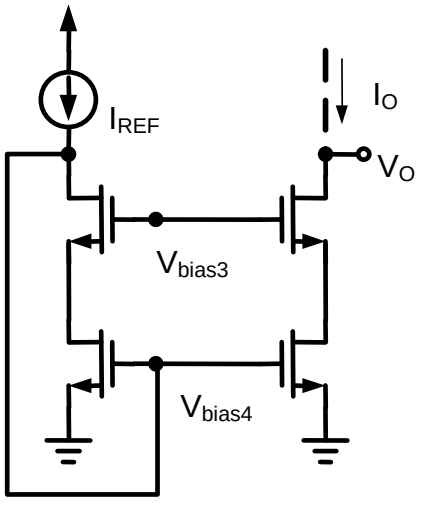

Fig. P4(b)

(20%) 5. A folded-cascode OPAMP is shown in Fig. P5 where I_{M11} = 200 uA, I_{M10} = 250 uA, and $|V_{OV}|$ for all transistors is 0.25 V. Assume that the fabrication process $u_n C_{ox}$= 200 uA/V^2, $u_p C_{ox}$ = 80 uA/V^2, λ_n = 0.1 um/V, λ_p = 0.2 um/V, V_{DD} = 3.3, V_{tn} = 0.7 V, and $|V_{tp}|$ = 0.8 V. Please find (a) The voltage gain and output resistance. (10%) (b) The input common-mode range and output voltage swing. (10%)

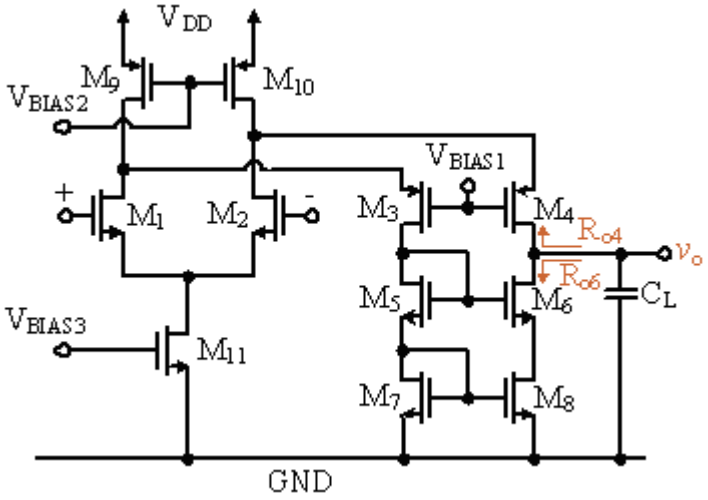

Fig. P5

(15%) 6. V_-, V_+, and V_O are the inverting input voltage, noninverting input voltage, and output voltage of the OPAMP, respectively 0 V<output swing of V_O<3.3 V.

(a) Calculate V_- and V_O of the circuit shown in Fig. P6(a) where the OPAMP gain A_a = 10. (5%)

(b) Calculate V_+ and V_O of the circuit shown in Fig. P6(b) where the OPAMP gain A_b = 10. (5%)

(c) Calculate V_+ and V_O of the circuit shown in Fig. P6(c) where the OPAMP gain A_c = 1. (5%)

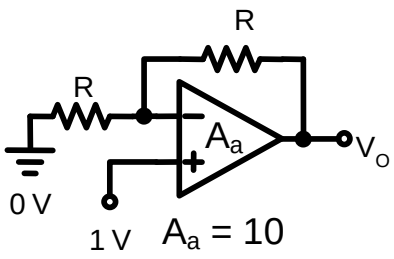

Fig. P6(a)

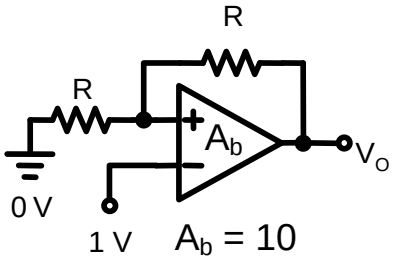

Fig. P6(b)

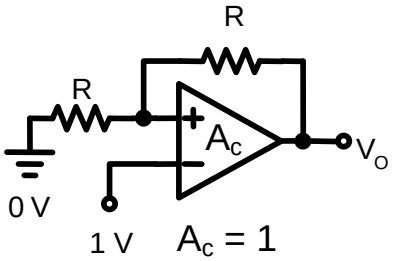

Fig. P6(c)

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