元智大學 107 學年度 碩士班 招生試題卷

系(所)別：電機工程學系碩士班　組別：甲組　科目：電子學

●不可使用電子計算機

Problem 1: (18%) For the bridge rectifier circhit shown in Fig. 1, V_{in} is a 100-Hz 5-V peak sine wave with zero offset, $D_1 \sim D_4$ are diodes with a constant voltage drop V_D = 0.7 V. Use the constant-voltage-drop diode mode to find the following:

(a) Draw wavforms V_{in} and V_{out} vesus time with their maximum amplitudes. (6%)

(b) Remove D_1, make terminals a and b open circuit, and please draw wavforms V_{in} and V_{out} vesus time with their maximum amplitudes. (6%)

(c) Make terminals a and b short circuit, and please draw wavforms V_{in} and V_{out} vesus time with their maximum amplitudes. (6%)

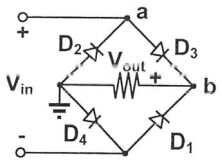

Fig. 1

Problem 2: (15%) For a CMOS inverter with matched MOSFETs having V_{th} = 0.7 V, if V_{DD} = 3.3 V, find (a) input low level, V_{IL}, (b) input high level, V_{IH}, and (c) noise margins.

Problem 3: (17%) (a) Sketch a static CMOS logic circuit that realizes the function $\overline{A(B+CD)}$. (9%) (b) Provide the W/L ratios for nMOS and pMOS transistors. Assume that for the basic CMOS inverter $(W/L)_n$ = 2 and $(W/L)_p$ = 5. (8%)

Problem 4: (25%) Consider a typical Opamp with two amplification stages (A_{v1} and A_{v2}). The input and output impedance of each stage is denoted as R_{in1}, R_{out1}, R_{in2}, and R_{out2}. A compensation capacitance C_c is placed across A_{v2}.

(a) Determine the bandwidth of the Opamp by Miller Effect. (10%)

(b) Redo (a) without using Miller Effect. (5%)

(c) Under what condition will the results of (a) and (b) become identical? (10%)

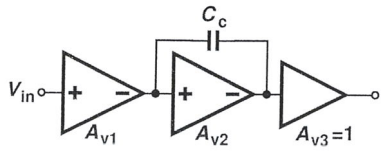

Fig. 2

Problem 5: (25%) A fully differential telescopic Opamp is shown below with the parameters: $\mu_n C_{ox}=100\mu A/V^2$, $\mu_p C_{ox}=50\mu A/V^2$, $\lambda_n=\lambda_p=0.2V^{-1}$, $\gamma=0$, $V_{THN}=|V_{THP}|=0.7V$, $V_{DD}=3V$, $I_{M9}=1mA$, $V_{OD9}=V_{GS9}-V_{TH9}=0.4V$. $M_{1\text{-}4}$: (W/L)=1000, $M_{5\text{-}8}$: (W/L)=2000.

(a) Calculate the dc gain. (10%)

(b) Determine the maximum differential output swing. (5%)

(c) Using resistive feedback with the Opamp to construct a voltage amplifier with typical dc gain of 10dB. Draw the circuit with the calculated resistance and calculate the gain error. (10%)

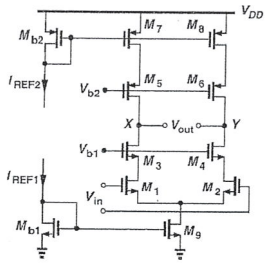

Fig. 3.