

# 中原大學 100 學年度 碩士班 入學考試

3 月 19 日 10:30~12:00

電子工程學系晶片設計組

誠實是我們珍視的美德，  
我們喜愛「拒絕作弊，堅守正直」的你！

科目：電子學

(共 2 頁第 1 頁)

■ 可使用計算機，惟僅限不具可程式及多重記憶者

□ 不可使用計算機

1. For a CMOS inverter operating from a 3.3V supply in a technology for which  $|V_T|=0.8V$ , and  $k'_n = 6k'_p = 240\mu A/V^2$ , evaluate the drain-source resistance associated with minimum-size transistors for which  $W/L = 1.2\mu m/0.9\mu m$ . For which ratio ( $W_p/W_n$ ) will  $Q_N$  and  $Q_P$ , which have equal channel lengths, have equal resistances? (20%)
2. (1) Find the transfer function  $T(s)=V_o(s)/V_i(s)$  of the circuit in Fig. 1. (8%)  
(2) Sketch Bode plots for the magnitude response and the phase response by given  $R_i=2k\Omega$ ,  $R_1=2k\Omega$ ,  $R_2=2k\Omega$ ,  $C_1=1\mu F$ , and  $C_2=1\mu F$ . (12%)

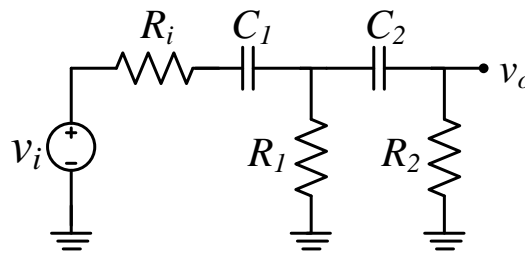


Fig. 1

3. In Fig. 2, find the transfer functions with each input voltages. (20%)

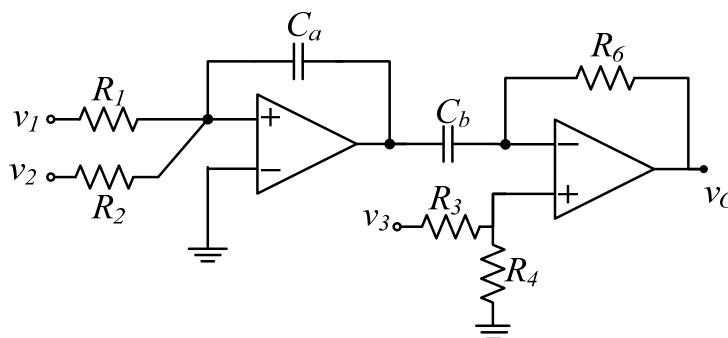


Fig. 2

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4. Sketch a CMOS realization for the function:  $Y = \overline{A(C + BD)} + E$ . (15%)
5. In Fig. 3, the differential amplifier uses a resistor  $R_S = 200\Omega$  to establish a 5-mA dc bias current with  $V_{DD} = 5V$ . There is a dc common-mode voltage  $V_{CM}$ . Transistors  $M_1$  and  $M_2$  have  $k_n' W/L = 5\text{mA/V}^2$ ,  $V_t = 0.8V$ , and  $\lambda = 0$ . (25%)
- (a) Find the required value of  $V_{CM}$ .
- (b) Find the value of  $R_D$  that result in a differential gain  $A_d$  of  $2V/V$ .
- (c) Find the dc voltage at the drains.
- (d) Find the common-mode gain.
- (e) Use the common-mode gain found in (d) to determine the change in  $V_{CM}$  that results in  $M_1$  and  $M_2$ , entering the triode region.

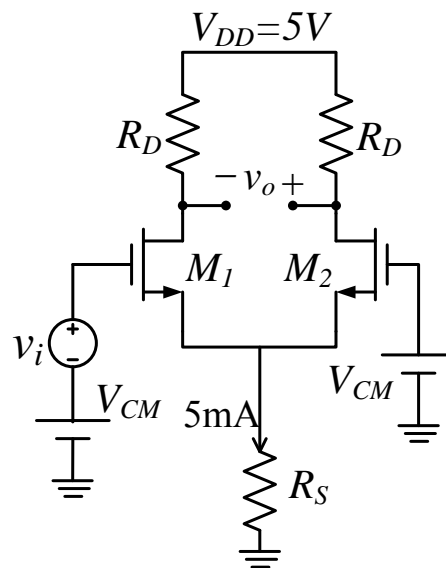


Fig. 3