

國立虎尾科技大學九十八學年度研究所(碩士班)考試入學試題

所別：光電與材料科技研究所

科目：考試科目 2(電子學)

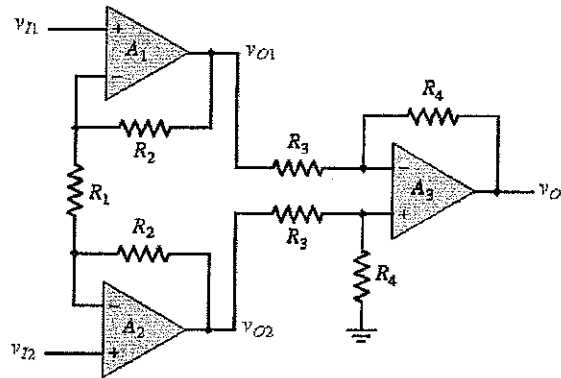
注意事項：

- (1) 共十大題，每題十分。  
 (2) 請於答案卷上註明題號。

1. 名詞解釋：(10%)

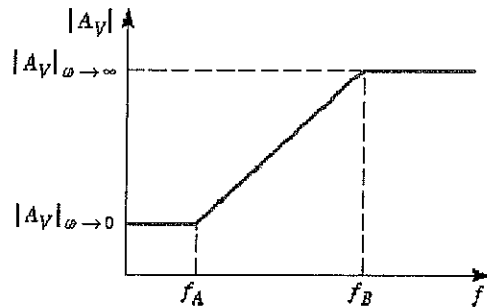
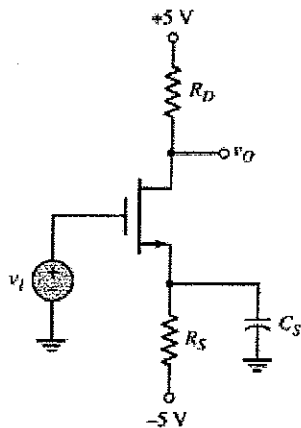
- (a) 何謂 Zener Breakdown?  
 (b) 在金氧半場效電晶體(MOSFET)元件中，何謂反轉層(inversion layer)?  
 (c) 在金氧半場效電晶體(MOSFET)元件中，何謂通道長度調變效應(channel-length modulation effect)?  
 (d) 在金氧半場效電晶體(MOSFET)元件中，何謂基體效應(body effect)?

2. 一儀器放大器如圖所示，若電路中的 OP 皆是理想的電路，求此一電路的電壓增益  $v_O/(v_{I1} - v_{I2}) = ?$  (10%)



3. 一放大器電路及其電壓增益( $A_V$ )的波德圖(Bode plot)如下圖，電晶體參數為： $K_n=0.5 \text{ mA/V}^2$ ， $V_T=0.8 \text{ V}$ ， $\lambda=0$ ， $R_D=5.6 \text{ k}\Omega$ 、 $R_S=6.4 \text{ k}\Omega$ ， $C_S=5 \mu\text{F}$ 。(10%)

- (a) 求兩個電壓增益  $|A_V|_{\omega \rightarrow \infty}$  及  $|A_V|_{\omega \rightarrow 0}$ ；(b) 求兩個轉角頻率  $f_A$  及  $f_B$ 。

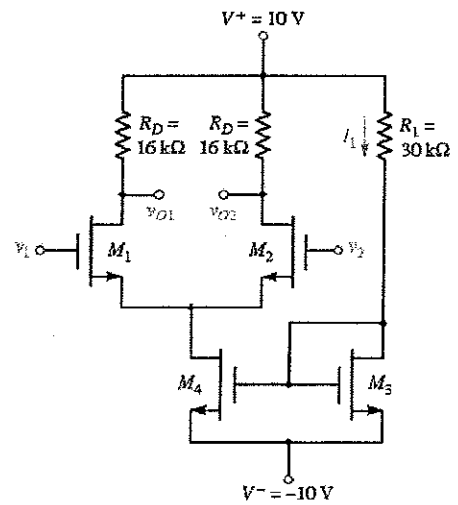


4. 一個差動放大器電路如圖所示，各電晶體皆工作在飽合區(saturation region)，其參數分別為：(10%)

$$K_{n1} = K_{n2} = 1 \text{ mA/V}^2, K_{n3} = K_{n4} = 0.3 \text{ mA/V}^2,$$

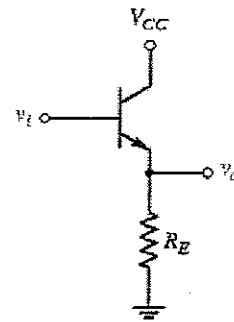
$$\lambda = 0, V_{TN} = 1 \text{ V}$$

- (a) 求偏壓電流  $I_1 = ?$   
 (b) 求差動增益  $(v_{O1} - v_{O2}) / (v_1 - v_2) = ?$

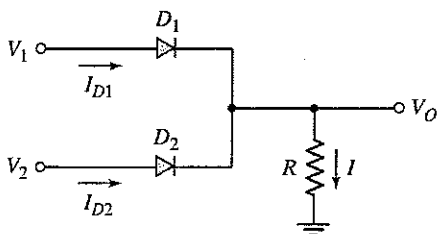


5. 一射極隨耦器(emitter follower)電路如圖所示，(10%)

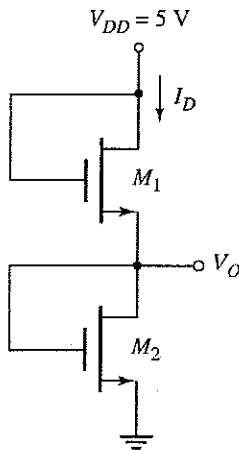
- (a) 請問此一電路為何種回授組態？  
 (b) 此回授組態的回授因子(feedback factor)  $\beta = ?$



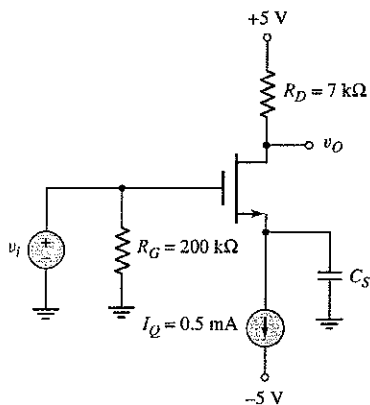
6. (a) Analyze the output voltage,  $V_O$ , by  $V_1, V_2$  in following circuit  
 (b) What kind of the logic function for the following circuit (10%)



7. The transistors in the circuit in following figure both have parameters  $V_{TN}=0.7V$  and  $k_n=30\mu A/V^2$ . If the width-to-length ratios of  $M_1$  and  $M_2$  are  $(W/L)_1=(W/L)_2=40$ , determine  $V_{GS1}$ ,  $V_{GS2}$ ,  $V_O$ , and  $I_D$  (10%)



8. Consider the PMOS common-source circuit in following figure with transistor parameters  $V_{TP}=-2V$  and  $\lambda=0$ , and circuit parameters  $R_D=R_L=10\text{ k}\Omega$  (a) Determine the value of  $K_p$  and  $R_S$  such that  $V_{SDQ}=6V$  (b) Determine the resulting value of  $I_{DQ}$  and small-signal voltage gain (10%)



9. Consider the bandpass filter in following figure. Show the voltage transfer function is (10%)

$$A_v(s) = \frac{v_O}{v_I} = \frac{\frac{-I}{R_4}}{\frac{I}{R_1} + sC + \frac{I}{sCR_2R_3}}$$

10. Consider the circuit in following figure. The transistors are matched. Assume that base current are negligible and that  $V_A = \infty$ . If  $\beta \gg 1$  and the two transistors are identical, show that (10%)

$$I_O R_{E2} - I_{REF} R_{E1} = V_T \ln \left( \frac{I_{REF}}{I_O} \right)$$

