

國立臺北科技大學 102 學年度碩士班招生考試

系所組別：1521 自動化科技研究所乙組

第二節 電子學 試題 (選考)

第一頁 共二頁

注意事項：

1. 本試題共八題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

- (c) How to add a fixed resistor so that the gain range can be 1 to 21V/V? What should the resistor value be? (7pts)

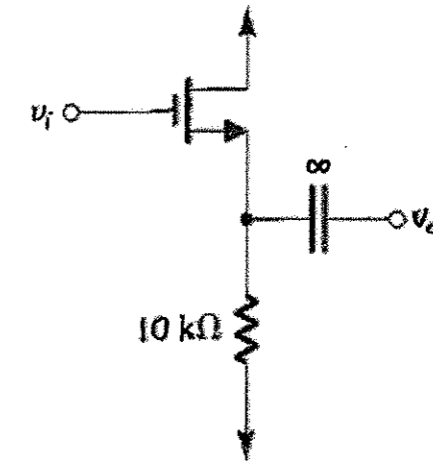


Fig. 1

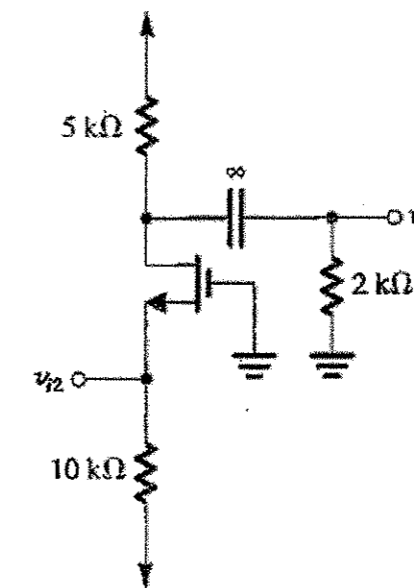


Fig. 2

1. The NMOS transistor in the source follower circuit of Fig. 1 has $g_m=5\text{mA/V}$ and a large r_o . Find
 - (a) The open-circuit voltage gain. (7pts)
 - (b) The output resistance. (7pts)
2. The NMOS transistor in the common-gate amplifier of Fig. 2 has $g_m=5\text{mA/V}$ and a large r_o . Find
 - (a) The input resistance. (7pts)
 - (b) The voltage gain. (7pts)
3. If the output of the source follower in Fig. 1 is connected to the input of the common-gate amplifier in Fig. 2, use the results of problems 1 and 2 to obtain the overall voltage gain v_o/v_i . (7pts)
4. In Fig. 3, it is assumed that the diodes are ideal. Find the value of
 - (a) V. (7pts)
 - (b) I. (7pts)
5. The circuit shown in Fig. 4 utilizes a $10\text{k}\Omega$ potentiometer to realize an adjustable-gain amplifier. It is assumed that the op amp is ideal.
 - (a) Derive an expression for the gain as a function of the potentiometer setting x . (7pts)
 - (b) What is the range of gains obtained? (7pts)

注意：背面尚有試題

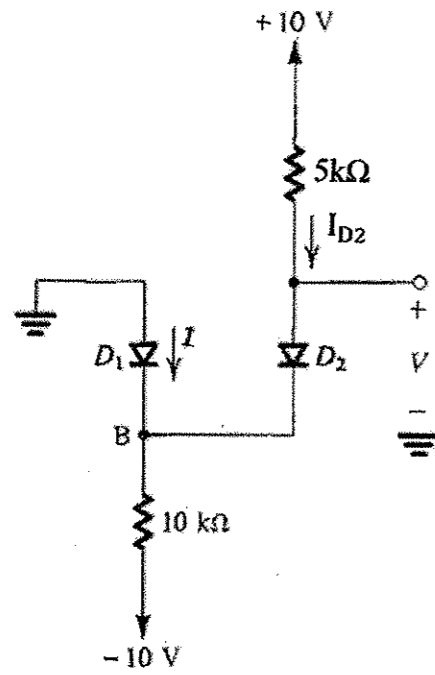


Fig. 3

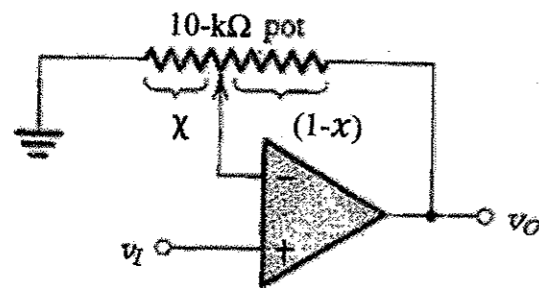


Fig. 4

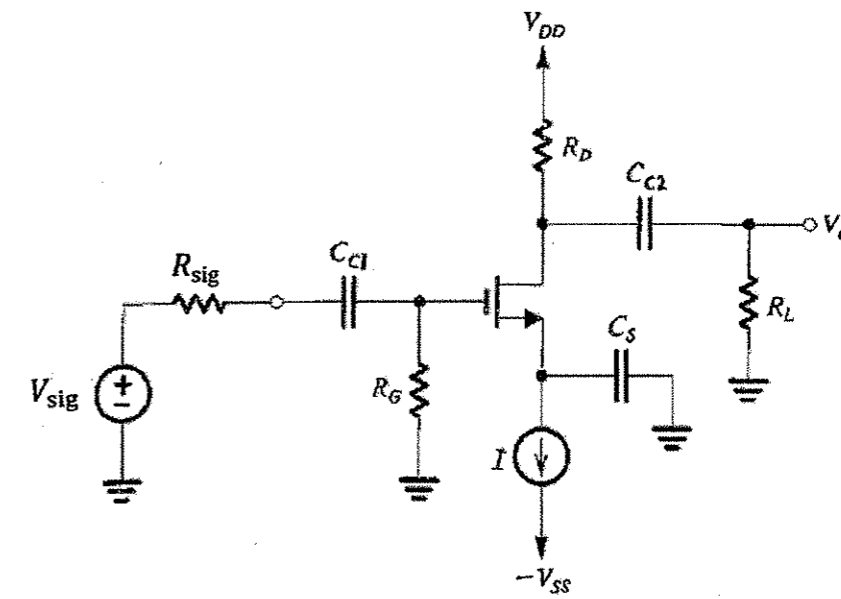


Fig. 5

6. For a 741 employing $\pm 5\text{V}$ supplies, $|V_{BE}|=0.6\text{V}$ and $|V_{CEsat}|=0.2\text{V}$, find the output voltage limits that apply. (7pts)
7. Design a CMOS logic circuit that realizes a three-input even-parity checker. Specifically, the output Y is to be low when an even number (0 or 2) of the inputs A, B, and C are high.
 - (a) Express the logic equation between Y and A, B, and C. (4pts)
 - (b) Draw the CMOS logic circuit. (5pts)
8. Fig. 5 shows a common-source (CS) amplifier with $R_{sig}=100\text{k}\Omega$, $R_G=4.7\text{M}\Omega$, $R_D=R_L=15\text{k}\Omega$, $g_m=1\text{mA/V}$, $r_o=150\text{k}\Omega$, $C_{gs}=1\text{pF}$, $C_{gd}=0.4\text{pF}$, $C_S=1.6\mu\text{F}$, $C_{C1}=3.3\text{nF}$, and $C_{C2}=0.53\mu\text{F}$. Find
 - (a) The midband gain A_M . (7pts)
 - (b) The upper 3-dB frequency f_H . (7pts)