

八十六學年度 工程與系統科學系(所) 組碩士班研究生入學考試

科目 電子學 科號 4009 共 3 頁第 1 頁 *請在試卷【答案卷】內作答

1. Answer the following questions as briefly as possible.

- (a) What is the purpose of frequency compensation? (4%)
- (b) What are the differences between RAM and ROM in the applications (operation system or most programs)? in the structures (capacitor or latch)? in the operations (read-only or read/write)? (6%)
- (c) For a MOSFET in the operation region of triode, how does the channel resistance vary with V_{DS} (not changed or increase or decrease)? After the channel reaching pinch-off, how does the drain current vary with V_{DS} (slightly increase or increase or slightly decrease or decrease)? (6%)

2. For the difference amplifier in Fig. 2, find the differential gain V_O/V_d . (8%)

3. Sketch and label the transfer characteristic of Fig 3 for $-20\text{ V} \leq V_I \leq +20\text{ V}$. The diodes and zener are represented by piecewise-linear models with $V_{D0} = 0.65\text{ V}$, $r_D = 20\ \Omega$, and $V_Z = 8.2\text{ V}$ at $I_Z = 10\text{ mA}$, $r_Z = 20\ \Omega$, respectively. (8%)

4. Find the logic function implemented in Fig. 4. (8%)

5. In Fig. 5, the MOSFET has $V_t = 1.5\text{ V}$, $K = 0.125\text{ mA/V}^2$, and $V_A = 50\text{ V}$. The low frequency response is dominated by a pole with the other pole at least a decade lower. Find the frequency of these two poles. (12%)

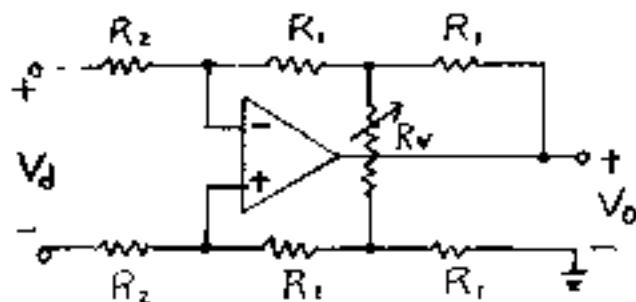


Fig. 2

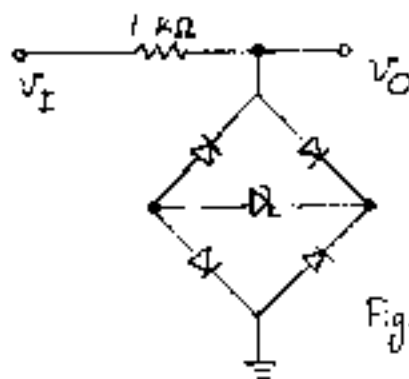


Fig. 3

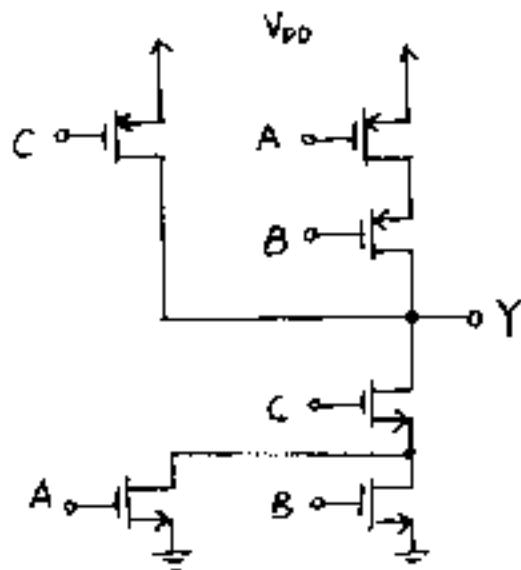


Fig. 4

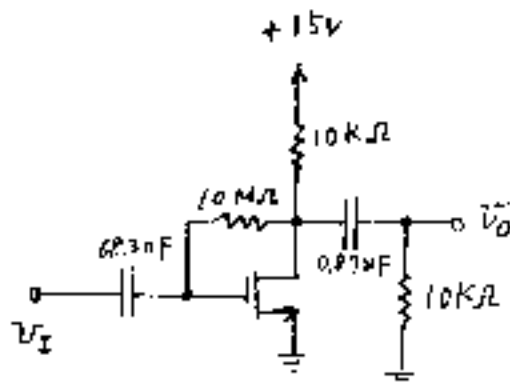
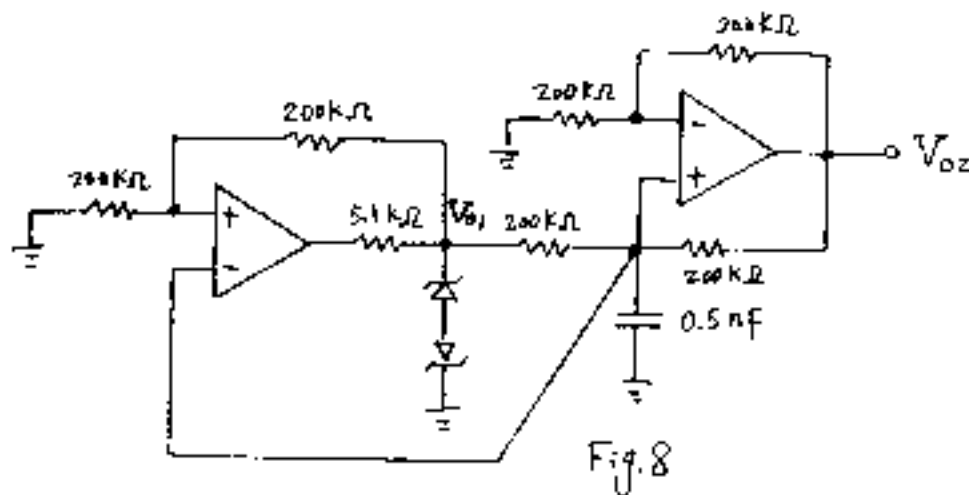
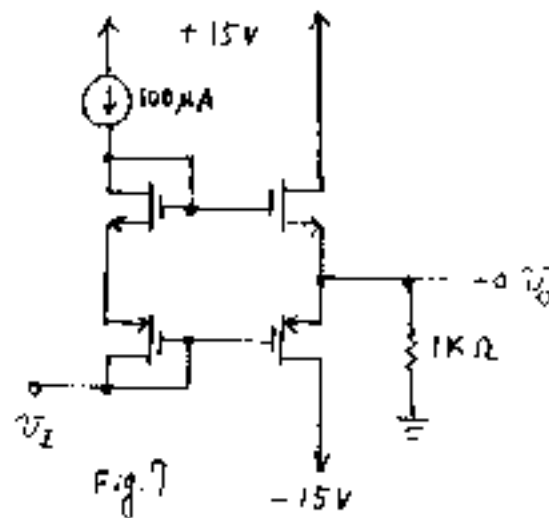
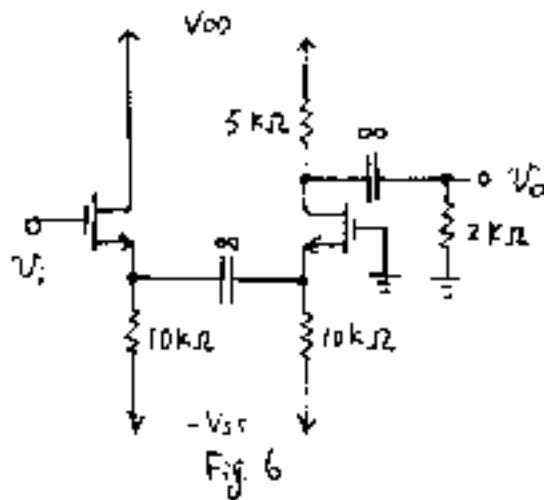


Fig. 5

八十六學年度 工程與系統科學系(所) 組碩士班研究生入學考試

科目 電子學 科號 4009 共 3 頁第 2 頁 *請在試卷【答案卷】內作答

- Find the overall voltage gain v_o/v_i of Fig. 6 with $g_m = 5 \text{ mA/V}$ and r_o very large. (12%)
- For the class AB output stage circuit in Fig. 7, all MOSFETs have $|V_t| = 1 \text{ V}$, $K_1=K_2=nK_3=nK_4$, $K_1 = 1 \text{ mA/V}^2$. Find the value of n that results in a small-signal gain of 0.99 for output voltages around zero. (12%)
- Sketch and label the V_{O1} and V_{O2} waveforms in Fig. 8 with $V_Z = 6.8 \text{ V}$. (12%)



八十六學年度 電子學 系(所) _____ 組碩士班研究生入學考試

科目 電子學 科號 4009 共 3 頁第 3 頁 *請在試卷【答案卷】內作答

- 9 For the shunt-shunt feedback circuit in Fig. 9, find the voltage gain V_o/V_s , the input resistance R'_{if} , and the output resistance R'_{of} . The OP amp has open-loop gain $\mu = 10^4$, $R_{id} = 100 \text{ k}\Omega$, $R_{i_{cm}} = 10 \text{ M}\Omega$, and $r_o = 1 \text{ k}\Omega$ (12%)

