

大同大學 100 學年度轉學入學考試試題

考試科目：電子學

所別：電機工程學系

第 1/1 頁

註：本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 可以使用計算器。

1. Refer to Fig. P1, diode with cut-in voltage $V_{D0}=0.7\text{ V}$, diode reresistance $r_D=0$, $V_{B1}=V_{B2}=4.3\text{ V}$,
 (a). Draw VTC (i.e. v_o vs v_i) plot, indicate the breakpoint voltage clearly. (10%)
 (b). $v_i(t)=10\sin\omega t$ Volt, draw the output waveform, v_o vs ωt for $0\leq\omega t\leq 4\pi$. (10%)

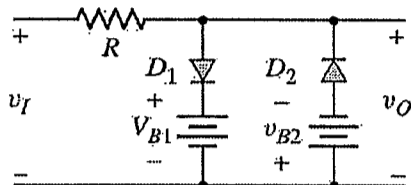


Fig. P1

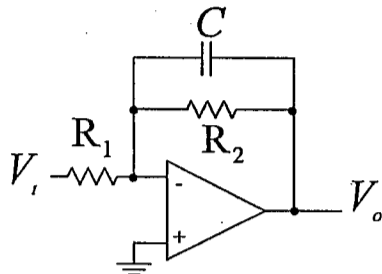


Fig. P2

2. (a). Refer to Fig. P2, for ideal OP amp, derive the transfer function $A(s)=V_o/V_i$. (8%)
 (b). Design the circuit to obtain the input resistance of $2\text{ K}\Omega$, a dc gain of 40 dB , and a 3-dB frequency of 4 KHz (i.e. calculate R_1, R_2 and C). (9%) Calculate the unity gain frequency f_t ? (3%)
3. Refer to Fig. P3, BJT $\beta=100$, neglect BJT Early effect, $I_R=1\text{ mA}$, $R_S=5\text{ K}\Omega$, $R_B=100\text{ k}\Omega$, $R_C=8\text{ k}\Omega$, $R_L=5\text{ k}\Omega$.
 (a). Draw the small-signal equivalent circuit. (3%).
 (b). Calculate voltage gain $A_v = \frac{v_o}{v_i}$ (12%) and input resistance R_{in} . (5%)

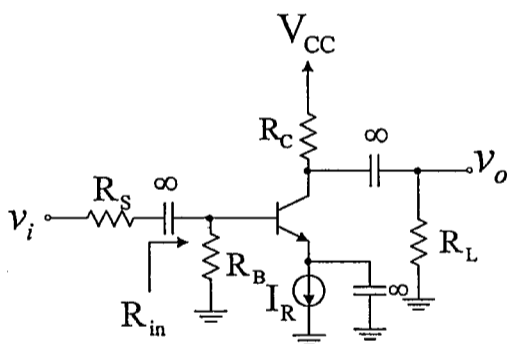


Fig. P3

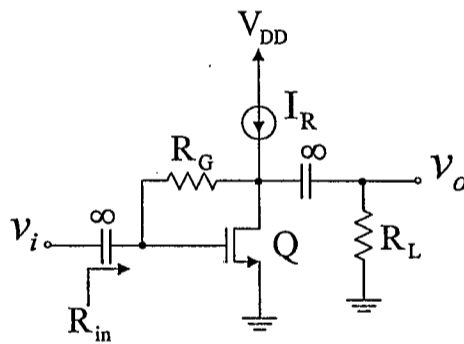


Fig. P4

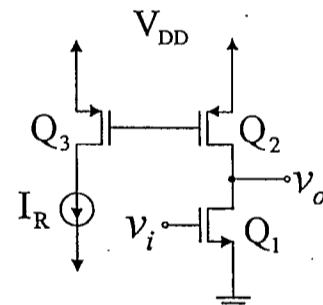


Fig. P5

4. Refer to Fig. P4, nMOS, $I_R=500\mu\text{ A}$, $V_{tn}=0.9\text{ V}$, $R_G=10\text{ M}\Omega$, $R_L=10\text{ k}\Omega$, $V_A=50\text{ V}(=\frac{1}{\lambda})$,
 $\mu_n C_{ox} W/L=2\text{ mA/V}^2$.
 (a). Draw the small-signal equivalent circuit. (3%)
 (b). Calculate the midband voltage gain $A_v = \frac{v_o}{v_i}$ (12%) and input resistance R_{in} . (5%)
5. Refer to Fig. P5, $I_R=100\mu\text{ A}$, $\mu_n C_{ox}=200\mu\text{ A/V}^2$, $\mu_p C_{ox}=65\mu\text{ A/V}^2$, $V_{tn}=-V_{tp}=0.6\text{ V}$, $V_{An}(=\frac{1}{\lambda_n})=20\text{ V}$,
 $|V_{Ap}|(=\frac{1}{\lambda_p})=10\text{ V}$, assume $L=0.4\mu\text{ m}$ and $W=4\mu\text{ m}$ for all nMOS and pMOS.
 (a). Draw the small-signal equivalent circuit. (3%)
 (b). Calculate midband voltage gain $A_M = v_o/v_i$. (17)