大同大學 九十四 學年度 轉學考試 試題

考試科目:電子學　　系別:電機工程學系　第 1 頁,共 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, assuming the diodes to be ideal, derive the relationship between V_O and V_I. Sketch the transfer characteristic (i.e. V_O vs V_I plot) for $-10 \le V_I \le 10$, indicate the voltage at the breakpoints clearly and identify the stae of diodes to be on or off in each region. (20%)

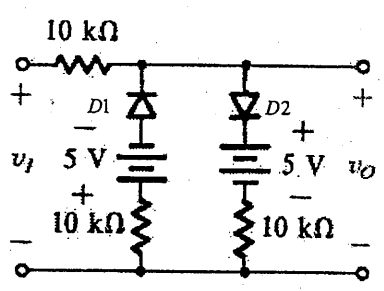

Fig. P1

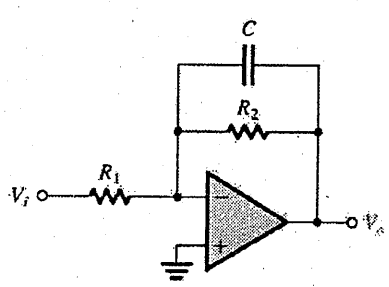

Fig. P2

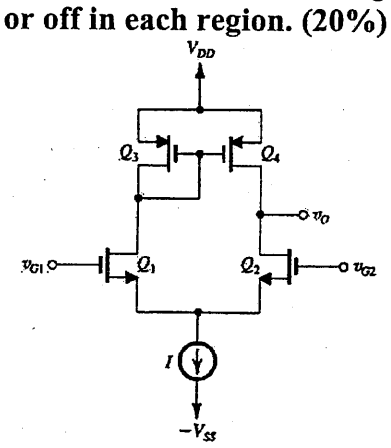

Fig. P3

2. (a). Refer to Fig. P2, assuming the OP. to be ideal, derive the transfer function $T(s) = \frac{V_O}{V_i}$ (8%)

   (b). Design the circuit to obtain the input resistance of 1 $K\Omega$, a dc gain of 20dB, and a 3-dB frequency of 4 KHz. At what frequency does the magnitude of the transfer function reduce to unity ? (16%)

3. Refer to Fig. P3, for n-MOS $(W/L)_n$=100, $\mu_n C_{ox} = 0.2mA/V^2$, $\lambda_n = 0.05V^{-1}$; for p-MOS, $(W/L)_p$=200, $\mu_p C_{ox} = 0.1mA/V^2$, $\lambda_p = 0.05V^{-1}$; current source, I=0.8 mA with output resistance R_{ss}=25 $K\Omega$, $v_{G1} - v_{G2} = v_{id}$. Calculate transconductance (G_m), output resistance (R_o) of the differential amplifier and voltage gain (A_d) for the fifferential mode. (15%)

4. Fig. P4 shows the high-frequency equivalent circuit of a MOS amplifier, use the parameters shown in the circuit.

   (a). Derive an expression for the low frequency voltage gain $\frac{V_O}{V_{sig}}$. (6%)

   (b). Using OCTC (open-circuit time constants) method to derive the time constants τ_{gs} for C_{gs}, τ_{gd} for C_{gd} and write an expression for the upper 3dB frequency f_H for the circuit. (15%)

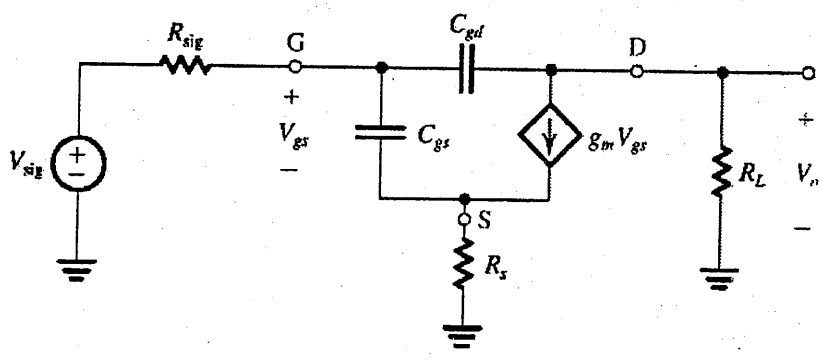

Fig. P4

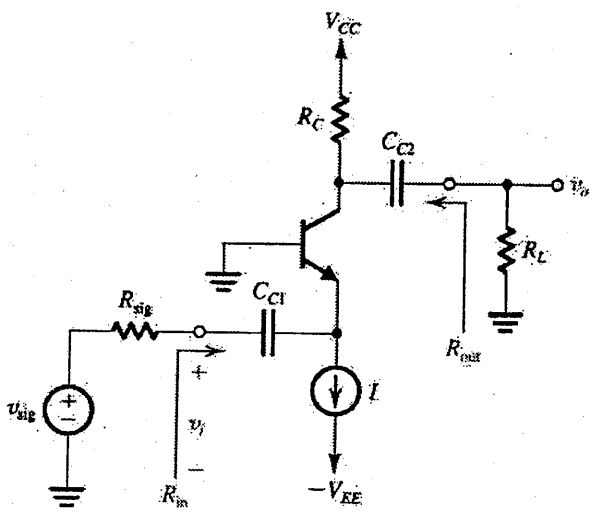

Fig. P5

5. Refer to Fig. P5, neglect BJT's r_o, I=1mA, β=100, R_{sig}=R_L=5 $K\Omega$, and R_C=8 $K\Omega$. Calculate R_{in}, R_{out}, $A_v = \frac{v_o}{v_i}$, and $G_v = \frac{v_o}{v_{sig}}$. (20%)