大同大學 98 學年度轉學入學考試試題

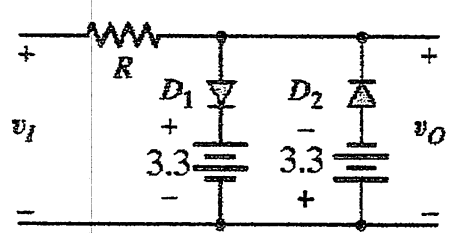
考試科目：電子學　　所別：電機工程學系　　

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 cut-in voltage V_{D0}=0.7 V, r_D=0

(a). Draw VTC (v_o vs v_I) plot. (10%)

(b). Draw the output waveform, v_O vs t plot for $0 \le \omega t \le 4\pi$. Indicate the breakpoints clearly. (10%)



$v_I = V_p \sin \omega t = 10 \sin \omega t$ Volt

Fig. P1

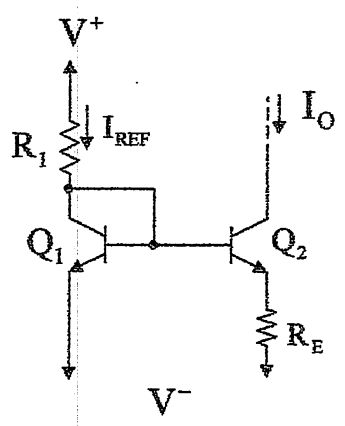


Fig. P2

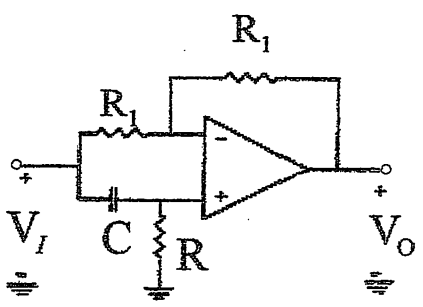


Fig. P3

2. (a). Refer to Fig. P2, state the assumption, derive the relationship between I_o and I_{REF}. (10%)

(b). V^+=5V, V^- = -5V, I_{REF}= 1 mA, to generate a constant current I_o=12 μA, determine the value of R_1, R_E, assuming that V_{BE}=0.7 V at I_C=1 mA. (10%)

3. (a). Refer to Fig. P3, for the ideal op amp derive the transfer function $T(s) = \frac{V_O}{V_I}$. (10%)

(b). Derive an expression for the magnitude $|T(j\omega)|$ and phase $\phi(\omega)$,

$T(s)|_{s=j\omega} = T(j\omega) = |T(j\omega)|e^{j\varphi}$, plot $|T(j\omega)|$ vs ω, φ vs ω (10%)

4. I_{REF} =100μA, $\mu_n C_{ox}$ =90 μA/V², $\mu_p C_{ox}$ =30 μA/V², $V_{tn} = -V_{tp}$=0.5V, $1/\lambda_n$= 12.8 V, $1/|\lambda_p|$=19.2V.

V_{DD}=V_{SS} = 5 V, Assume MOS W/L=100μm/1.6μm for all MOSs. (Neglect channel length modulation in DC calculation) (Refer to Fig. P4)

(a) Calculate R_{REF}. (6%)

(b) Calculate voltage gain v_o/v_i. (14%)

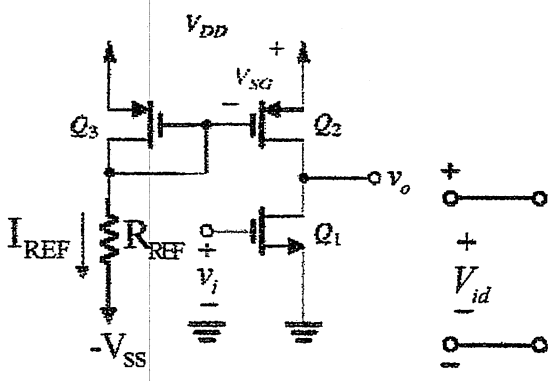


Fig. P4

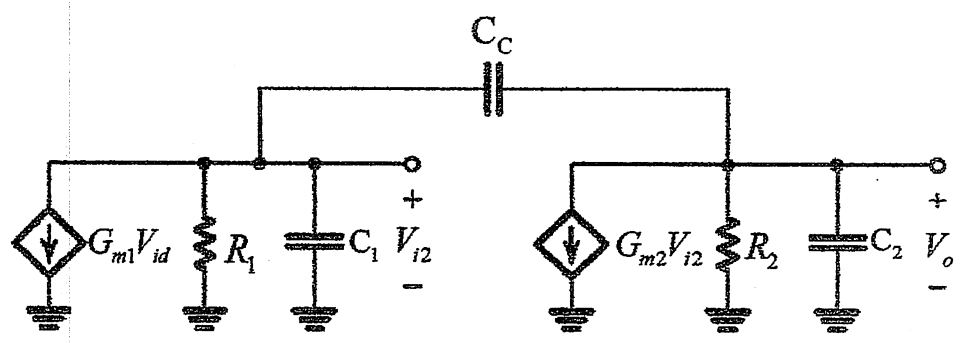


Fig. P5

5. Refer to Fig. P 5, the equivalent circuit of 2-stage amplifier.

Neglect capacitances C_1 and C_2 and use Miller approximation, the voltage gain can be written as $A(s) = \frac{V_O}{V_{id}} = \frac{A_0}{1 + \frac{s}{\omega_p}}$

Given G_{m1}=60μA/V and G_{m2}=100μA/V, R_1 =1MΩ, R_2 =2MΩ, Cc = 10 PF.

(a). Calculate the dc voltage gain $A_0 = \frac{V_0}{V_{id}}$ (10%).

(b). Neglect capacitances C_1 and C_2, write an expression for the dominant pole frequency(ω_p) due to Cc in terms of R_i, C_i and G_{mi} (i=1, 2). Calculate ω_p and unity gain frequency ω_t. (10%)