1. Given R_1=5 KΩ, R_2=10 KΩ, V^+=5 V, V^-= - 5 V, diode cut-in voltage V_{D0}=0.7 V, diode resistance r_D =0, determine V_o, I_{D1} and I_{D2} for (a) V_i=0 V, (b) V_i=4 V. (12%) (Refer to Fig. P1.)
   (c). Draw the VTC (i.e. V_o vs V_i) plot, indicate the breakpoint point voltages and diode state (on or off) clearly.(13%)
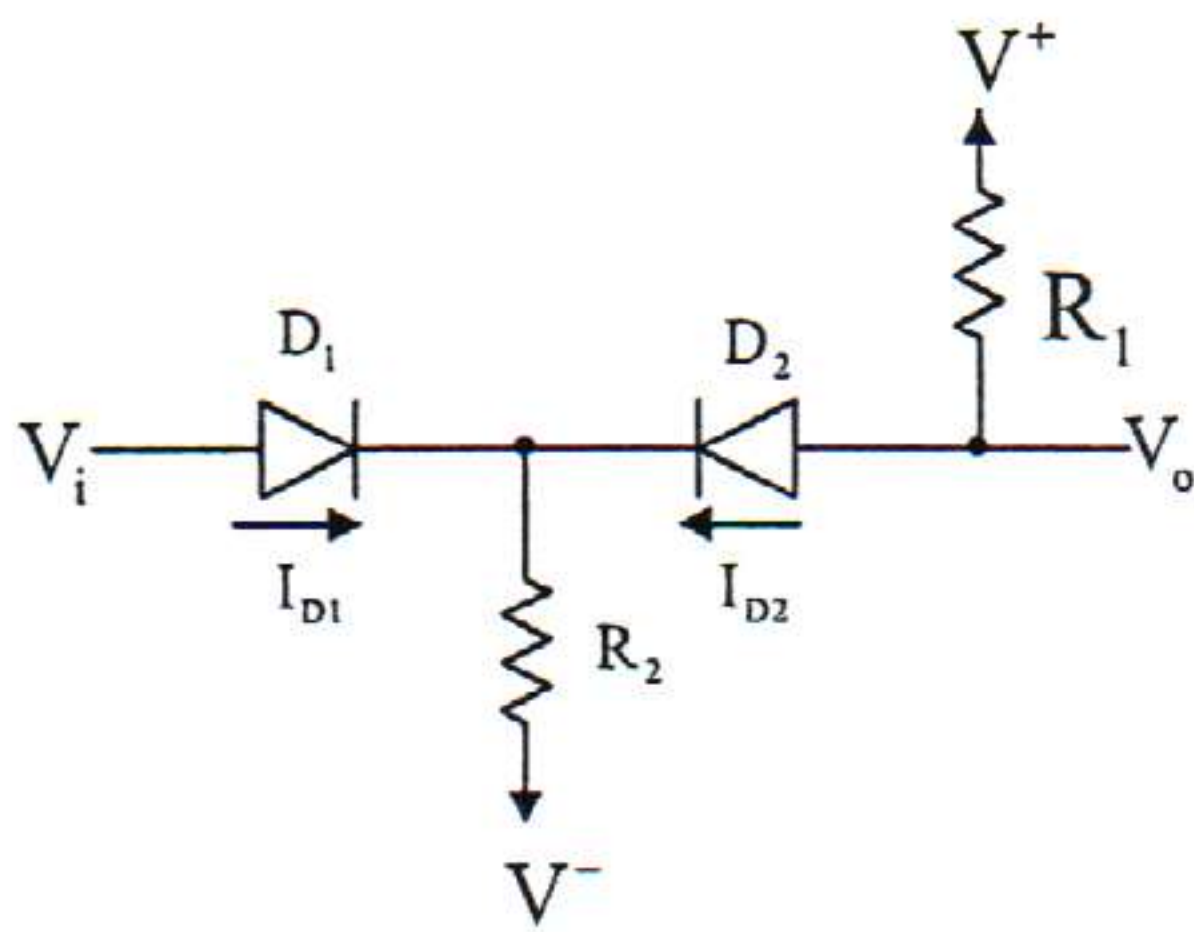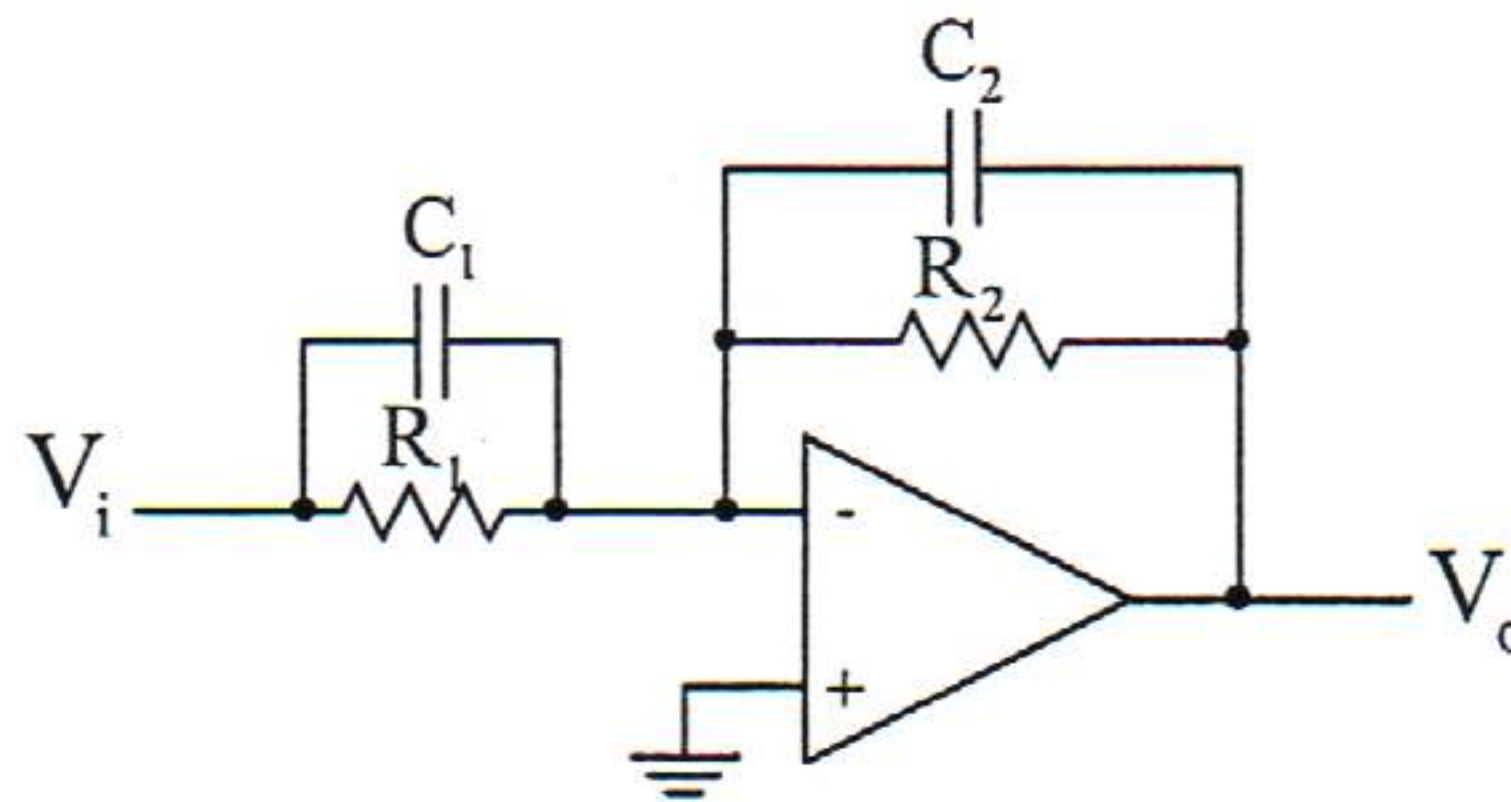

Fig. P1　　　　　　　　　　　　　Fig. P2

2. (a). Derive the transfer function $T(s)= V_o/ V_i$ of Fig. P2 (12%), in term of R, C, find the pole frequency ω_p, zero frequency ω_z ,dc gain and high frequency gain. (8%)
   (b). If $R_2C_2 > R_1C_1$ draw the magnitude Bode plot $|T(j\omega)|=|T(s)|_{s=j\omega}$ vs ω qualitatively. (5%)

3. Refer to Fig. P3, BJT, β=99, bias current I=1mA, $R_{sig} = 5K\Omega$, $R_B = 100K\Omega$, $R_C = 10K\Omega$, $R_E = 0.225K\Omega$ and $R_L = 10K\Omega$, neglect the BJT Early effect.
   (a). Draw the small-signal equivalent circuit (4%).
   (b). Calculate input resistance R_{in} (5%), midband voltage gain $G_v = \frac{v_o}{v_{sig}}$(16%).
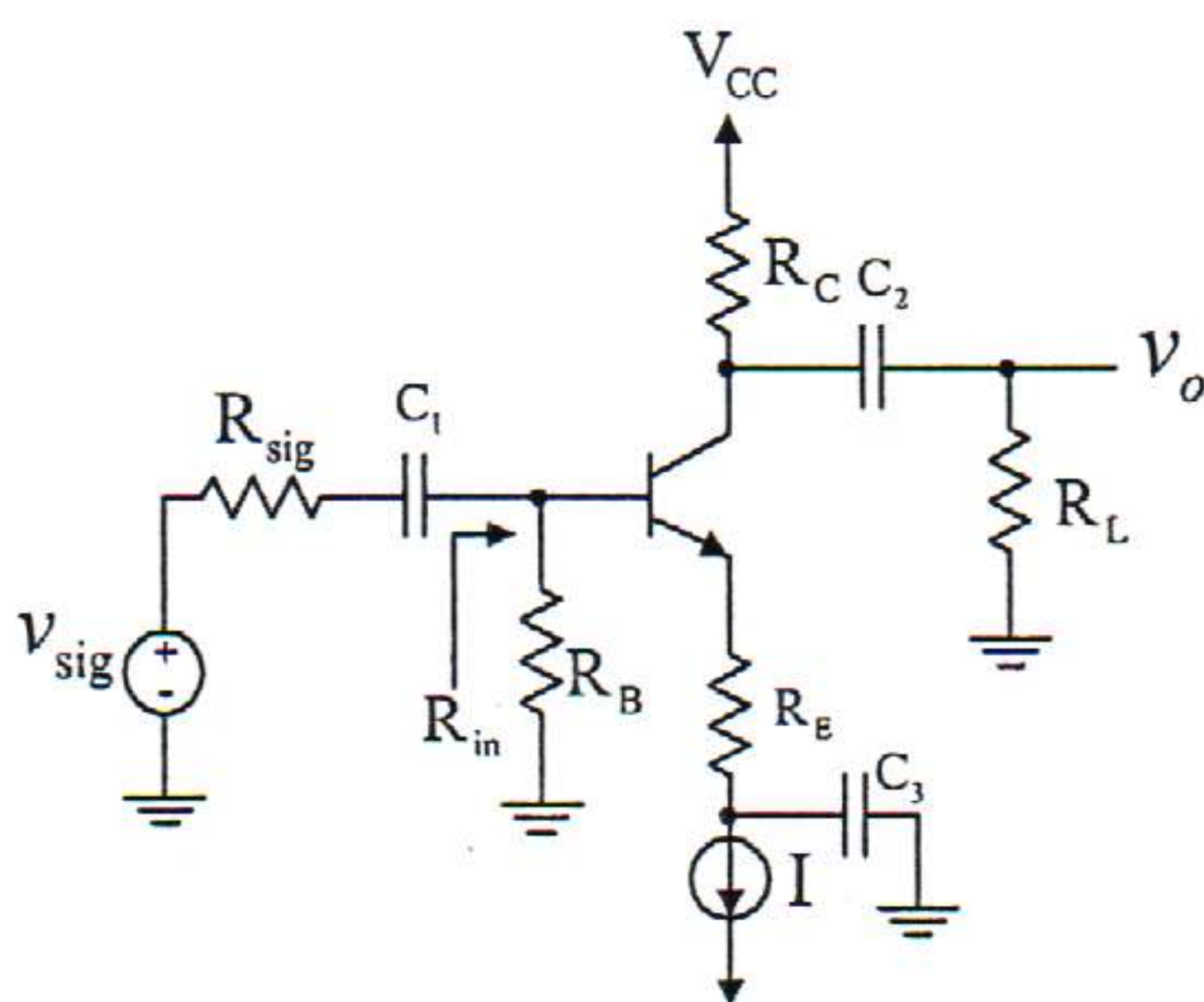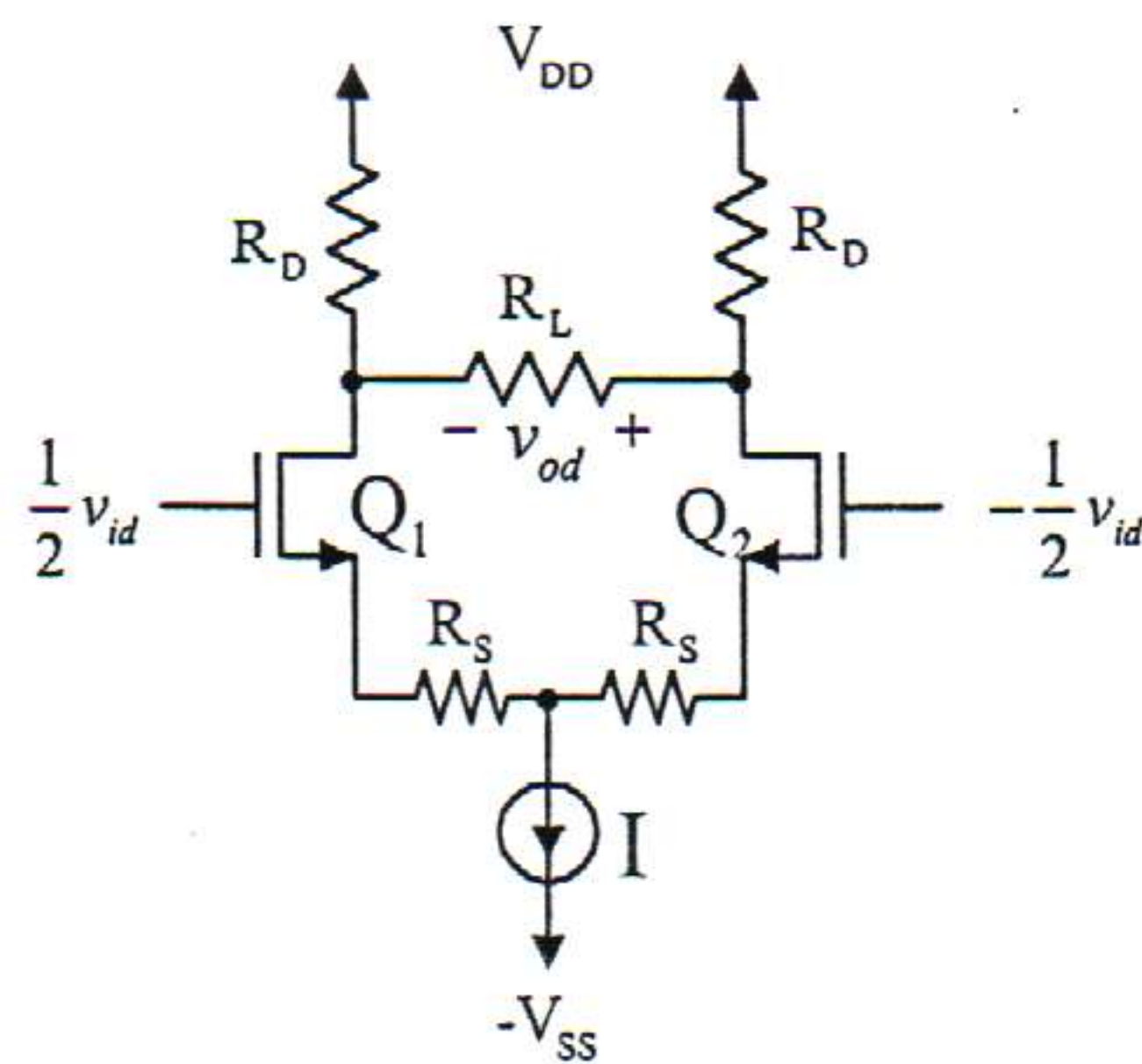

Fig. P3　　　　　　　　　　　　　Fig. P4

4. (a). Neglect r_o, draw the differential half-circuit of Fig. P4, derive the differential voltage gain $A_d = \frac{v_{od}}{v_{id}}$.(10%)
   (b). Given biasing current I=0.8 mA, MOS W/L=100, $\mu_n C_{ox} = 0.2mA/V^2$, $R_D = 10K\Omega$, $R_L = 20K\Omega$ $R_S = 0.125K\Omega$, calculate A_d .(15%)