

國立彰化師範大學 100 學年度碩士班招生考試試題

系所：電子工程學系，電信工程研究所

科目：電子學

☆☆請在答案紙上作答☆☆

共 1 頁，第 1 頁

1. For the circuit shown in Fig.1, assume C_{C1} and C_{C2} are large enough for ac signal coupling. Also β of the BJT is 100, Early voltage $V_A = \infty$, $V_{BE(on)} = 0.7\text{ V}$, $V_{CC} = 12\text{ V}$, $R_L = 2\text{ k}\Omega$, $R_E = 2\text{ k}\Omega$, $R_C = 4\text{ k}\Omega$, $R_1 = 20\text{ k}\Omega$, and $R_2 = 10\text{ k}\Omega$. (a) Determine the Q-point values (namely, V_{CE} , I_C , and I_B). (b) Find the small-signal voltage gain $A_v = v_o/v_s$. (V_T is 0.026 V at room temperature.) (20%)
2. For the common-gate circuit shown in Fig. 2, the n-MOSFET parameters are: $V_t = 1\text{ V}$, the conduction parameter $k_n = \frac{1}{2}\mu_n C_{ox} \frac{W}{L} = 3\text{ mA/V}^2$, and $V_A = \infty$. (a) Determine I_D and V_{DS} . (b) Calculate $g_m (= 2\sqrt{k_n I_D})$ and r_o . (c) Find the small-signal voltage gain $A_v = v_o/v_i$. (Assume C_{C1} and C_{C2} are large enough for ac signal coupling.) (20%)
3. For the voltage-to-current converter shown in Fig. 3, assume ideal op amp and design $R_3/R_2 = R_F/R_1$. Show that the load current $i_L = -v_I/R_2$, and is independent of the load impedance Z_L . (20%)
4. Consider a CS amplifier whose high frequency equivalent model shown in Fig. 4. The transistor has $W/L = 3.6\text{ }\mu\text{m}/0.18\text{ }\mu\text{m}$, $\mu_n C_{ox} = 200\text{ }\mu\text{A/V}^2$, the bias current is $200\text{ }\mu\text{A}$, $V_A = 3\text{ V}$, $C_{gs} = 20\text{ fF}$, $C_{gd} = 5\text{ fF}$, $C_L = 20\text{ fF}$, $R_L = 30\text{ k}\Omega$ and $R_{sig} = 10\text{ k}\Omega$. Find A_M , f_{3dB} , f_i , f_z . (20%)
5. Find the voltage gain and the input resistance of the amplifier shown in Fig. 5. Assume $\beta = 100$. (20%)

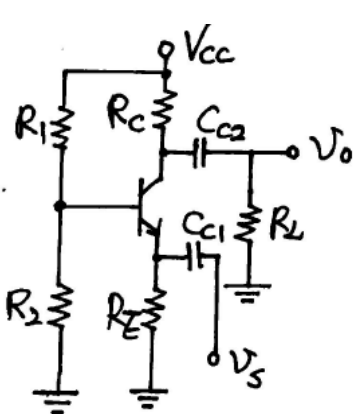


Fig. 1

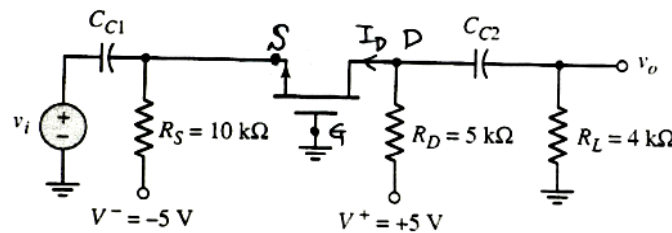


Fig. 2

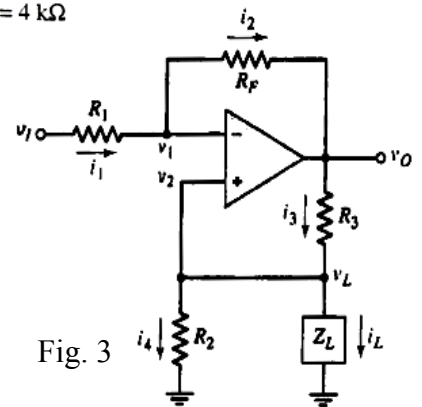


Fig. 3

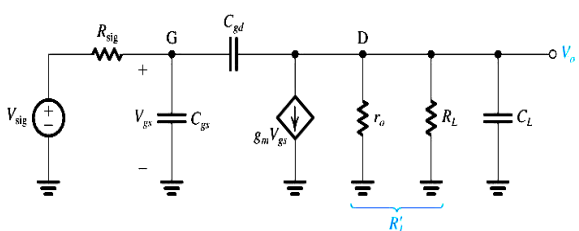


Fig. 4

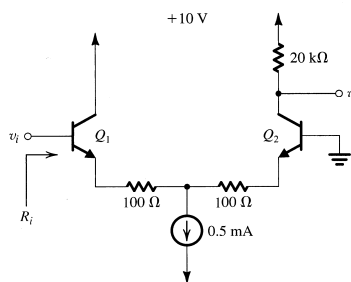


Fig. 5