國立臺灣科技大學
八十七學年度碩士班招生考試試題

所　別：電子工程技術研究所　　組別：元件與材料組　　科目：電子電路學
學程別：

1. Assume the B-E cut-in voltage for the transistor is 0.7 V, the C-E saturation voltage is 0.2 V for every transistor.

(a)The measured value of V_C is 6.34 V. Determine I_B I_E I_C V_{CE} and β for the circuit shown in Figure 1. (10%)

(b)Consider the circuit shown in Figure 2. Let $\beta = 150$, $R_E = 0.2$ KΩ. and $R_C = 1$ KΩ. Find R_1, R_2 such that the bias is stable and the quiescent output voltage is 0V. (10%)

Hint: for good bias stability $R_B \ll (1+\beta)R_E$.
Set $R_B = 0.1(1+\beta)R_E$ $R_B = R_1 \parallel R_2$

(c)Assuming $\beta = 50$, determine I_{BQ}, I_{CQ}, and V_{CEQ} for the circuit shown in Figure 3. (10%)

(d)Assume C is short to a-c signal. Determine the voltage gain, and input impedance for the circuit shown in Figure 3. (10%)

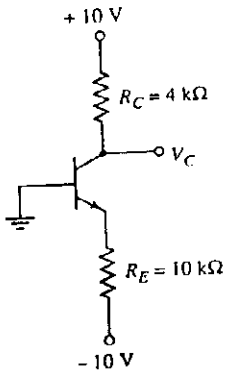

Figure 1

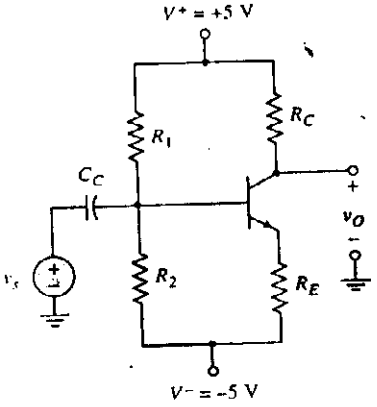

Figure 2

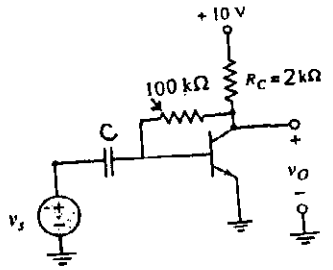

Figure 3

2. For the NMOS common-source amplifier shown in Figure 4, the transistor parameters are: V_{Th}=2V, K_n=1 mA/V^2, and λ=0. The circuit parameters are V_{DD}=12V, R_s=2KΩ, R_D=R_L=3KΩ, R_1=300KΩ, and R_2=200KΩ.

(a) Determine the quiescent values of I_D and V_{DS}. (5%)

(b) Find the small-signal voltage gain. (5%)

(c)Determine the maximum symmetrical swing in the output voltage. (10%).

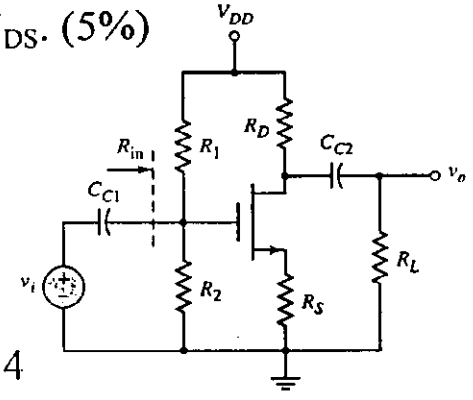

Figure 4

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3. For the circuit shown in Figure 5, the transistor parameters are: $V_{ThD} = 1V$, $V_{ThL} = -1V$, $K_{nD} = 1\ mA/V^2$, $K_{nL} = 0.2\ mA/V^2$, and $\lambda_D = \lambda_L = 0.01\ V^{-1}$. Assume the circuit is biased at $V_{DD} = 5V$.

(a) Analyze whether M_D and M_L are in saturation region or nonsaturation region when V_{GSD} increase from 0V to V_{DD}. Draw the voltage transfer characteristic curve. (10%)

(b) Find V_{GSD} and I_{DQ} such that the Q-point is in the middle of the saturation region. (10%)

(c) Determine the small-signal voltage gain. (5%)

Remark: M_L is a N-channel depletion mode MOSFET
M_D is a N-channel enhancement mode MOSFET

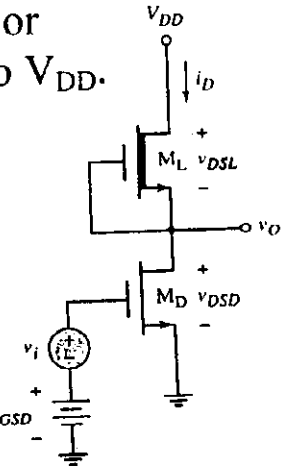

Figure 5

4. For the circuit shown in Figure 6, the parameters are: $R_S = 0.1\ K\Omega$, $R_1 = 20\ K\Omega$, $R_2 = 2.2\ K\Omega$, $R_E = 0.1\ K\Omega$, $R_c = 2\ K\Omega$, $C_C = 47\ \mu F$, and $V_{CC} = 10V$. The transistor parameters are $V_{BE(ON)} = 0.7\ V$, $\beta = 200$, and $VA = \infty$.

(a) Determine the corner frequency. (5%)

(b) Calculate the midband gain. (5%)

(c) Draw Bode plots for this circuit. (5%)

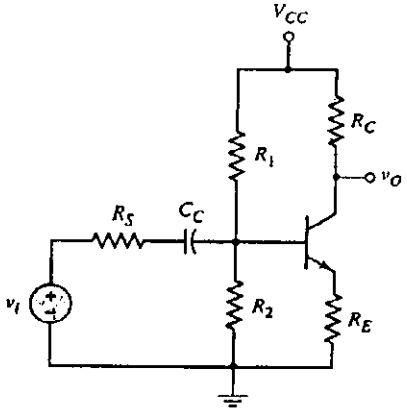

Figure 6