

國立臺灣師範大學 101 學年度碩士班招生考試試題

科目：電子學

適用系所：工業教育學系

注意：1.本試題共 4 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則不予計分。

1. Consider the BJT cascode amplifier of Fig. 1 when biased at a current of 0.1 mA. Assuming that *npn* transistors have $\beta = 100$ and Early voltage $V_A = 4$ V and that *pnp* transistors have $\beta = 50$ and Early voltage $|V_A| = 3$ V, find R_{in} , R_{on} , R_{op} , and the voltage gain A_v . (Assume that the thermal voltage $V_T = 25$ mV) (20 分)

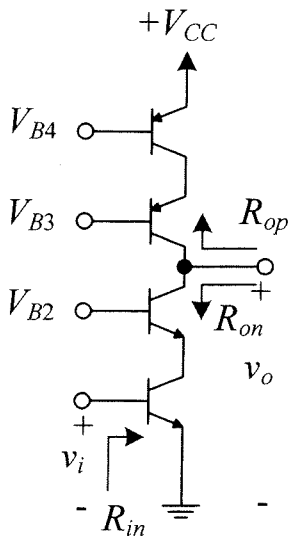


Fig. 1

2. Consider the MOS differential amplifier of Fig. 2 when biased at a current $I = 0.4$ mA. Assuming that the transistors have a W/L ratio of 100, the process transconductance parameter $k'_n = 0.1$ mA/V², Early voltage $V_A = 20$ V and that $R_D = 10$ k Ω , find the overdrive voltage V_{OV} and the differential voltage gain $A_d \equiv v_{od} / v_{id}$. (10 分)

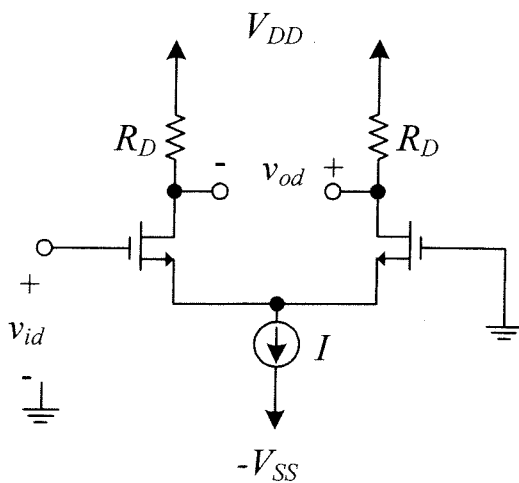


Fig. 2

3. Fig. 3a shows a feedback amplifier. (20 分)

(a) Determine its feedback topology.

(b) Draw the feedback network.

(c) Assuming that the feedback network in (b) can be represented by the network as shown in Fig. 3b, determine the components p_{11} , p_{22} , and p_{12} .

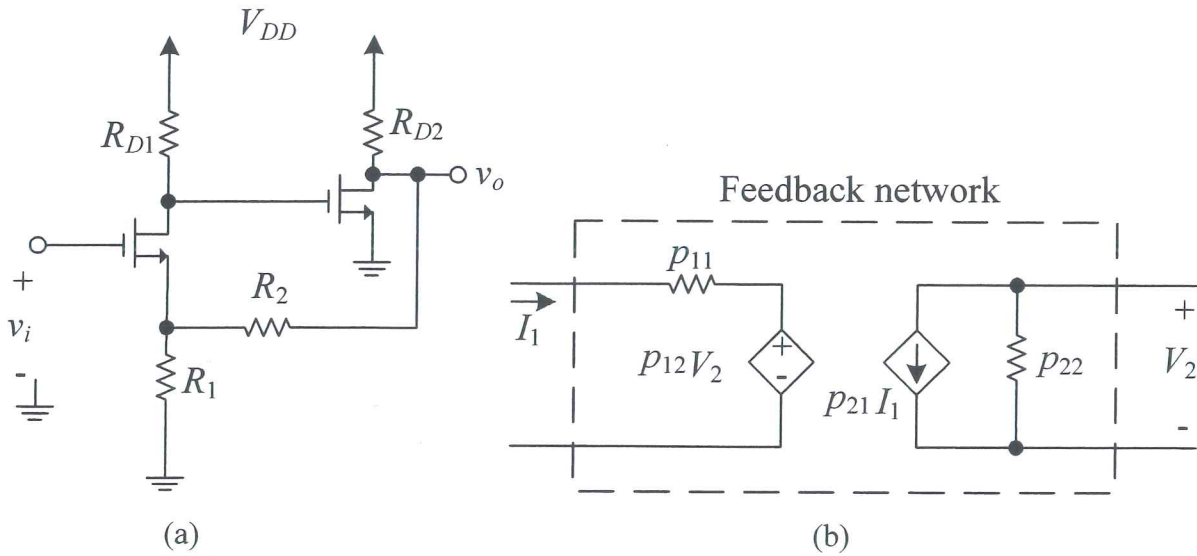


Fig. 3

國立臺灣師範大學 101 學年度碩士班招生考試試題

4. The circuit with ideal OP as shown in the fig. 4,

(a) Find the transfer function (for physical frequency) $T(j\omega) = v_o/v_i$. (5 分)

(b) Solve the magnitude response $|T(j\omega)|$. (3 分)

(c) Solve the phase response $\angle T(j\omega)$. (3 分)

(d) Plot bode plot : Magnitude response (5 分) and phase response. (5 分)

(e) What kind of filter is it? (3 分)

(f) Find the dc gain of the circuit (Gain at frequency equals zero). (3 分)

(g) Find the 3-dB frequency. (3 分)

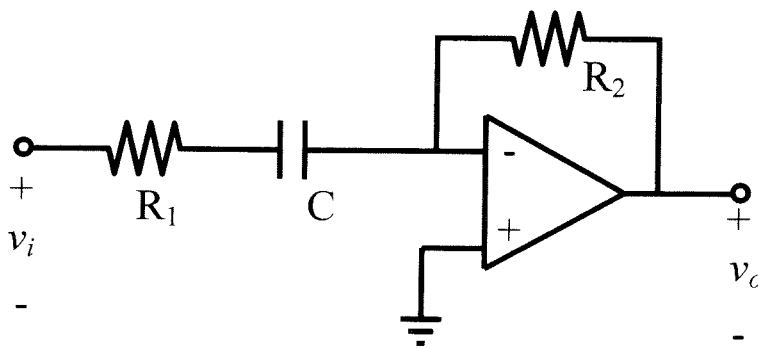


Fig. 4

5. Fig. 5 shows a common-emitter amplifier. Input signal v_{sig} is a small signal sine-wave signal. Assume the current source to be ideal, $\beta = 100$, and $V_T = 25$ mV. Neglect the early effect.

(a) Replace the BJT with its hybrid-model and sketch the small-signal equivalent circuit of the common-emitter amplifier. (5 分)

(b) Find the value of the input resistor R_{in} . (5 分)

(c) Find the value of the small-signal gain v_o/v_{sig} . (5 分)

(d) If the amplitude of the signal v_{be} is limited to 1 mV, what is the largest signal amplitude of the input signal v_{sig} ? (5 分)

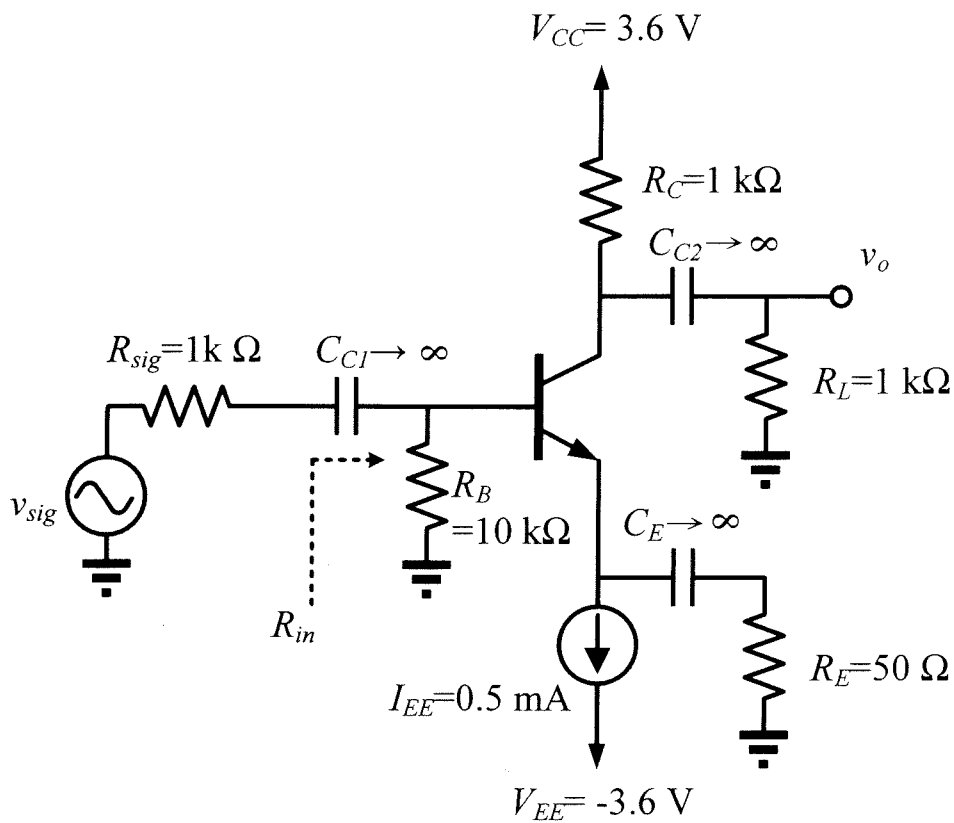


Fig. 5