國立臺灣師範大學 100 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 3 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. For the series-series feedback amplifier in Fig. 1, the op amp is characterized by an open-loop voltage gain $\mu=10^5$ V/V, an input differential resistance R_{id}=10 kΩ, and an output resistance r_O=100 Ω. The amplifier supplies a current i_O to a load of resistor R_L=1 kΩ. The feedback network is composed of resistors r=100 Ω, R_2=10 kΩ, and R_1=100 Ω. It is required to find (30 分)
   (a) the gain-with-feedback $A_f \equiv i_O/v_S$,
   (b) the input resistance R_{in}, and
   (c) the output resistance R_{out}.

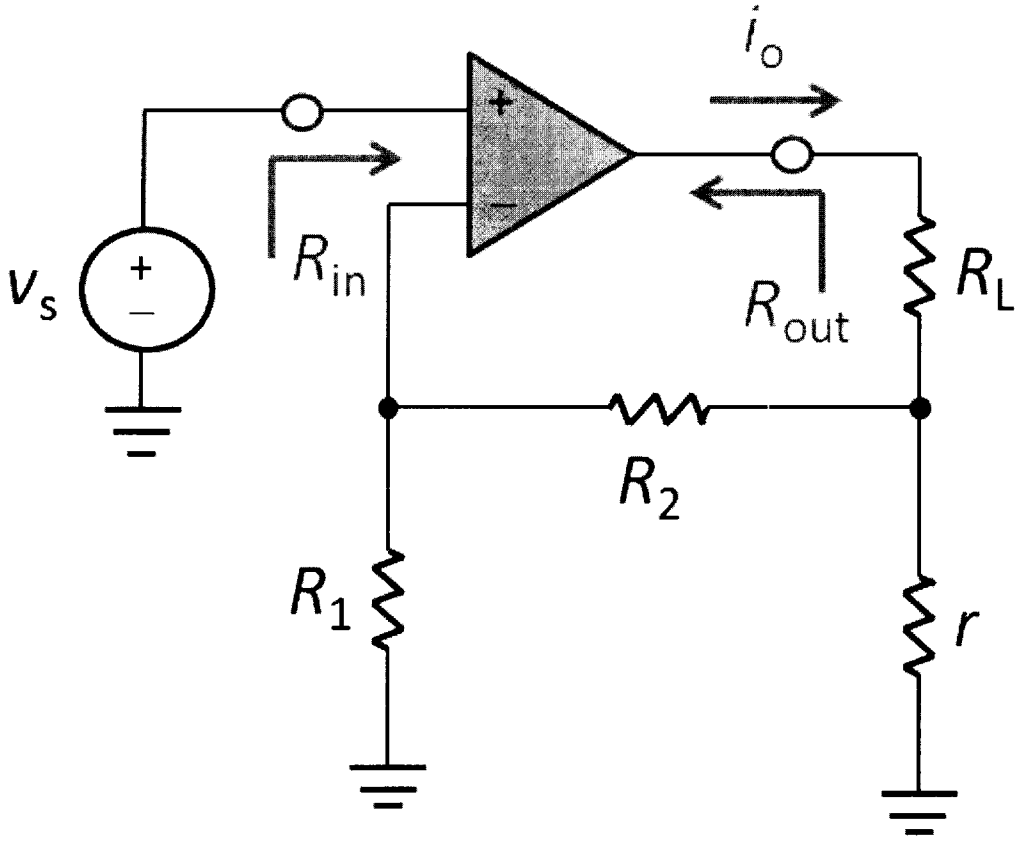

Fig. 1

2. Find the voltage gain v_O/v_i and the input resistance R_i of the amplifier shown in Fig. 2 assuming β=100. (20 分)

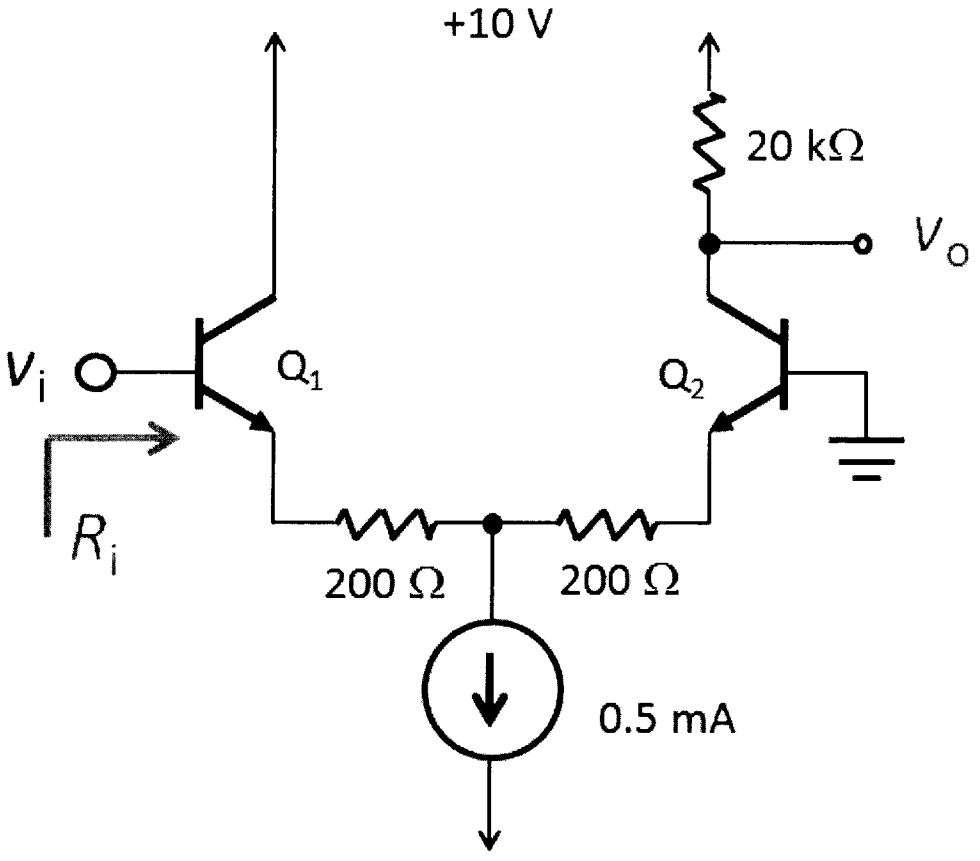

Fig. 2

3. The open-loop gain of an internally compensated op amp is 86 dB at very low frequencies and is 60 dB at 200 kHz. Estimate the 3-dB frequency and the unity-gain frequency of the op amp. (10 points)

4. In Fig. 3, v_{sig} is a small sine-wave signal with zero average. Assume that the PMOS has a very large output resistance r_o and a threshold voltage V_{tp} = -0.6 V. (20 points)
   (a) Find a value for R_S to bias the transistor at the drain current I_D = 0.5 mA and the overdrive voltage $|V_{OV}|$ = 0.4 V.

(b) Find a value for R_D to result in the voltage gain $\frac{v_o}{v_{sig}} = -15$ V/V.

(c) Explain the body effect? Does this circuit have the body effect? Reason your answer.

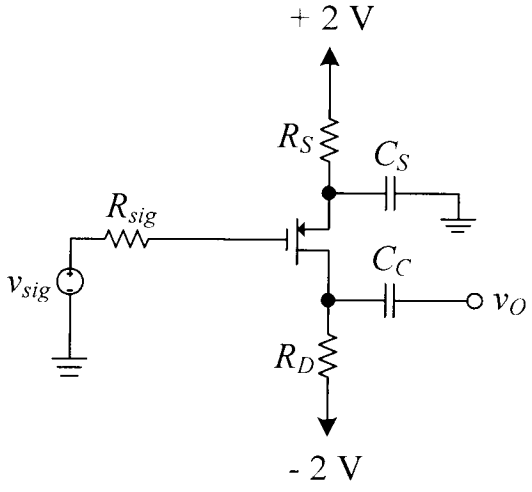

Fig. 3

5. Figure 4 shows a differential amplifier. Sketch the differential half-circuit for this circuit and use it to derive an expression for the differential gain $A_d \equiv v_{od}/v_{id}$ in terms of g_m, R_D, and R_S. Neglect the Early effect. (20 points)

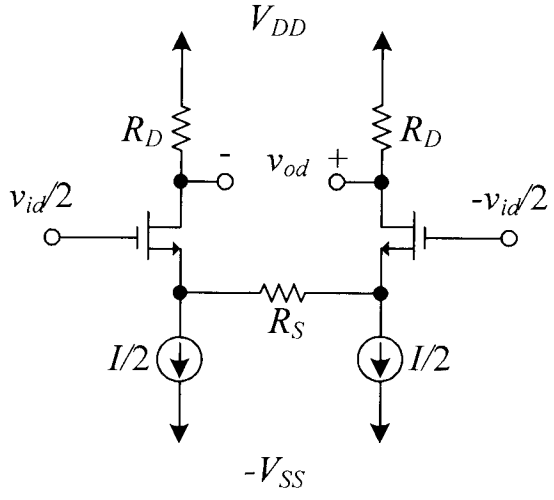

Fig. 4