

國立臺灣科技大學

八十九學年度碩士班招生考試試題

系所組別：電機工程系乙二組

科目：電子學

1. Consider the circuit in Figure 1. Find the voltage gain v_o/v_i . (10%)

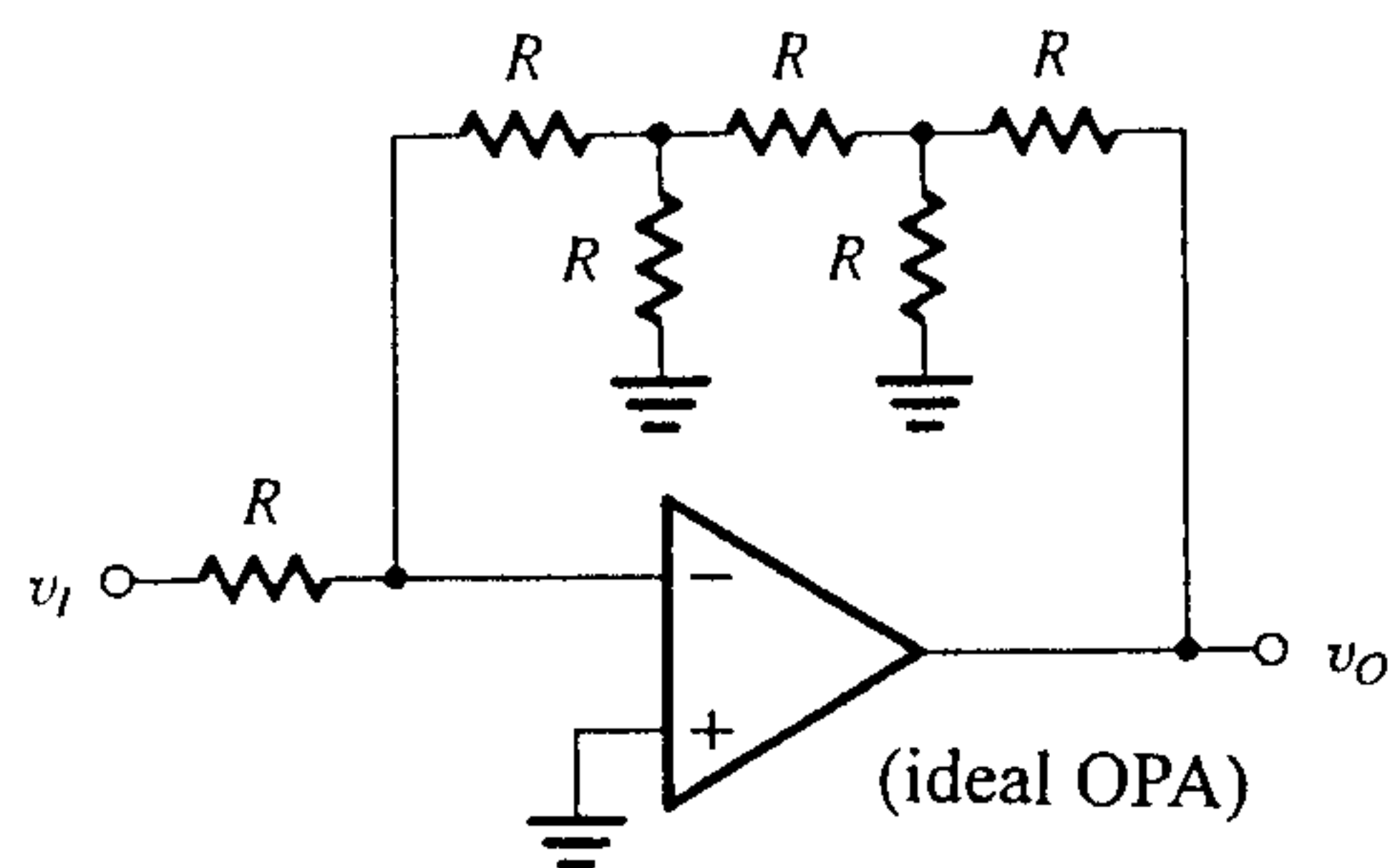


Figure 1

2. For the circuit in Figure 2:

- (1) Find the dc emitter current and g_m , r_e , and r_π . Use $\beta = 100$. (10%)
- (2) Replace the BJT with its hybrid- π model (neglecting r_o) and analyze the circuit to determine the input resistance R_i and the voltage gain v_o/v_s . (5%)
- (3) Repeat (2) for the case when capacitor C_B is open-circuited. Compare the results with those obtained in (2). (5%)

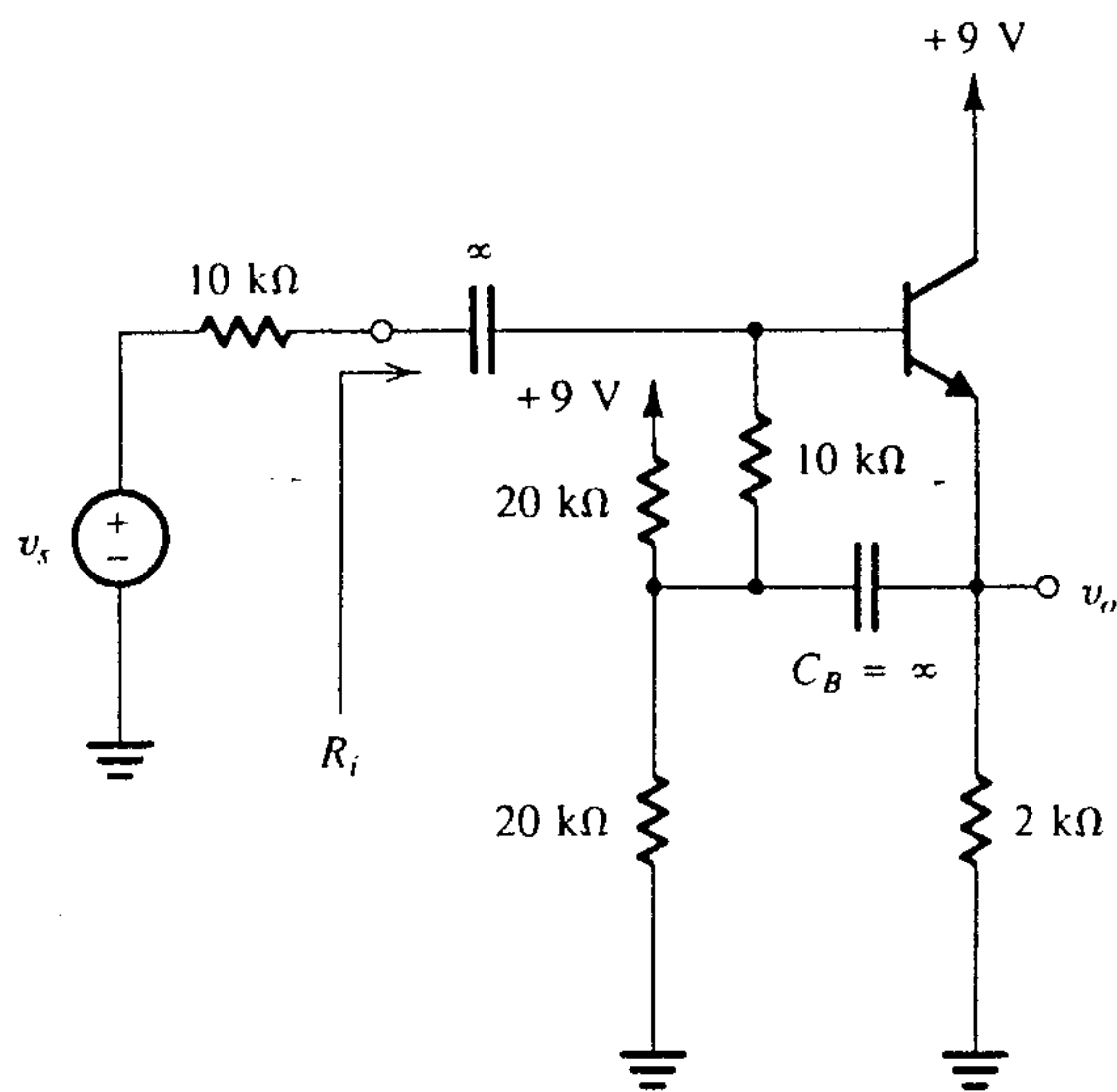


Figure 2



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3. For the differential amplifier shown in Figure 3, identify and sketch the differential half-circuit and the common-mode half-circuit. Find the differential gain, the differential input resistance, the common-mode gain, and the common-mode input resistance. For these transistors, $\beta = 100$, and $V_A = 100V$. (20%)

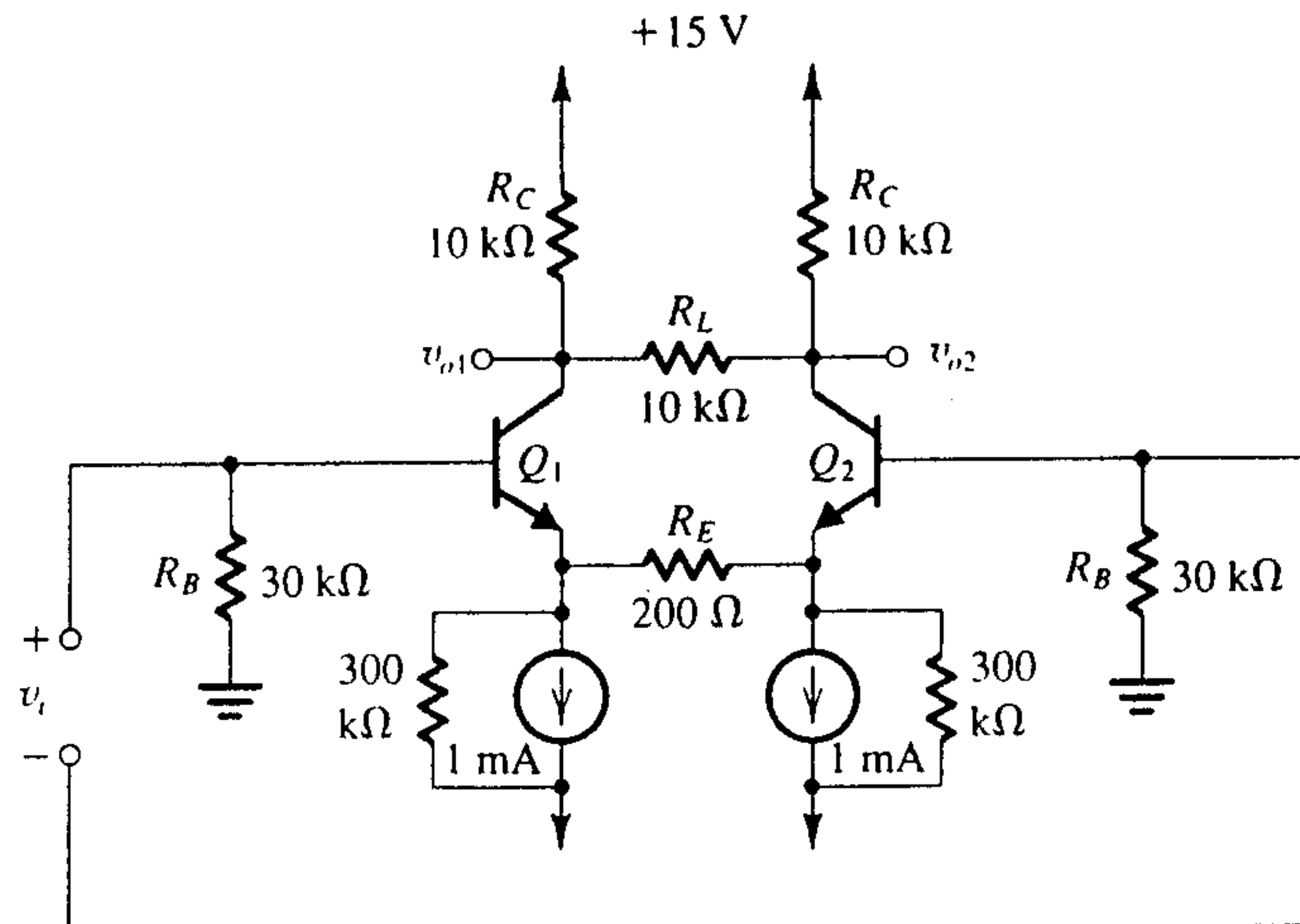


Figure 3

4. The circuit shown in Figure 4 is one kind of feedback amplifier.

(a) What is the feedback type of this circuit? (5%)

(b) Determine the **approximate** small-signal gain $A_f = \frac{I_o}{I_s}$. Although the problem provides all detail parameters of the circuit, try to get the answer by a simple method rather than precise calculation. [Hint: $A_f \approx \frac{1}{\text{feedback factor}}$] (10%)

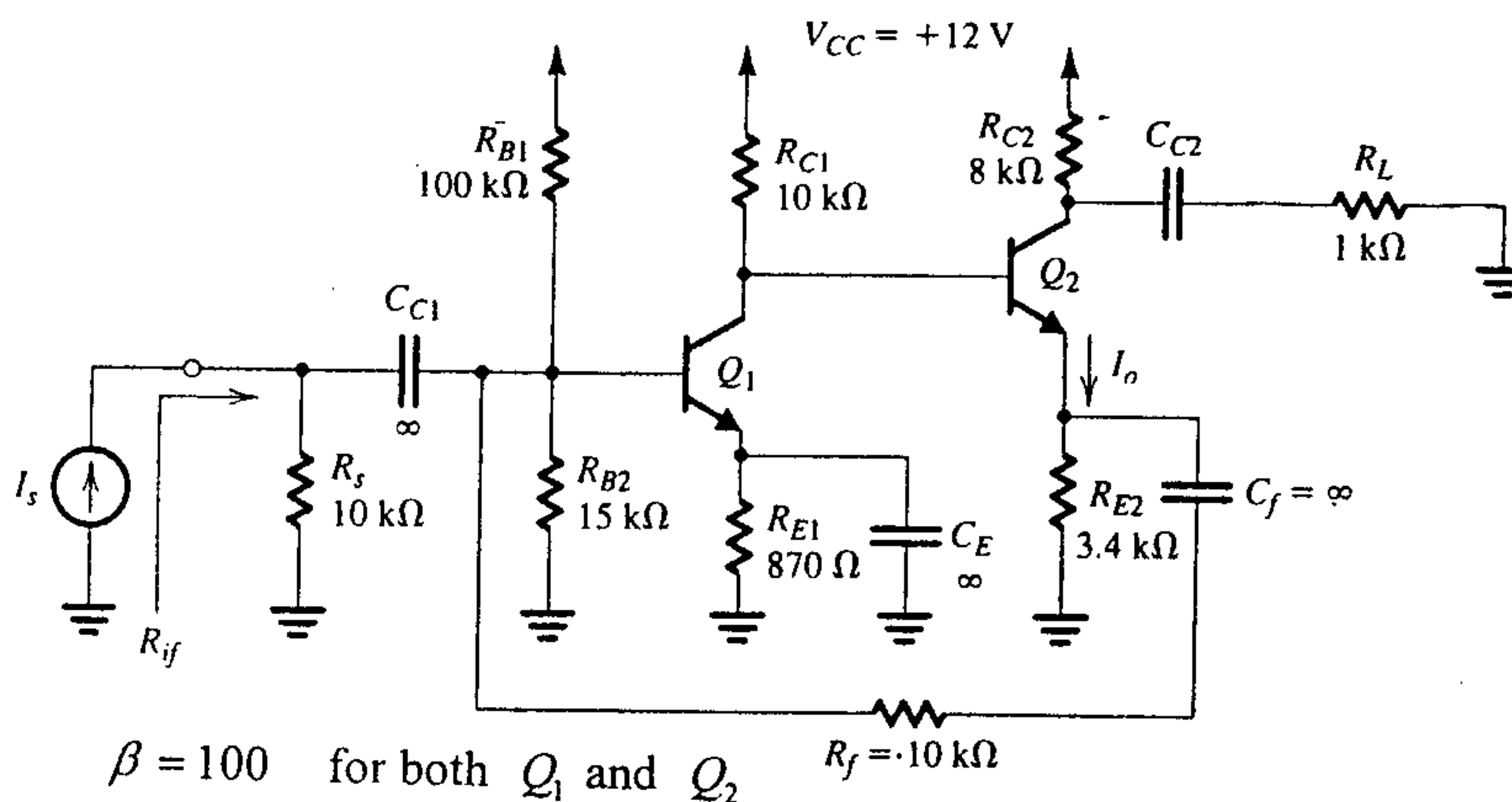


Figure 4



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5. For the circuit shown in Figure 5,

- (a) derive the transfer function $T(s) = \frac{V_o(s)}{V_i(s)}$. (10%)
- (b) Sketch the Bode plots for $T(s)$. (10%)
- (c) Can you give a name for this circuit? (5%)

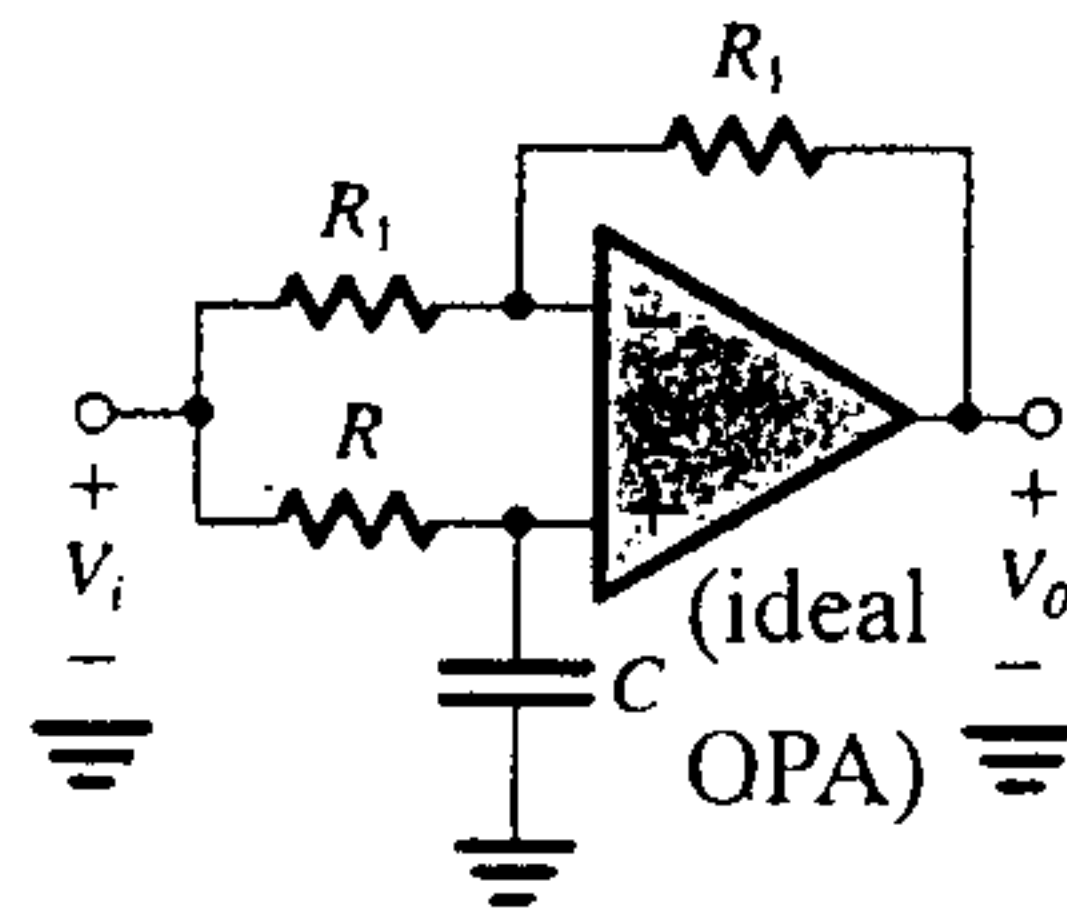


Figure 5

6. Sketch the transfer characteristics of the circuit in Figure 6. (10%)

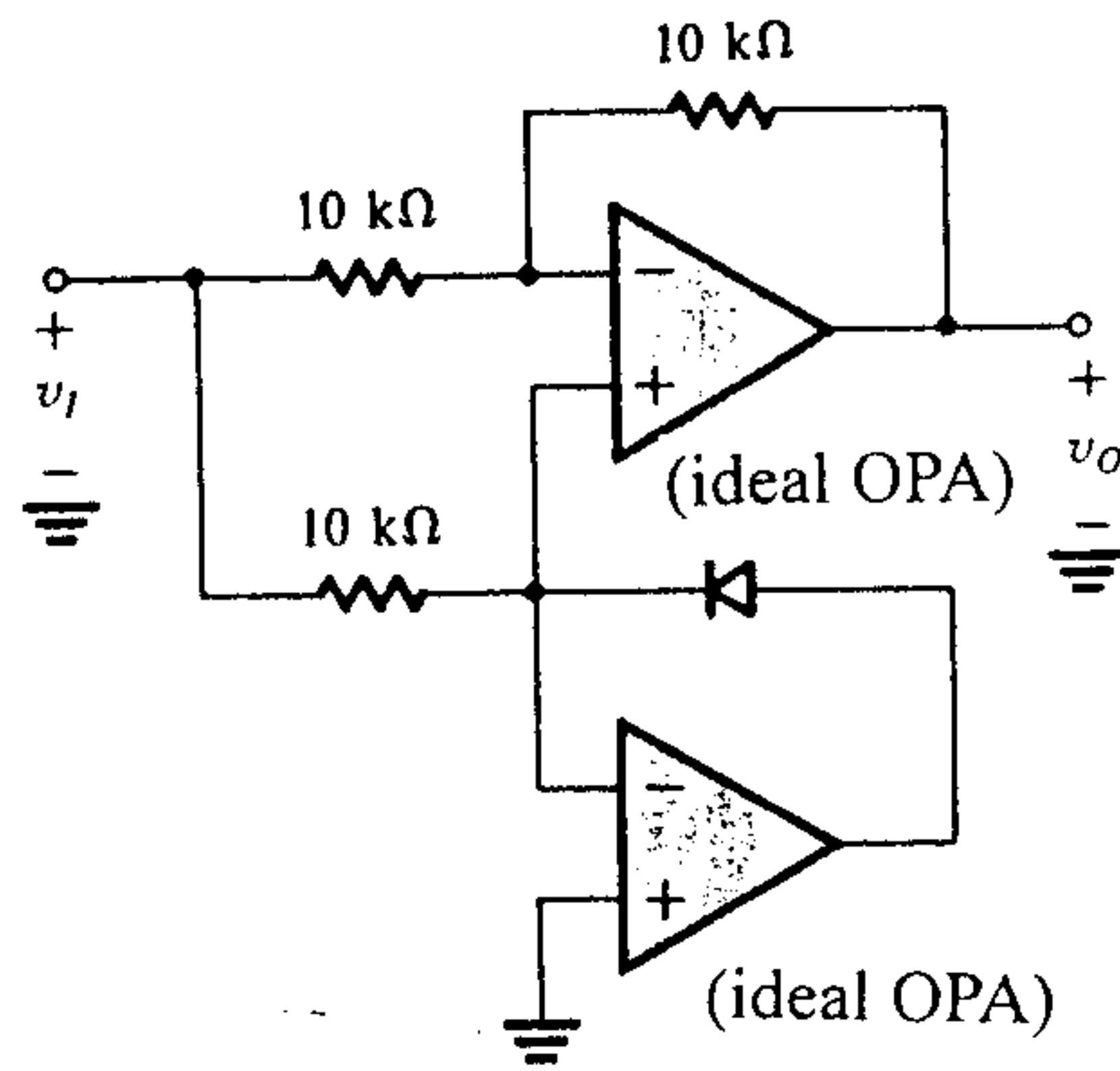


Figure 6

