Repaso Examen 1

4202 - Primer semestre 2009-2010

Bajas frecuencias

- Método complejo: reemplazar cada condensador externo por impedancia y analizar
- Método simplificado: desde los terminales de cada condensador
  - buscar resistencia equivalente R_{EQ}
  - calcular frecuencias de los polos

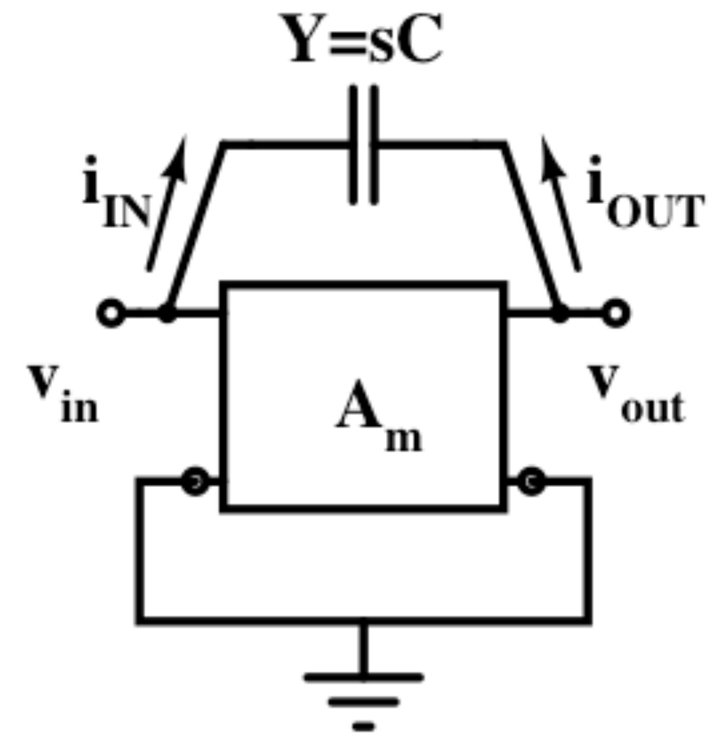
$$f_L = \frac{1}{2\pi R_{EQ} C}$$

  - para condensador de bypass, calcular frecuencia del cero

$$f_Z = \frac{1}{2\pi R_E C}$$

  - frecuencia polo mas alta es la dominante y determina el ancho de banda

Efecto de Miller



<u>Entrada</u>

$$\begin{aligned} i_{IN} &= Y(v_{IN} - v_{OUT}) \\ &= sC(1 - A_M)v_{IN} \end{aligned}$$

Actúa como un condensador $C(1\text{-}A_M)$

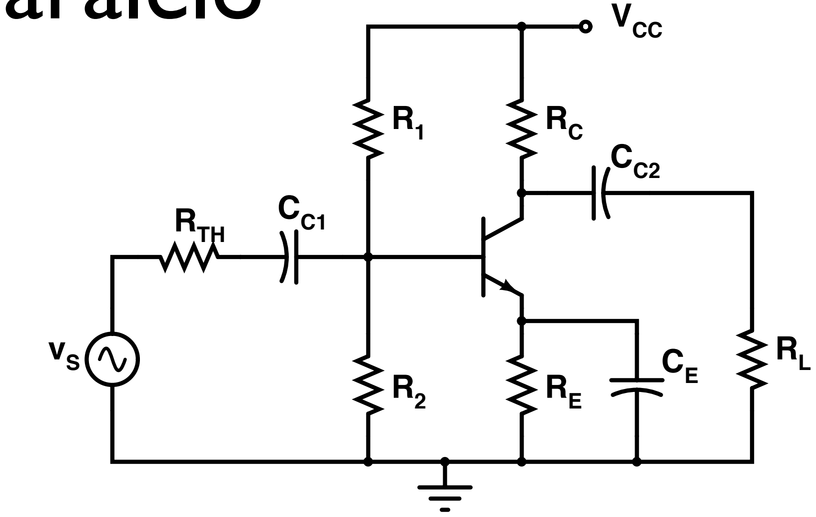
<u>Salida</u>

$$\begin{aligned} i_{OUT} &= Y(v_{OUT} - v_{IN}) \\ &= sC\left(1 - \frac{1}{A_M}\right)v_{OUT} \end{aligned}$$

Actúa como un condensador $C(1\text{-}1/A_M) \approx \text{-}C/A_M$

Frecuencias altas - CE/CS

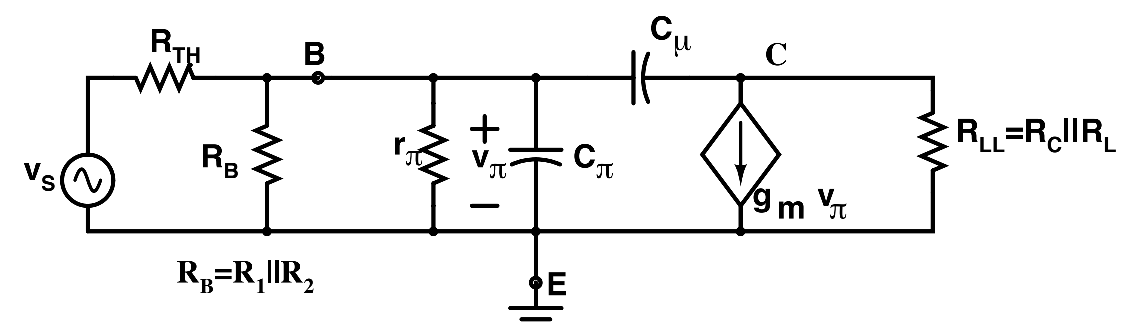
- Usar Miller para reemplazar C_μ con una capacitancia equvalente que aparece en paralelo con C_π



- $C_M = C_\pi + (1 - A_M)C_\mu$
  - A_M es usualmente $-g_m R'_L$ para CE/CS
  - $R'_L = R_L || R_C$ = carga equivalente en ac
- Determine polo de alta frecuencia usando

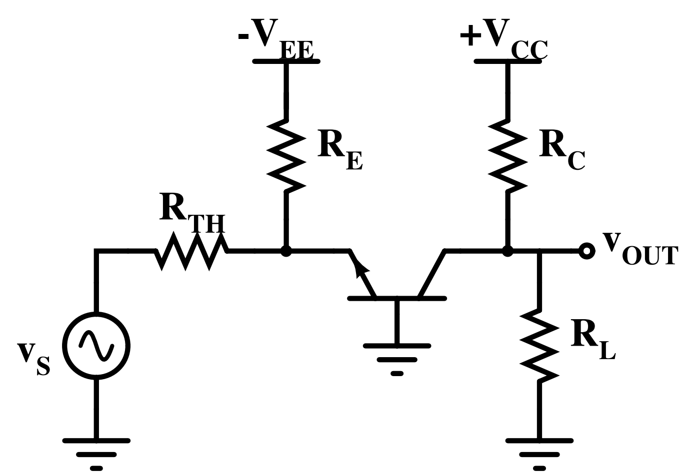
$$f_H = \frac{1}{2\pi C_M R_{EQ}}$$

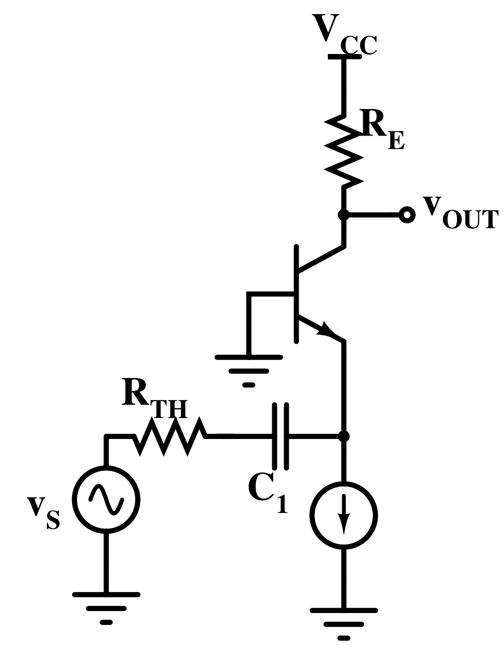
- R_{EQ} = res. equivalente desde terminales de C_M



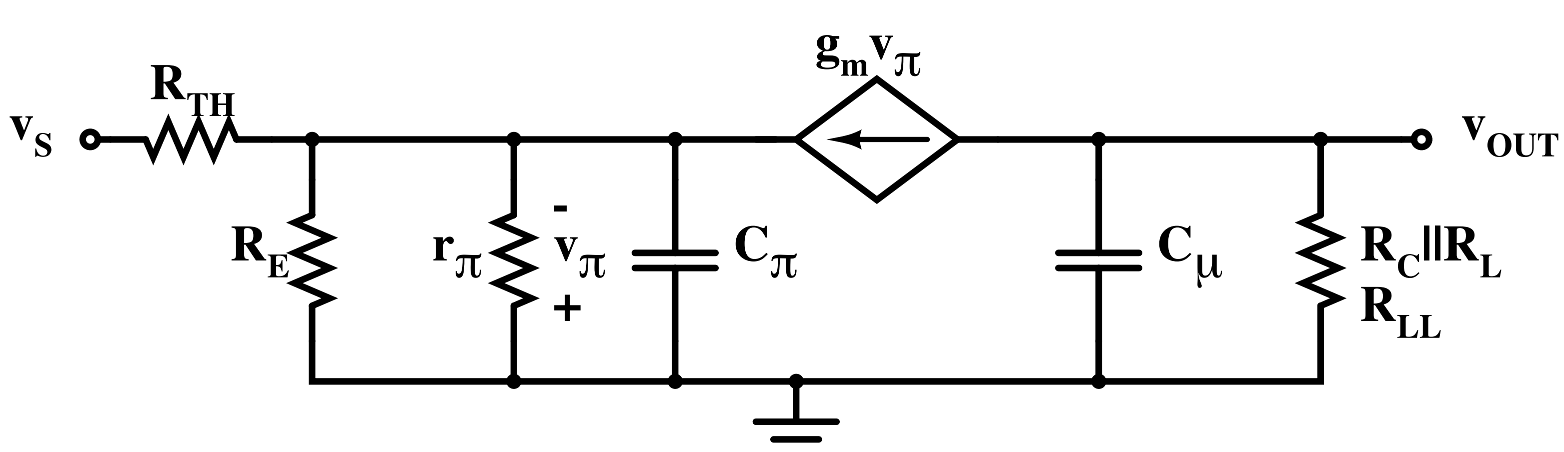
Common-base/-gate

- $A_v = \frac{v_c}{v_e}$
- $C_\pi \rightarrow$ emisor a tierra
- $C_\mu \rightarrow$ colector a tierra
- dos polos

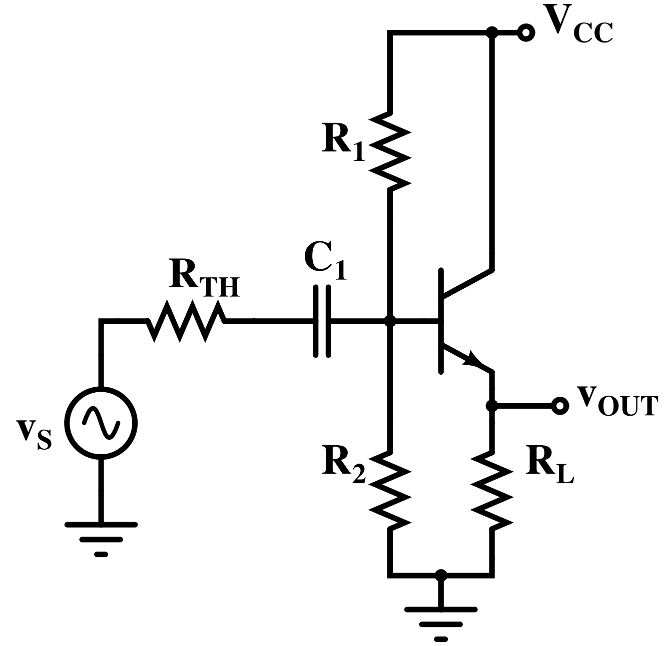


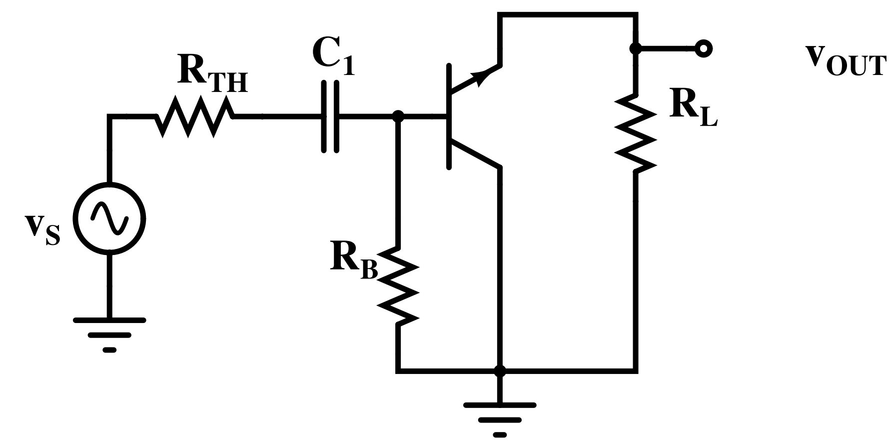


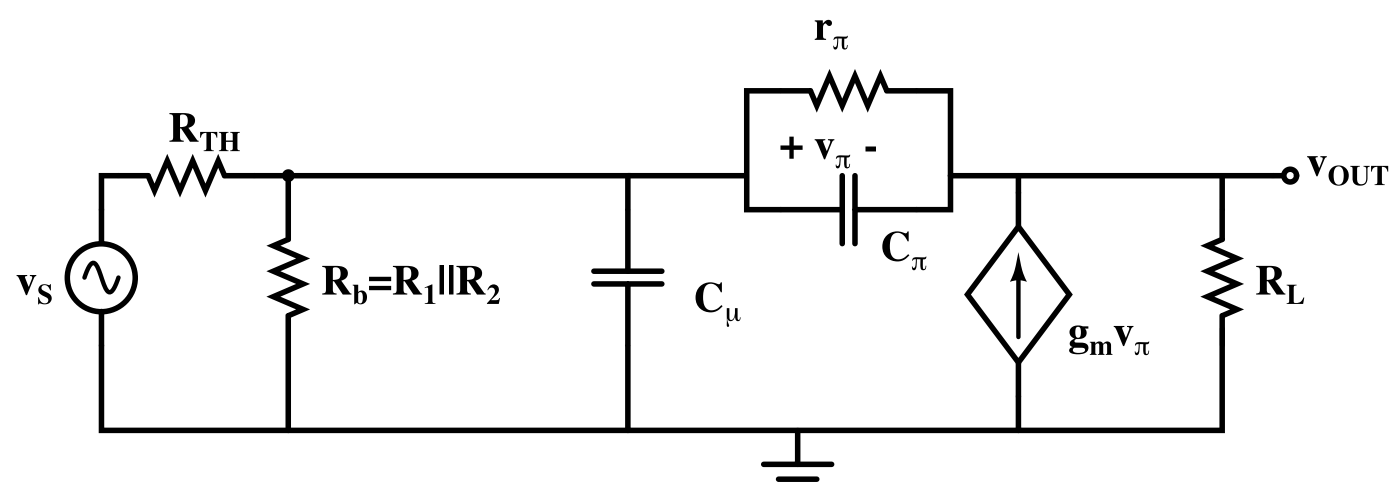
$$f_{H1} = \frac{1}{2\pi C_\mu R_{EQ,1}} \qquad f_{H2} = \frac{1}{2\pi C_\pi R_{EQ,2}}$$



Common-collector/common-drain





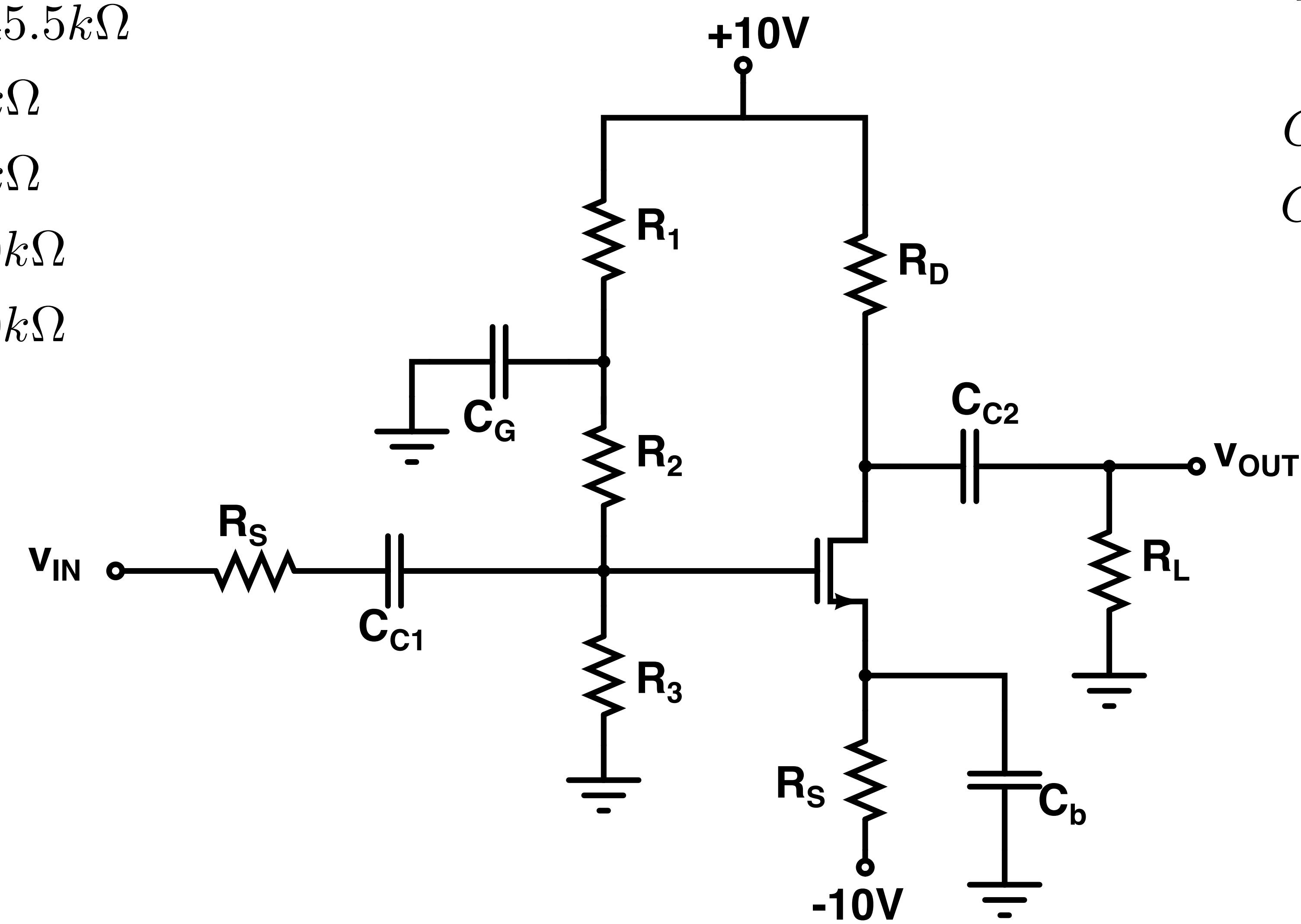


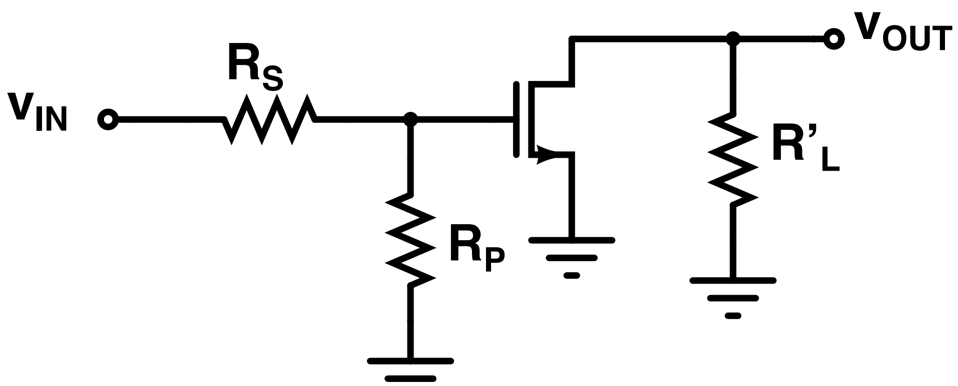
- $A_M = \frac{v_e}{v_b} = \frac{g_m R_L}{1+g_m R_L}$
- Aplicar Miller aun cuando $A_M < 1$
- Capacitancia equivalente en la entrada: $C_{eq} = C_\mu + \frac{C_\pi}{1+g_m R_L}$

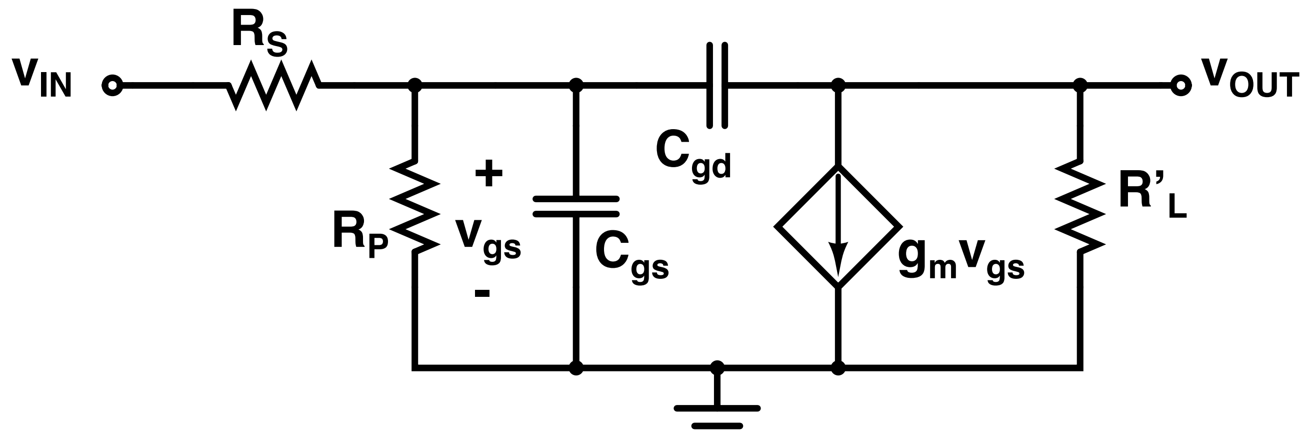
Ejemplo

$$R_1 = 179.5k\Omega$$
$$R_2 = 179k\Omega$$
$$R_3 = 145.5k\Omega$$
$$R_S = 2k\Omega$$
$$R_D = 3k\Omega$$
$$R_L = 10k\Omega$$
$$R_S = 10k\Omega$$

$$K_N = 1.2mA/V^2$$
$$V_{TN} = 2V$$
$$\lambda = 0$$
$$C_{gs} = 5pF$$
$$C_{gd} = 0.8pF$$







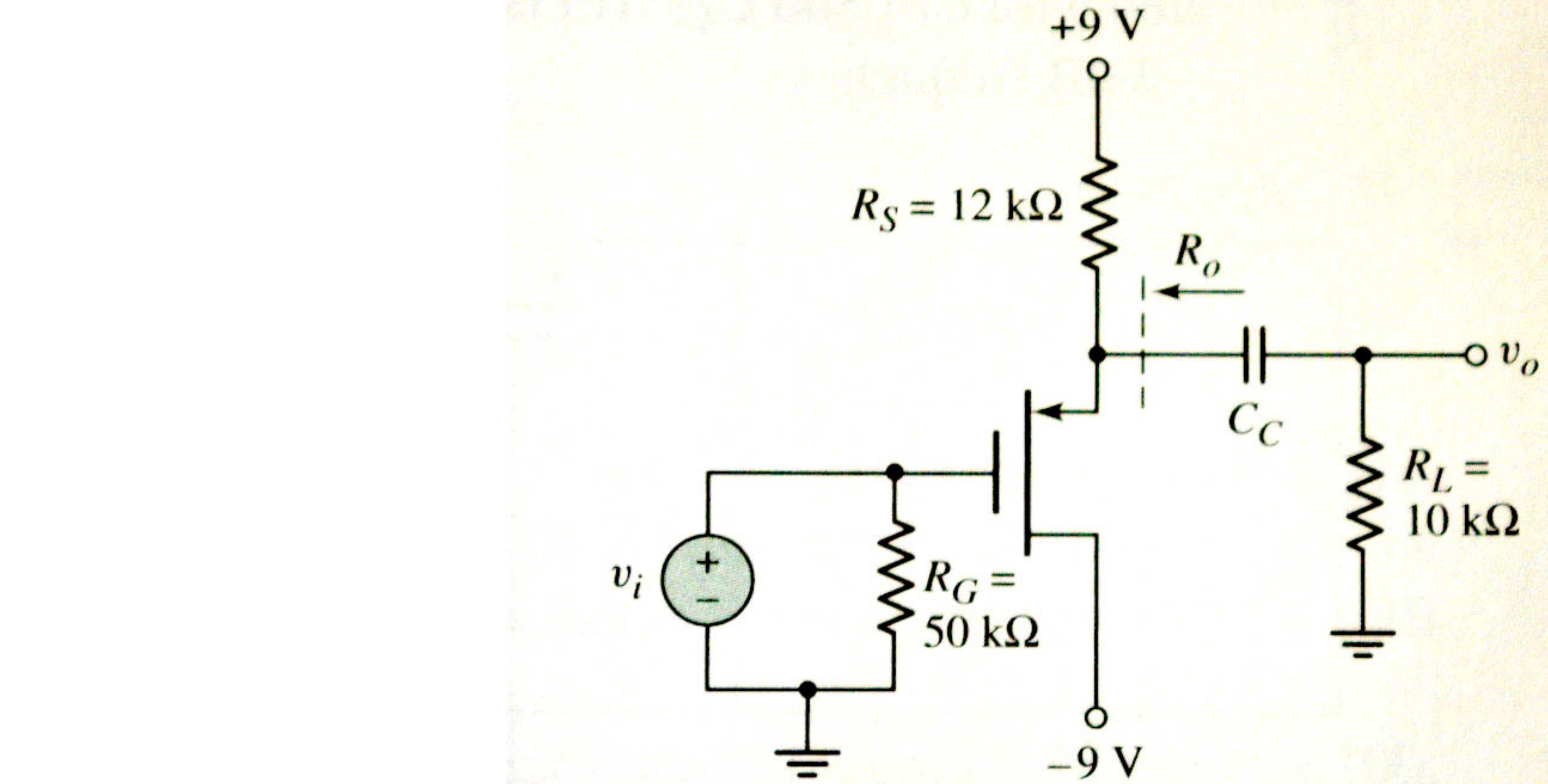


Figure P7.16

*D7.16 The transistor in the circuit in Figure P7.16 has parameters $K_p = 0.5\ \text{mA/V}^2$, $V_{TP} = -2$ V, and $\lambda = 0$. (a) Determine R_o. (b) What is the expression for the circuit time constant? (c) Determine C_C such that the lower 3 dB frequency is 20 Hz.

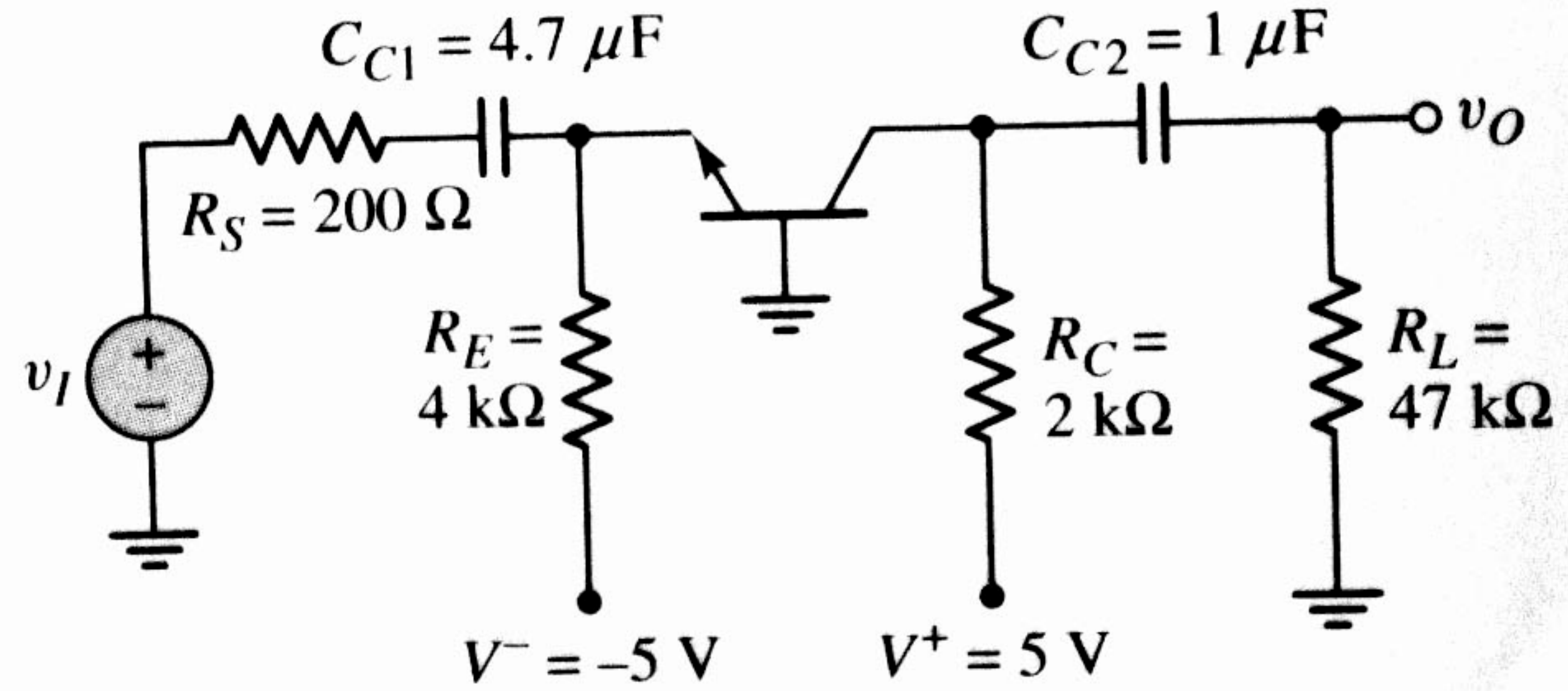


Figure P7.18

7.18 The parameters of the transistor in the circuit in Figure P7.18 are $V_{BE}(\text{on}) = 0.7$ V, $\beta = 100$, and $V_A = \infty$. (a) Determine the quiescent and small-signal parameters of the transistor. (b) Find the time constants associated with C_{C1} and C_{C2}. (c) Is there a dominant -3 dB frequency? Estimate the -3 dB frequency.

7.20 The parameters of the transistor in the circuit in Figure P7.20 are $K_p = 1\ \text{mA/V}^2$, $V_{TP} = -1.5$ V, and $\lambda = 0$. (a) Determine the quiescent and small-signal parameters of the transistor. (b) Find the time constants associated with C_{C1} and C_{C2}. (c) Is there a dominant pole frequency? Estimate the -3 dB frequency.

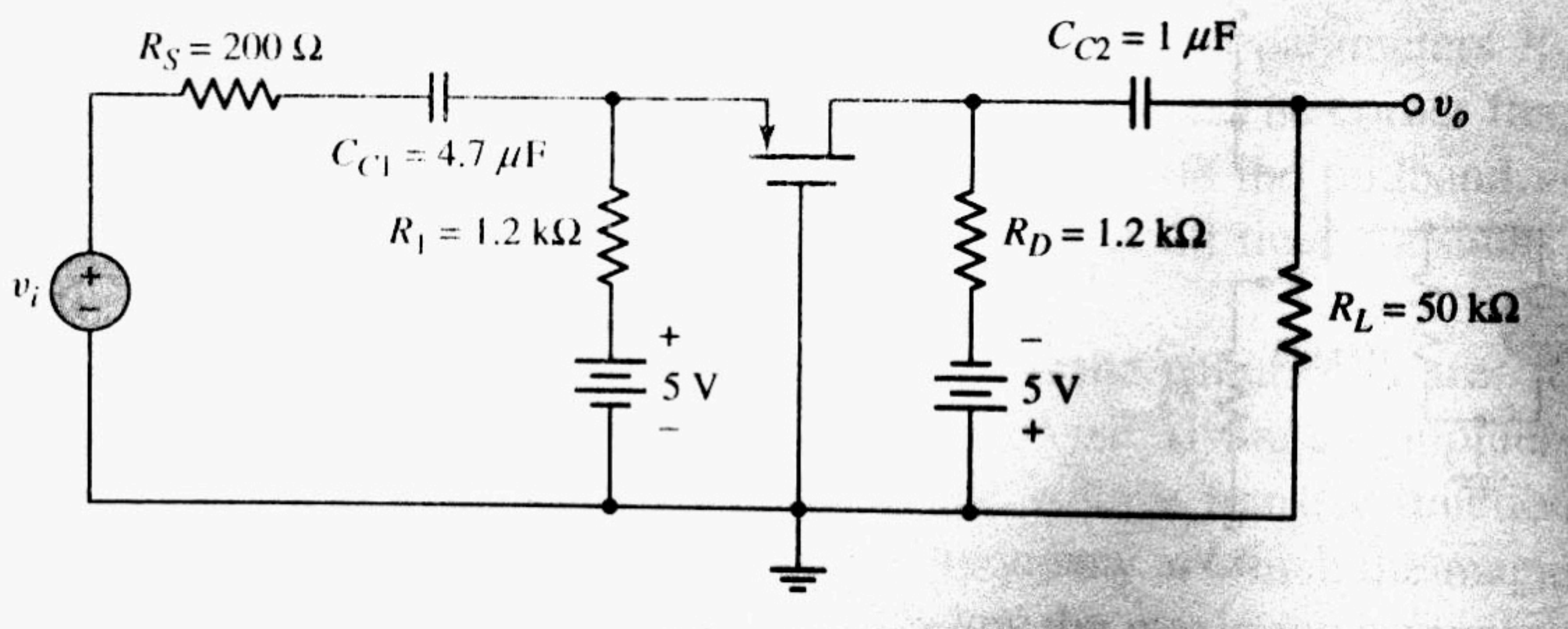


Figure P7.20

*7.37 For the multitransistor amplifier in Figure P7.37, choose appropriate transistor parameters. The lower 3 dB frequency is to be less than or equal to 20 Hz. Assume that all three coupling capacitors are equal. Let $C_B \rightarrow \infty$.

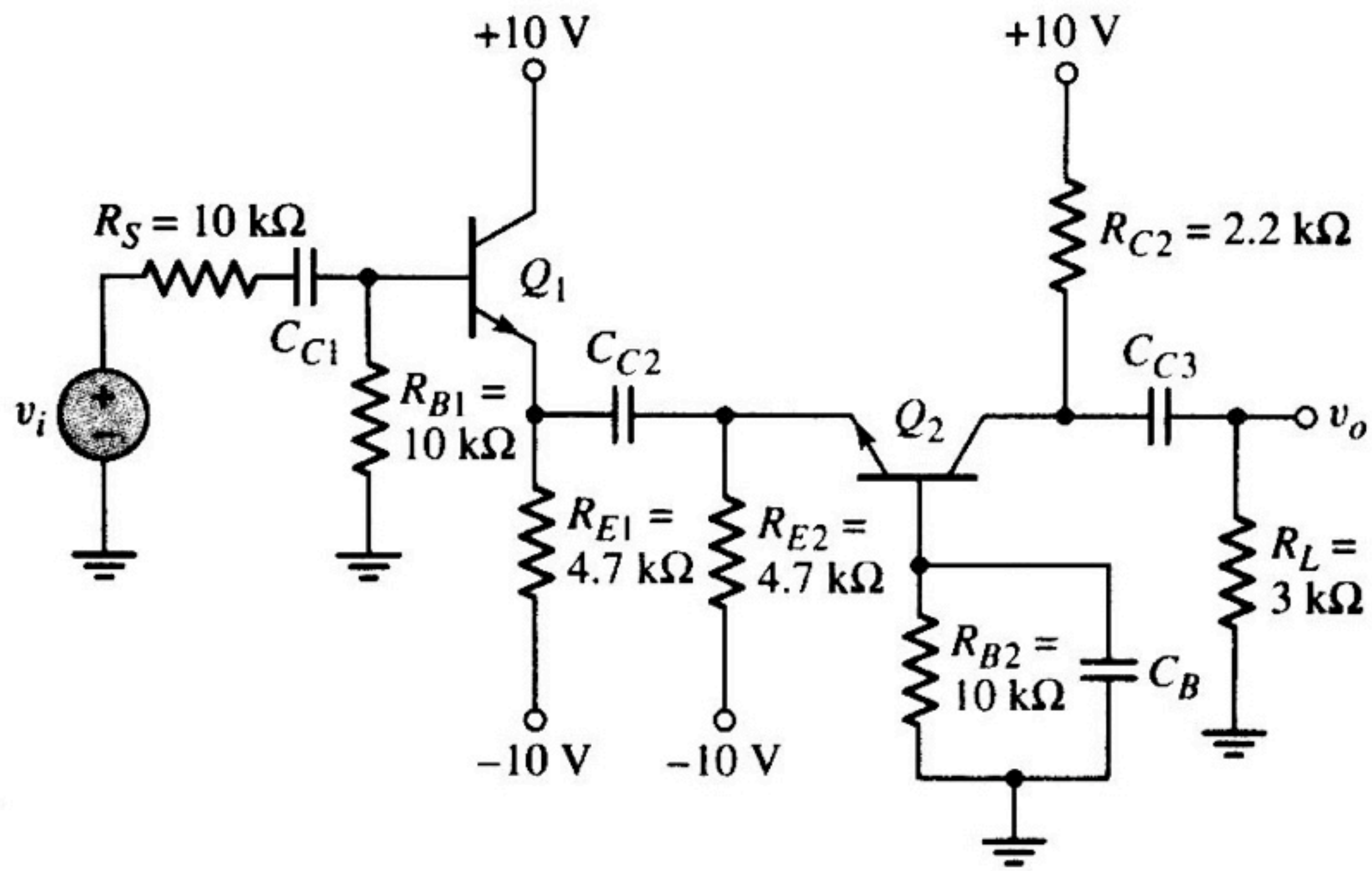


Figure P7.37

Using a computer analysis, determine the maximum values of the coupling capacitors. Determine the slope of the Bode plot of the voltage gain magnitude at very low frequencies.

7.38 A bipolar transistor is biased at $I_{CQ} = 1$ mA and has parameters $C_\pi =$ 10 pF, $C_\mu = 2$ pF, and $\beta_o = 120$. Determine f_β and f_T.

$$f_\beta = \frac{1}{2\pi r_\pi \left(C_\pi + C_\mu\right)}$$

7.57 The parameters of the transistor in the common-source circuit in Figure P7.57 are: $K_p = 2\ \text{mA/V}^2$, $V_{TP} = -2$ V, $\lambda = 0.01\ \text{V}^{-1}$, $C_{gs} = 10$ pF, and $C_{gd} = 1$ pF. (a) Determine the equivalent Miller capacitance C_M. (b) Find the upper 3 dB frequency and midband voltage gain.

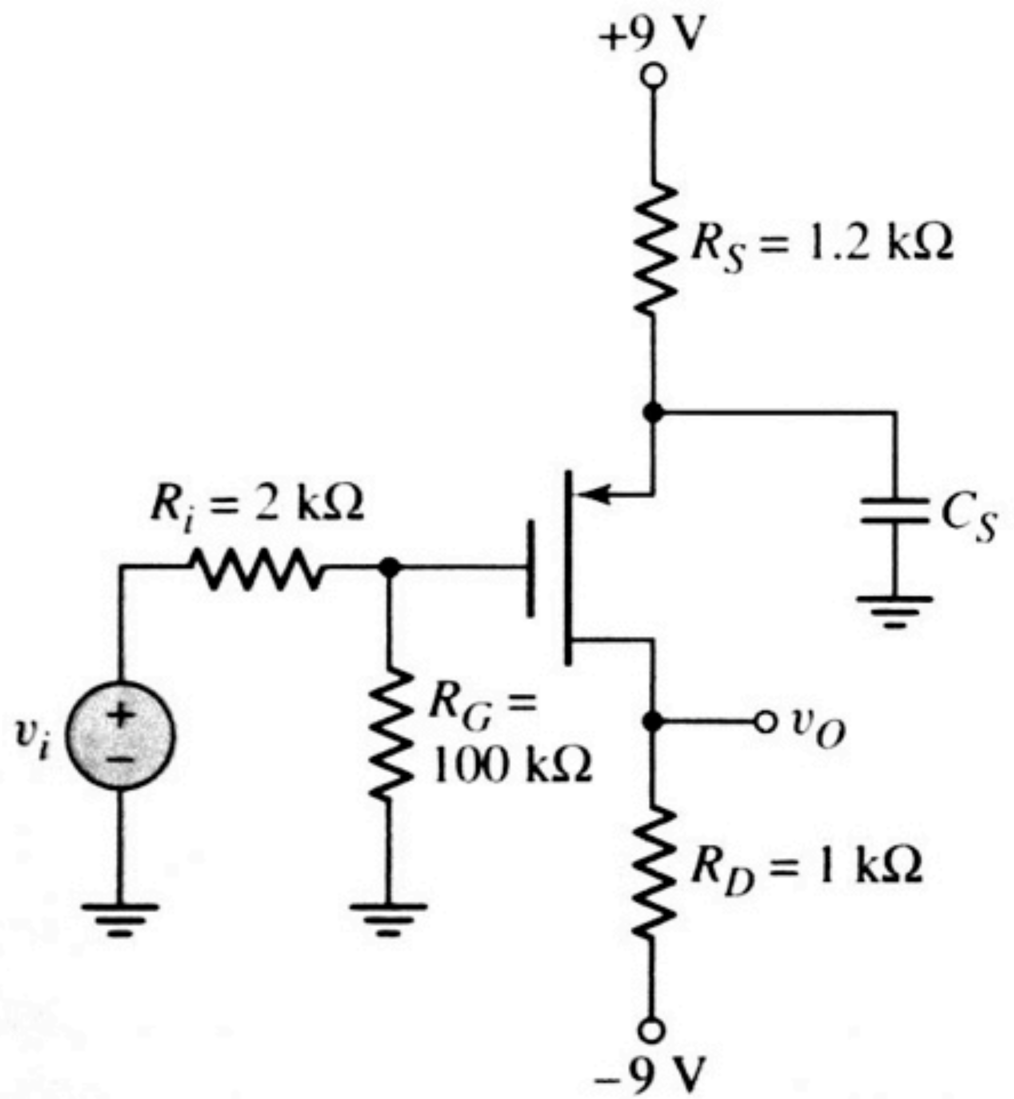


Figure P7.57

*7.63 For the cascode circuit in Figure 7.66 in the text, circuit parameters are the same as described in Example 7.16. The transistor parameters are: $\beta_o = 120$, $V_A = \infty$, $V_{BE}(\text{on}) = 0.7$ V, $C_\pi = 12$ pF, and $C_\mu = 2$ pF. (a) If C_L is an open circuit, determine the 3 dB frequencies corresponding to the input and output portions of the equivalent circuit. (b) Determine the mid-band voltage gain. (c) If a load capacitance $C_L = 15$ pF is connected to the output, determine if the upper 3 dB frequency is dominated by the load capacitance or by the transistor characteristics.

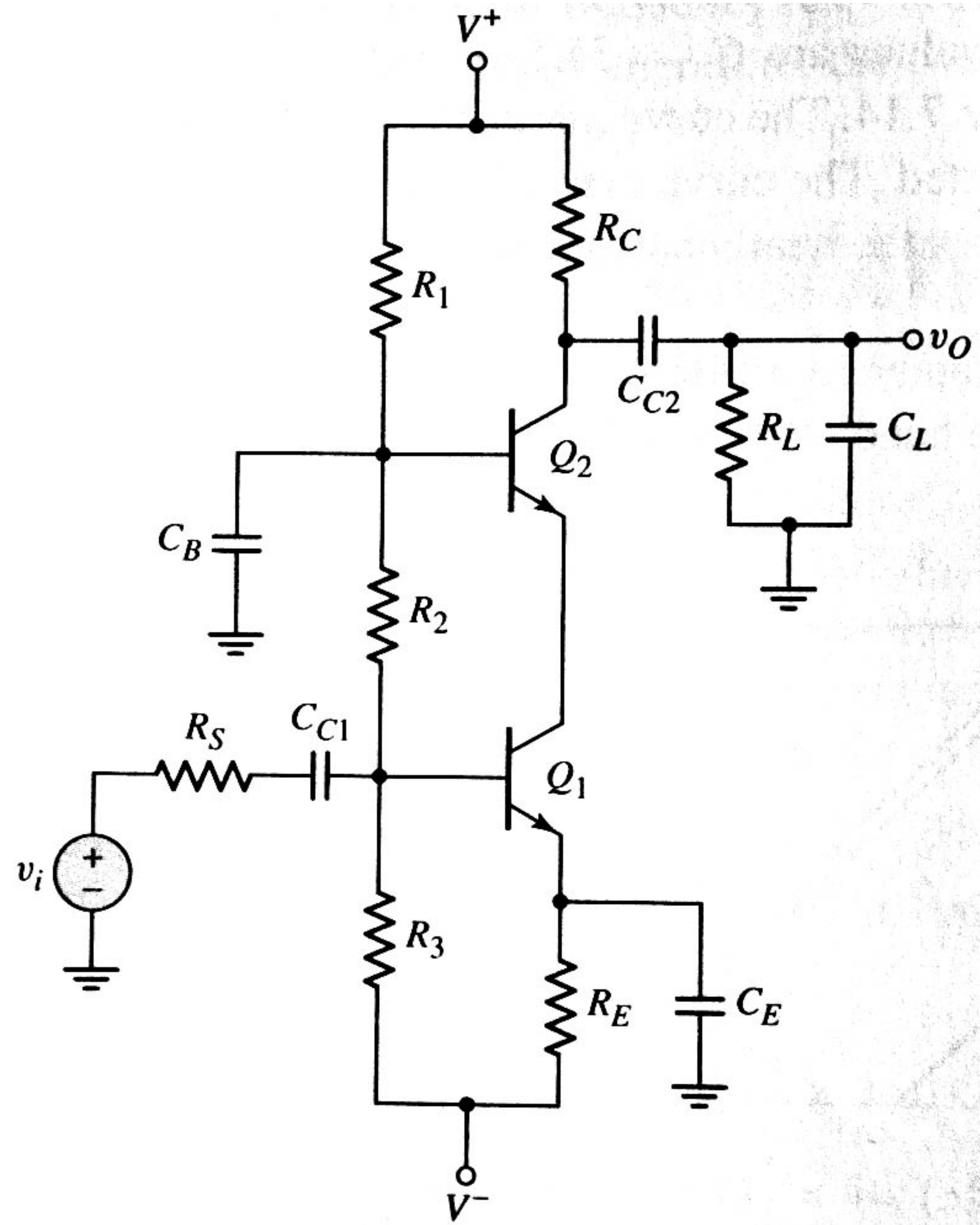


Figure 7.66 Cascode circuit