D 10.6 Figure P10.6 shows a CS amplifier biased by a constant-current source I. Let $R_{sig} = 0.5\ M\Omega$, $R_G = 2\ M\Omega$, $g_m = 3\ mA/V$, $R_D = 20\ k\Omega$, and $R_L = 10\ k\Omega$. Find A_M. Also, design the coupling and bypass capacitors to locate the three low-frequency poles at 100 Hz, 10 Hz, and 1 Hz. Use a minimum total capacitance, with the capacitors specified only to a single significant digit. What value of f_L results?

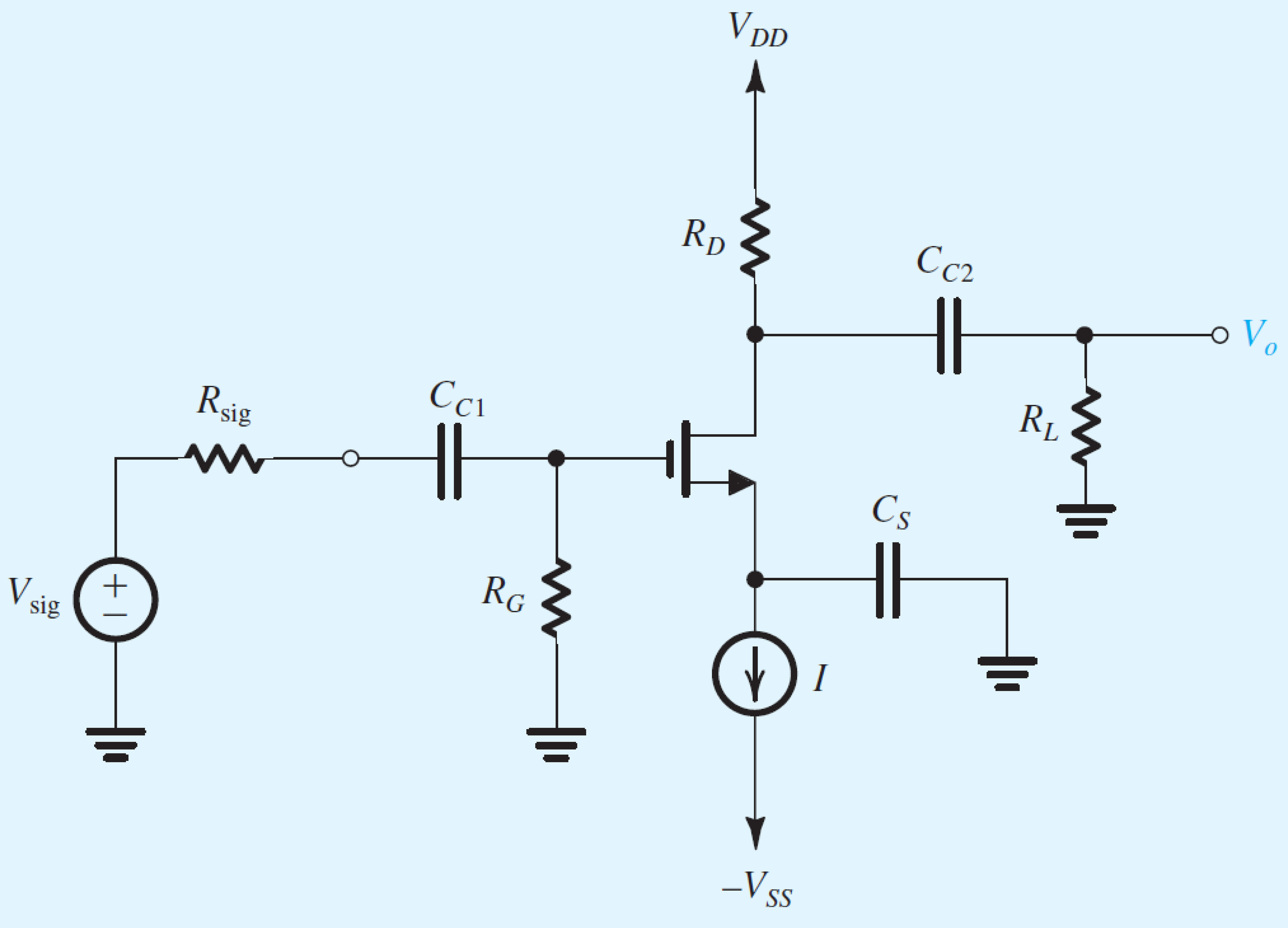

Figure P10.6

10.37 A designer wishes to investigate the effect of changing the bias current I_E on the midband gain and high-frequency response of the CE amplifier considered in Example 10.4. Let I_E be doubled to 2 mA, and assume that β_0 and f_T remain unchanged at 100 and 800 MHz, respectively. To keep the node voltages nearly unchanged, the designer reduces R_B and R_C by a factor of 2, to 50 kΩ and 4 kΩ, respectively. Assume $r_x = 50\ \Omega$, and recall that $V_A = 100$ V and that C_μ remains constant at 1 pF. As before, the amplifier is fed with a source having $R_{sig} = 5$ kΩ and feeds a load $R_L = 5$ kΩ. Find the new values of A_M, f_H, and the gain–bandwidth product, $|A_M| f_H$. Comment on the results. Note that the price paid for whatever improvement in performance is achieved is an increase in power. By what factor does the power dissipation increase?

Example 10.4

It is required to find the midband gain and the upper 3-dB frequency of the common-emitter amplifier of Fig. 10.9(a) for the following case: $I_E = 1$ mA, $R_B = R_{B1} \| R_{B2} = 100$ kΩ, $R_C = 8$ kΩ, $R_{sig} = 5$ kΩ, $R_L = 5$ kΩ, $\beta_0 = 100$, $V_A = 100$ V, $C_\mu = 1$ pF, $f_T = 800$ MHz, and $r_x = 50\ \Omega$. Also, determine the

Solution

The midband voltage gain is

$$A_M = -\frac{100}{100+5} \times \frac{2.5}{2.5 + 0.05 + (100 \| 5)} \times 120$$

$$= -39 \text{ V/V}$$

$$f_H = \frac{1}{2\pi C_{in} R'_{sig}} = \frac{1}{2\pi \times 128 \times 10^{-12} \times 1.65 \times 10^3} = 754 \text{kHz}$$