

EEE109 Assignment 2

1. The parameters of the MOSFET in the circuit shown in Figure 1. Parameters are $V_{TN} = 0.8 \text{ V}$, $K_n = 0.85 \text{ mA/V}^2$, and $\lambda = 0.02 \text{ V}^{-1}$

(a) Determine R_S and R_D such that $I_{DQ} = 0.1 \text{ mA}$ and $V_{DSQ} = 5.5 \text{ V}$ [10 marks]

(b) Find the small-signal transistor parameters g_m , and r_o . [6 marks]

(c) Draw the small-signal equivalent circuit [6 marks]

(d) Determine the small-signal voltage gain. [8 marks]

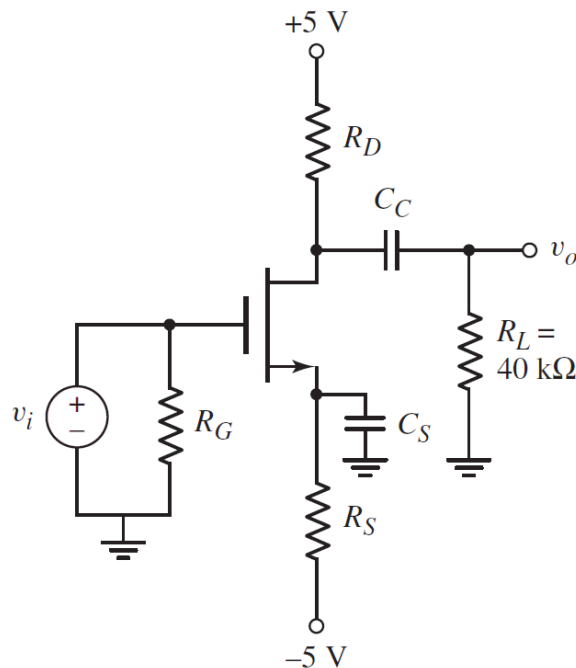


Figure 1

2. Consider the circuit show in Figure 2. The transistor parameters are $\beta = 100$ and $V_A = 100$ V. Assume $V_{BE}(\text{on}) = 0.7$ V and $V_T = 0.026$ V.

(a) Determine I_{CQ} and V_{CEQ} . [12 marks]

(b) Draw the small-signal equivalent circuit. [4 marks]

(c) Determine the input resistance R_i [5 marks]

(d) Determine the small-signal voltage gain A_v [9 marks]

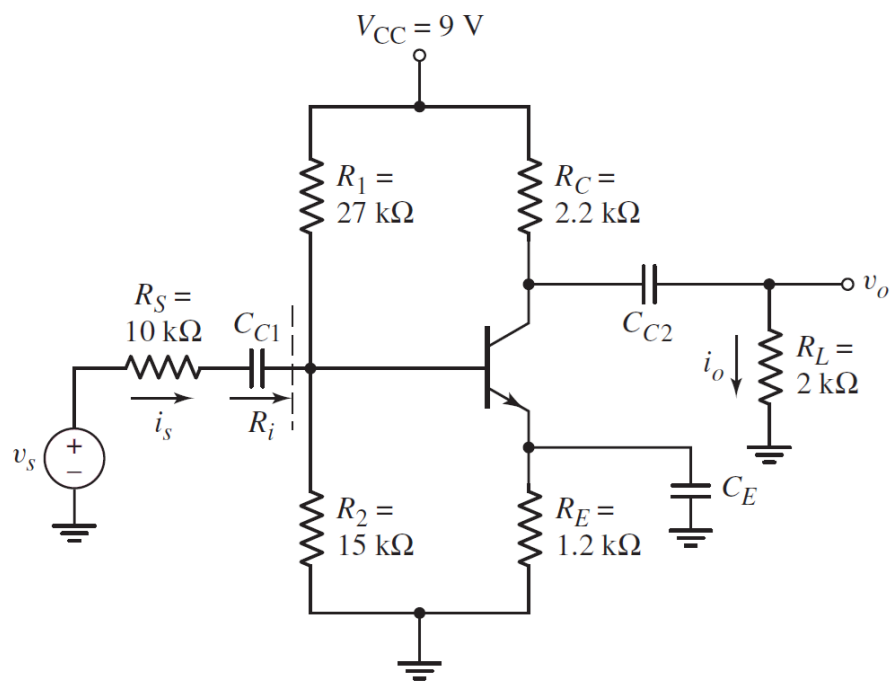


Figure 2

3. For the circuit in Figure 3, the transistor parameters are $\beta = 120$, $V_{BE}(\text{on}) = 0.7 \text{ V}$, and $V_A = 50 \text{ V}$. Let $R_{TH} = 0.1(1 + \beta)R_E$.

(a) Design a bias-stable circuit such that $I_{EQ} = 1.5 \text{ mA}$ **[10 marks]**

(b) Using the results of part (a), find the small-signal mid-band voltage gain **[14 marks]**

(c) Determine the output resistance R_o **[10 marks]**

(d) What is the lower 3 dB corner frequency? **[6 marks]**

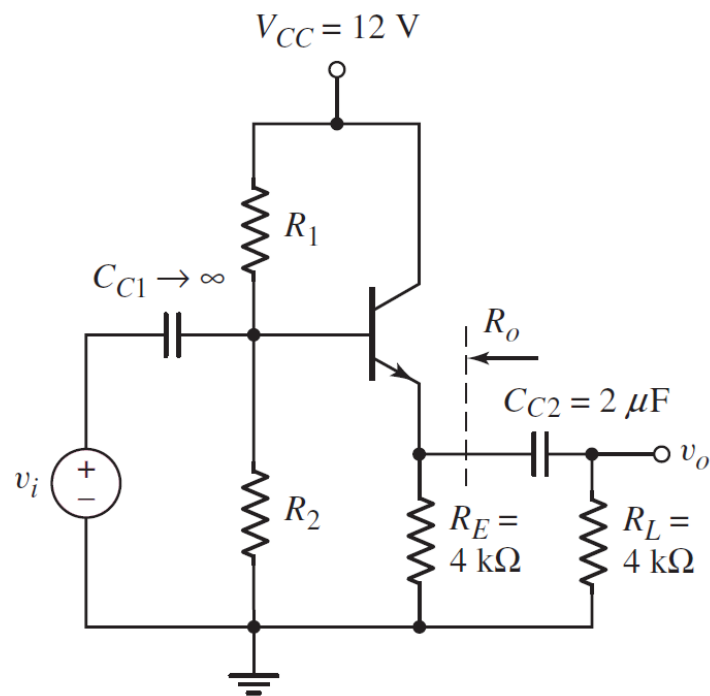


Figure 3