EEE109 Assignment 2 Chapter 4, 6, 7 and 8

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

   (a) Determine R_S and R_D such that $I_{DQ} = 0.1$ mA and $V_{DSQ} = 5.5$ V

   (b) Find the small-signal transistor parameters.

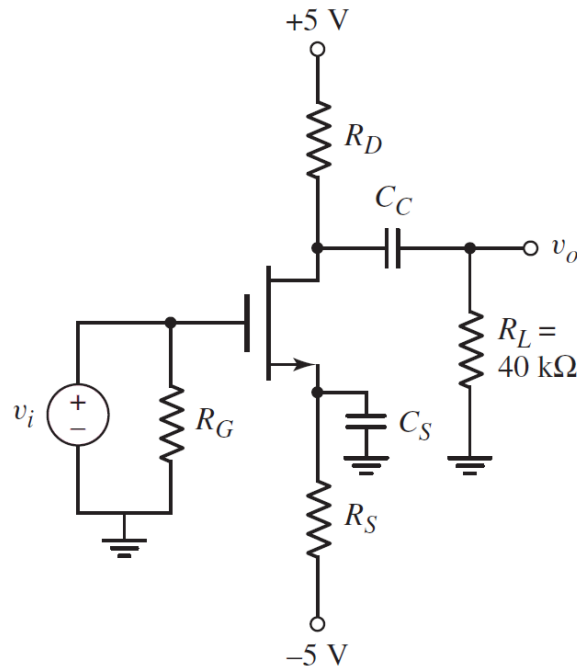   (c) Determine the small-signal voltage gain.

Figure 1

2. Consider the circuit show in Figure 2. The transistor parameters are $\beta = 100$ and $V_A = 100$ V.

(a) Determine R_i

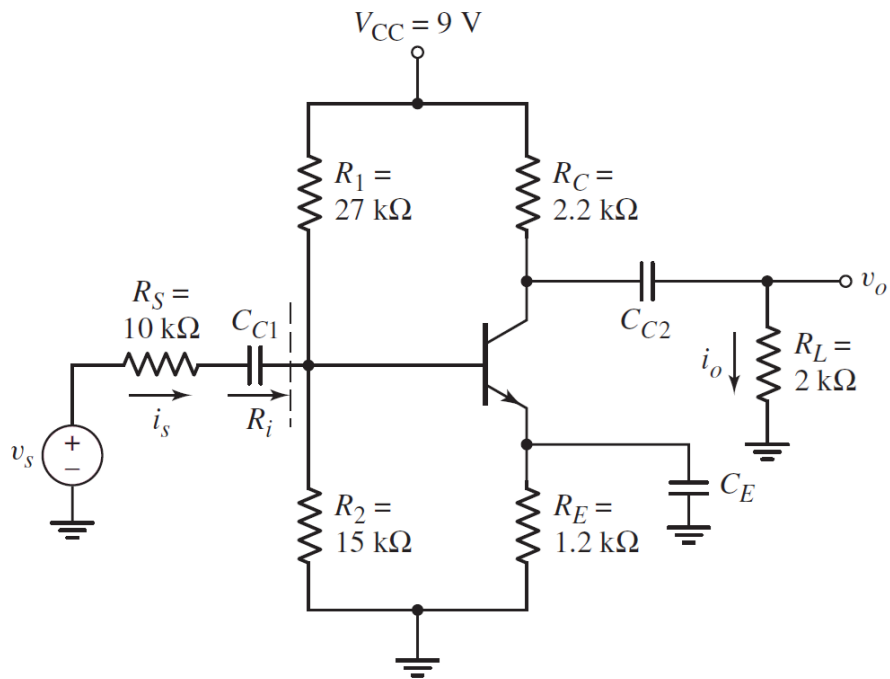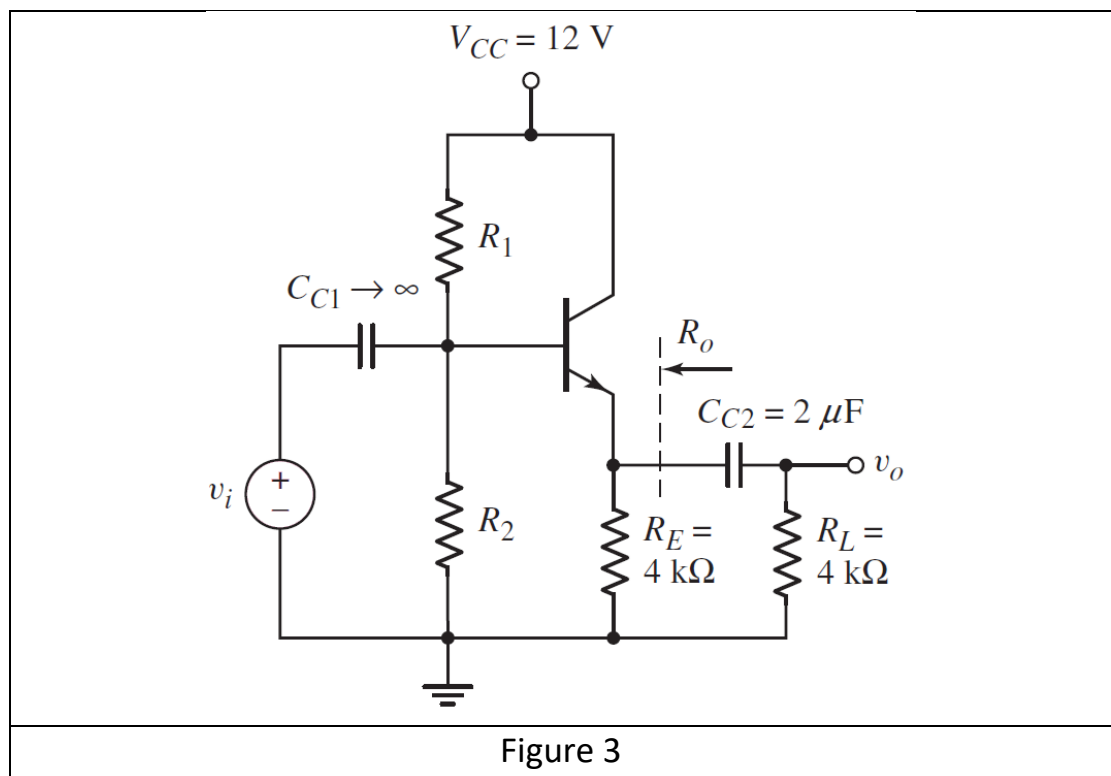(b) Determine the small-signal voltage gain A_v

Figure 2

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

(a) Design a bias-stable circuit such that $I_{EQ} = 1.5$ mA

(b) Using the results of part (a), find the small-signal mid-band voltage gain

(c) Determine the output resistance R_o

(d) What is the lower 3 dB corner frequency?

Figure 3

4. The common-emitter circuit in Figure 4 is biased at $V_{CC} = 24\text{ V}$. The maximum transistor power is rated at $P_{Q,max} = 25\text{ W}$. The other parameters of the transistor are $\beta = 60$ and $V_{BE}(\text{on}) = 0.7\text{ V}$.

Determine R_L and R_B such that the transistor is biased at the maximum power point.

Figure 4