# HOMEWORK #4

Principles of Electronics- Winter 2015

Problem 1

a) For CE transistor shown below, find the overall small signal gain (V0/Vi) as a function of RS, RC and β, VA, and IC.
b) Next, determine the value of DC collector current IC that maximizes the small signal voltage gain.
c) Explain qualitatively why the gain falls at very high and very low collector currents.
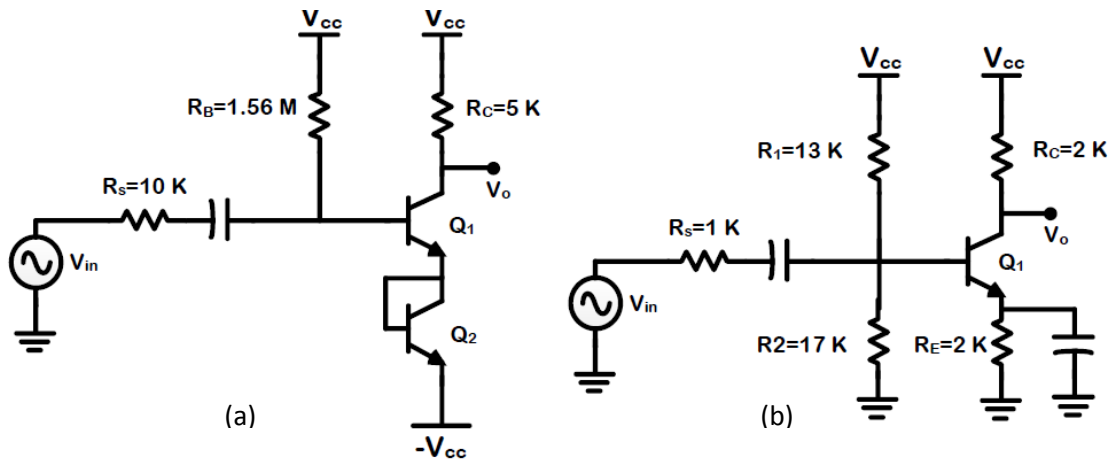d) What is the voltafe gain at optimum IC? [Gray 3.2]
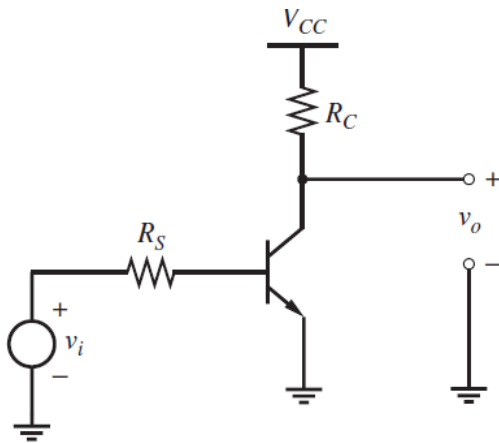
Problem 2

In Problem 1, assume $R_S = R_C = 50 \text{ k}\Omega$, and calculate I_C. What is the DC voltage drop across R_C? What is the voltage gain?

Problem 3

In the following circuits, assume $V_{CC}=3v$, $\beta=100$ and $I_s=10^{-15}$A. Calculate the bias current and bias voltage (I_C and V_{CE}).

V_{cc} V_{cc}

$R_B=1.56$ M $R_C=5$ K

$R_s=10$ K V_o

Q_1

V_{in}

Q_2

(a)

$-V_{cc}$

V_{cc} V_{cc}

$R_1=13$ K $R_C=2$ K

$R_s=1$ K V_o

Q_1

V_{in}

$R2=17$ K $R_E=2$ K

(b)

Problem 4

For the circuits in Problem 3, assuming capacitors are large,

a) Draw the small signal (AC) equivalent circuit

b) Calculate voltage gain $A_v=V_o/V_{in}$

c) Calculate input resistance from source and from base

d) Output resistance for VA= 50 v