Union College
ECE 248
Spring 2015
Homework #3

Due Thursday April 28, 2015

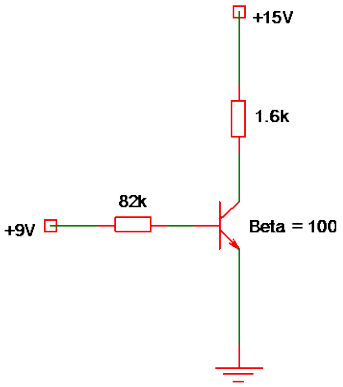
Unless otherwise noted, all problems from Malvino & Bates (7th ed)

A. BJT Basics (Read Textbook Ch 6.3 - 6.5)

6.5 You should get $I_B = 0.02$ mA.
6.8 You should get $V_{CE} = 11$V.
7.14 You should get $V_{CE,MIN} = 4.11$V and $V_{CE,MAX} = 4.70$V.

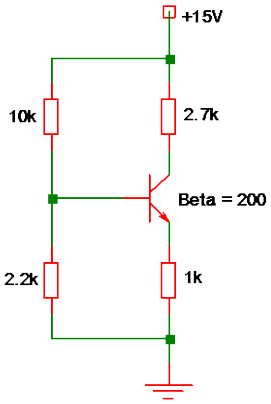
7.xx For the figure to the right, determine if the transistor is in active mode.

Hint: You should find that $V_{CE} = -1.2$V, which means the transistor is NOT in active mode.



B. Voltage Divider Biasing (Read Textbook Ch 8.1, 8.2)

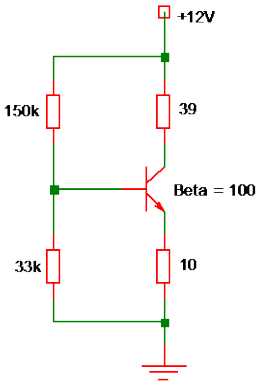
8.xx (Based on Problem 8.2 in textbook)
(a) Show that the voltage divider is stiff.
(b) Show that $V_{BB} = 2.7$ V.
(c) Show that $V_{CQ} = 9.6$ V.
(d) Show that $V_{CEQ} = 7.6$V.



8.yy (Based on Problem 8.24 in textbook)
(a) Show that the biasing voltage divider has $V_{TH} = 2.16$V.
(b) Show that the voltage divider is NOT stiff.
(c) Show that the base voltage is actually $V_{BB} = 0.75$V, which is much less than $V_{TH} = 2.16$V!

Hint: Using the Thevenized voltage divider, use KVL to determine the base current I_B. Once you know I_B you can compute the base voltage V_{BB}.

NOTE: This problem should highlight why a stiff divider makes it much easier to determine V_{BB}!



C. Amplifier Gain (Read Textbook Ch 9.3 - 9.7, 10.1)

9.19 Use the T-model for the AC circuit. You should R1//R2 = 271 ohm, R_C//R_L = 1.02 kohm, and r_e' = 6.1 ohm.

9.xx Compute the small signal voltage gain of the amplifier in Problem 9-19. Use β = 200. Your answer should be V_{OUT}/V_{IN} = -166.

9.yy

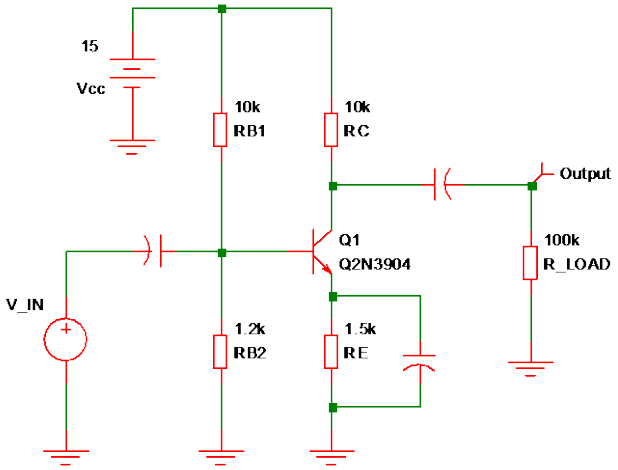
(a) Draw the AC equivalent circuit using the T-model. You should get r_e' = 42.6 ohm.

(b) Compute the small signal voltage gain of the amplifier. Assume β = 200.

You should get V_{OUT}/V_{IN} = -212.

(c) What is the gain if the 100 kohm load resistor is replaced with a 1 kohm load resistor?

You should get V_{OUT}/V_{IN} = -21.



10.xx

(a) What is the value of r_e' in Fig. 10-13 of the textbook? Use V_T = 26 mV. You should get r_e' = 23.6 ohm.

(b) Draw the AC equivalent circuit of Fig. 10-13.

(c) Compute the AC output voltage for V_{IN} = 2 mV. Assume β = 200. Your answer should be V_{OUT} = -223 mV.

D. Base and Input Impedance (Read Textbook Ch 10.2)

9.17 You should get R_{BASE} = 2.49 kohm
9.18 You should get R_{BASE} = 1.23 kohm
10.5 You should get r_e' = 47.3 ohm, R_{IN} =1.31 kohm, and V_{OUT} = -38 mV
10.6 You should get r_e' = 23.6 ohm, R_{IN} = 1.03 kohm, and V_{OUT} = -86 mV

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