Union College
ECE 248
Spring 2018
Assignment 3

Due: May 3, 2018

Unless otherwise noted, all problems from Malvino & Bates (8th ed).

Ignore the "Multisim" label for some of the problems – work out the calculations on paper.

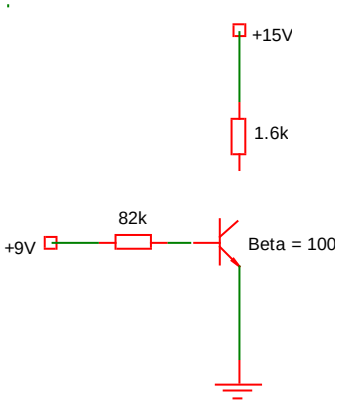
A. <u>BJT Basics (Read Textbook Ch 6.1 - 6.5)</u>

6.5 You should get $I_B = 0.02$ mA.

6.8

6.30 You should get $V_{CE,MIN} = 4.11V$ and $V_{CE,MAX} = 4.70V$.

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

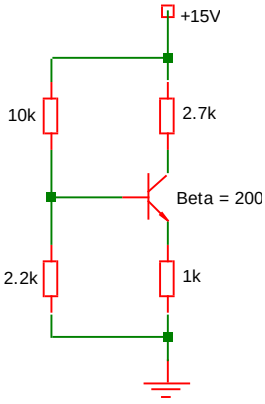


Hint: Check V_{CB} and V_{BE}. Also, you should find that $V_{CE} = -1.2V$, which means the transistor is NOT in active mode.

B. <u>Voltage Divider Biasing (Read Textbook Ch 7.5, 7.6)</u>

7.yy (Based on Problem 7.16 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 $V_{CEQ} = 7.6V$.

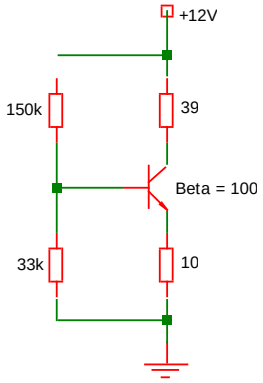


7.zz (Based on Problem 7.18 in textbook)

(a) Show that the biasing voltage divider has V_{TH} = 2.16V.
(b) Show that the voltage divider is NOT stiff.
(c) Show that the base voltage is actually V_{BB} = 0.75V, which is much less than V_{TH} = 2.16V!

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 8.2 - 8.7, 8.9-8.10)

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

8.xx Compute the small signal voltage gain of the amplifier in Problem 8-19. Use β = 200. Your answer should be V_{OUT}/V_{IN} = -166.

8.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.