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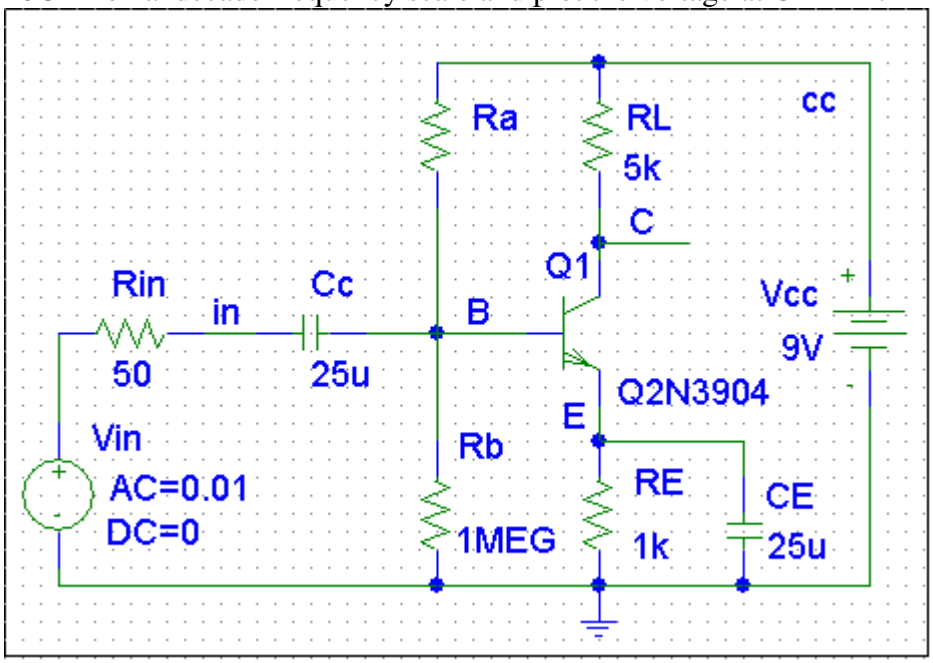
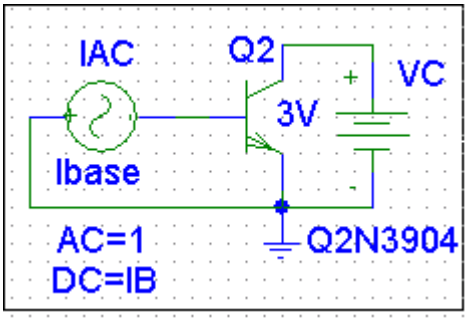
303 Fall 2008 – Homework 5 Due Tu 10/07/08

1. For the following circuit bias the transistor at IC=600uA and VCE=3V.
   a) Run Spice curves for the 2N3904 and determine the IB to give this Q point.
   b) With that IB analytically determine Ra to give this bias point with the values given for Vcc=9, RL=5k, RE=1k, and Rb=1MEG. Then run Spice and check if the bias point is as desired. Correct Ra to give the desired Q point.
   c) Run a frequency response with output the voltage at C. Do this from 100Hz to 10GHz on a decade frequency scale and plot the voltage at C in DB.



2. Using the following circuit find f_T for the above transistor at the bias point.



3.
   a) Using the formulas in the book, Table 5.7, p. 490, calculate all the parameters for the pi equivalent circuit of the 2N3904 as biased above. Use the VAF, TF and Cje=Cjeo of the Spice model and BF and fT found from the Spice curves at the bias IC (use the second line of the table equations to find Cπ and Cμ).
   b) Draw the resulting small signal equivalent circuit for the circuit of problem 1 above.
   c) Ignoring all capacitors find the center frequency voltage gain (voltage output at node C); compare with the value found via Spice in problem 1.