303H Fall 2014 – Homework 3 Due Th 09/25/14

1. (50 points, BJT curves & equivalent)[note: these are transistors used in labs here]
   For the 2N3904 =(npn) and the 2N3906 =(pnp)
   a) Obtain in Spice the transistor curves given on the course web page except do
      in separate plots, one for the npn in the first quadrant and one for the pnp in
      the third quadrant.
   b) Give for each transistor the hybrid-pi equivalent circuit when operating at
      I_C=10mA and V_{CE}=3V.

2. (25 points, Y matrix)
   a. For the NMOS (common source) give the low frequency admittance
      matrix
   b. Repeat for the NPN (common emitter).
   c. Compare numerically for an NMOS 4007 and a comparable npn 2N3904
      both biased at the same (output) current level, $I_C = I_D$ = 10mA.

3. (25 points, CS amplifier)
   Assume an NMOS 4007 is biased at I_C=10mA for R_L=200 Ohm, find the range of
   gains available by varying the load resistance (assume R_S=0 and a 9V power
   supply).