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303 Spring 20010– Homework 1 Due Th 02/04/10

For the following it will be helpful if you change the Probe background from black to white so that the curves can be well distinguished.

1. Run curves for the CMOS 4007 to reproduce those on the course web page under the title "4007 NMOS and PMOS curves." Devise a means to plot the PMOS curves as ID versus VDS (rather than VSD).
   You need not submit these curves but should understand the procedure.
   For this problem use breakout transistors and copy the 4007 models. You can follow the instructions on the course web page under "technique for customizing breakout device models" [which is for PSpice version 8 so there will be slight differences for later PSpice versions] and with the models given in "library file for breakout 4007 transistors."

2. Considering just the NMOS of the 4007s run the same set of curves but with another voltage source, V_{SB}, inserted between the bulk and source. Set that voltage as a parameter with values between 0V and 5V in 1 V steps and obtain a new set of curves through a parametric run. Submit both your circuit and the resulting curves.

3. Repeat part 2 with the bulk forward biased, that is for negative V_{SB} now between -0.5V and 0V in +0.25V steps.

4. Set up in Spice a circuit, using capacitors and Gvalue components, for the differential equation (where y=v on capacitor and x=time)
   $$\frac{dy}{dx} = -(y-1)^3; \quad y(0) = 2 \text{ for } 0 \le x \le 2$$
   Submit your schematic and the plot of the solution (with a white background).

5. For future use download the transistor file bicmosis12.olb and bicmosis12.lib (or for PSpice 8 the two equivalent files bicmosis12.slb & bicmosis12.lib) from the web. Install these on the computers or folders from which you will run Spice.