303 Spring 2009 – Homework 1 Due Th 02/05/09

1. Set up in Spice a circuit, using capacitors and Gvalue components, for the differential equation (where y=v on capacitor and x=time)

$$\frac{dy}{dx} = -y^3; \quad y(0) = 1 \text{ for } 0 \le x \le 2$$

submit your schematic and the plot of the solution (with a white background).

2. Repeat problem 1 for the linear matrix differential equation

$$\frac{dx}{dt} = \begin{bmatrix} 1-\sqrt{2} & \sqrt{2} \\ \sqrt{2} & -1-\sqrt{2} \end{bmatrix} x; \quad x(0) = \begin{bmatrix} 1 \\ -2 \end{bmatrix} \text{ for } 0 \le t \le 3$$

3. Download the transistor file bicmosis12.olb (or for PSpice 8 the two equivalent files bicmosis12.lib & bicmosis12.slb) from the web. Install these on the computers or folders from which you will run Spice.

4. Draw and run the following circuit in Spice and, in two separate plots to be turned in, plot in one the voltage at the node mid and in the other the current in the voltage source VinegR.

5. Turn off the nest and repeat the above circuit for the default value of Lp. For this circuit calculate the voltage gain, ΔVmid/ΔVin at Vmid=0 (that is find the slope of the voltage transfer curve at the output origin) as well as the (negative) conductance ΔI(VinegR)/ΔVin at Vin=0 . Comment on the linearity of this circuit.