

303H Fall 2014 – Homework 5 Due Th 10/09/14

1. (100 points, OTA designs)

For this problem use two equal in magnitude power supplies for each design with a ground in the middle. Make initial designs for a tail current of 4mA. To test in Spice, you can attach an F (=current controlled current source) component to the (current) output lead and ground; the output of F can go through a grounded resistor. In all of the following portions submit indicative circuits and plots.

- a) Design a MOS OTA using 4007 transistors.
- b) Also design a BJT OTA using 2N3904/2N3906 transistors. You can include ideal base current sources if necessary.
- c) In both cases calculate the small signal gm.
- d) In both cases run Spice and compare the gm's with those calculated in c). Sinusoidal inputs might be most convenient.
- e) In Spice do a frequency response and compare the BJT vs MOS responses over 10Herz to 1MegHerz.
- f) In both cases modify the tail currents to obtain a 2-quadrant multiplier, so that the tail current has a small sinusoidal component at 1KHerz (say of amplitude around 1milliAmp). With the main input also a sinusoid at two different frequencies of 1KHerz and again at 10KHerz, vary the main input amplitude to show large versus small signal effects.