

303 Fall 2017 – Homework 3 due Th 09/28/17

The transistors are ones used in teaching labs here; some useful data is on the course web page.

1. (25 points, CMOS Y matrix)
 - a. For the NMOS (common source) give the low frequency small signal admittance matrix, giving formulas for square-law operation (include g_m and go in terms of bias I & V values and transistor model constants).
 - b. Repeat for the PMOS (common source).
 - c. Compare numerically for an PMOS 4007 and an pnp 2N3906 both biased in the forward active region at the same (output) current level, $I_C = I_D = -8\text{mA}$; for the PMOS assume $V_{GS} = -3\text{V}$ (and give its V_{DS}); for the PNP assume $V_{BE} = -0.6$.
2. (25 points, CS amplifier)

Assume a common source NMOS 4007 circuit is biased at $I_D = 8\text{mA}$ for $R_L = 150\text{ Ohms}$ with a 9V power supply ($=V_{DD}$), find the range of low frequency gains available by varying the load resistance R_L while keeping the transistor in saturation and maintaining $I_D = 8\text{mA}$ (assume a signal source resistance of $R_S = 0$). Repeat for a PMOS 4007.
3. (50 points, CMOS biasing)

Separately bias the two amplifiers of problem 2 and check in Spice your circuits' time domain responses to an input 2KHz sinusoid of 5mV amplitude.