

ENEE 302 Homework Set 2 Due Th 02/17/05

for all CMOS transistors in these problems use the mnmosis and mpmosis transistors with (unless otherwise specified) $L=W=10\mu$, $V_{dd}=5V=-V_{ss}$.

#1. 25 points (inverter curves)

Set up Spice and run to obtain the curves of Figures ~~4.54~~ and ~~4.55~~ of page 338 of the text. Here set $V_{ss}=0$.

#2. 50 points (inverter dynamics)

- a) For the CMOS inverter of Figure 4.57, page 343, when $C=0$, do parametric runs using W for the PMOS as a parameter to make $V_o=0$ when $V_i=0$. (as a first value choose $W_p=15\mu$). Submit the final V_o vs V_i curve with the final value of W_p .
- b) Insert $C=50\text{pF}$ and do a transient analysis to obtain curves as in Figure 4.57 (b). Submit the resulting curves.
- c) Obtain I vs V_i as in Figure 4.58.

#3 25 points (NMOS voltage dividers)

For the circuit of Figure P4.38 find by hand calculations, assuming $\lambda=0$, the widths if all three transistors are nmosis. Repeat in the presence of λ . Run Spice for your calculated widths (in the $\lambda=0$ case) and compare the voltages with those of the hand calculations.