

University of New Mexico
Department of Electrical and Computer Engineering

ECE 321L – Electronics I (Fall 2023)

Homework #11

Due in class: Wednesday November 8, 2023

1. Assume that we have an inverter with $V_{DD}=1.5\text{ V}$, $K'_n=100\text{ }\mu\text{A/V}^2$, $V_{tn}=0.4\text{ V}$, $\lambda_n=0.1\text{ V}^{-1}$, $(W/L)_n=10$, $K'_p=60\text{ }\mu\text{A/V}^2$, $V_{tp}=-0.4\text{ V}$, $\lambda_p=0.2\text{ V}^{-1}$, $(W/L)_p=17$.
 - a) Calculate V_{OH} , V_{OL} , and V_M
 - b) Calculate g (slope of VTC).
 - c) Estimate V_{IL} and V_{IH} from g found in part b.
 - d) Sketch a rough VTC using the parameters found in parts a through c.
 - e) Calculate NMH and NML.
 - f) Assuming that the load capacitance is 100 fF and using the average current technique, calculate t_{PLH} and t_{PHL} .
 - g) Assuming that the load capacitance is 100 fF and using the average current technique, calculate t_r and t_f .

2. Assume that $V_{T0} = 0.5\text{ V}$, $\gamma = 0.3\text{ V}^{1/2}$, and $|\phi_f| = 0.35\text{ V}$. Calculate the voltages at nodes: V_1 , V_2 , and V_O . Considering the body effect for all transistors.

