University of New Mexico

Department of Electrical and Computer Engineering

ECE 520 - VLSI Design (spring 2026) Homework #4

Due in class: Thursday February 26, 2026

1. Given Table 1, the goal is to derive the important device parameters from these data points. As the measured transistor is processed in a deep-submicron technology, the "unified model" holds. From the material constants, we also could determine that the saturation voltage V_{Dsat} equals -1V. You may also assume that $-2\varphi_F = -0.6V$.

a. Is the measured transistor a PMOS or an NMOS device? Explain your answer.

b. Determine the value of V_{To}.

c. Determine γ.

d. Determine λ.

e. Given the obtained answers, determine for each of the measurements the operation region of the transistor (choose from cutoff, resistive, saturated, and velocity saturation).

Measurement Number	VGS [V]	VDS [V]	VSB [V]	ID [µA]	Operation Region?
1	-2.5	-2.5	0	-84.375	
2	1	1	0	0.0	
3	-0.7	-0.8	0	-1.04	
4	-2.0	-2.5	0	-56.25	
5	-2.5	-2.5	-1	-72.0	
6	-2.5	-1.5	0	-80.625	
7	-2.5	-0.8	0	-66.56	