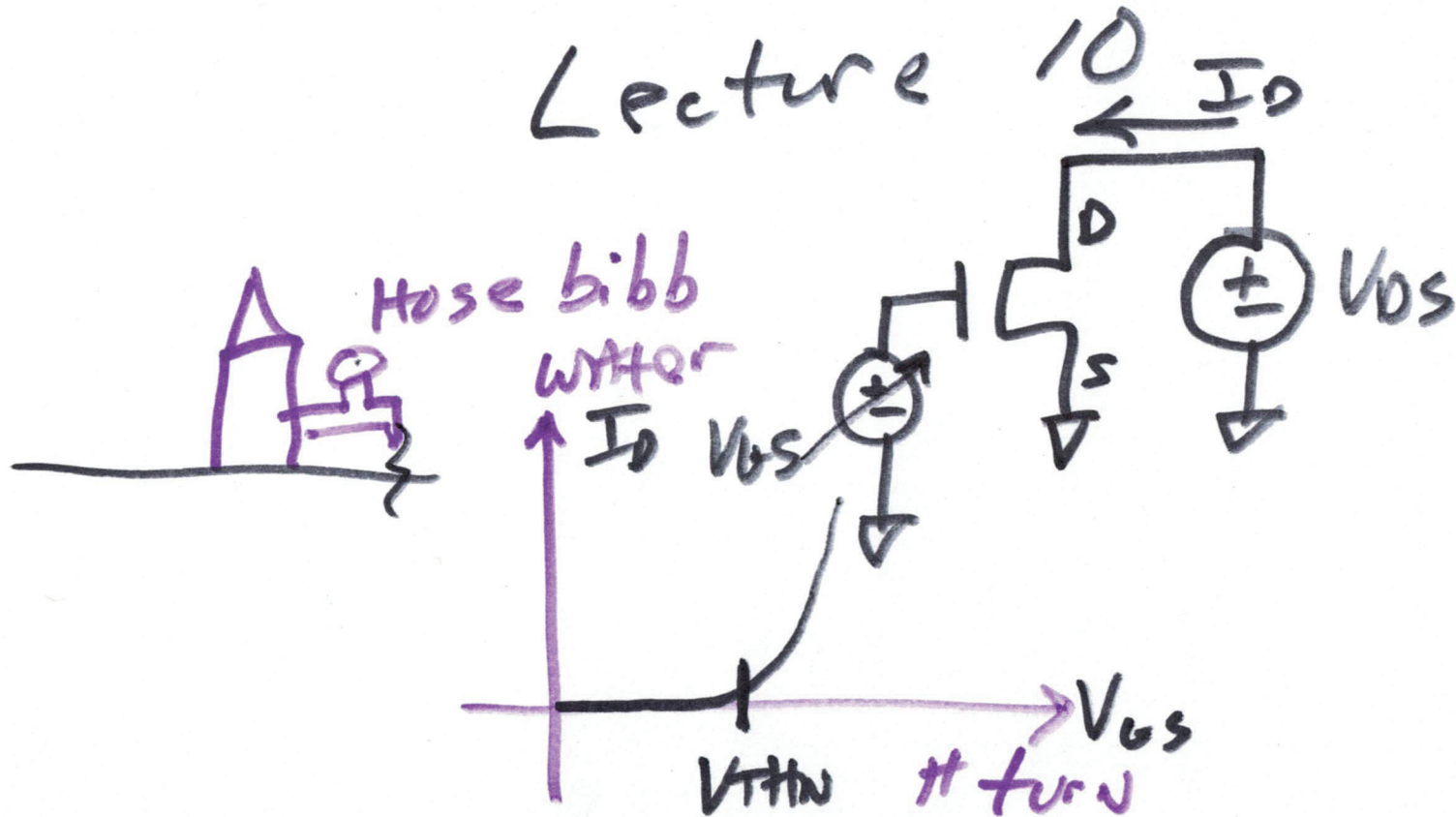


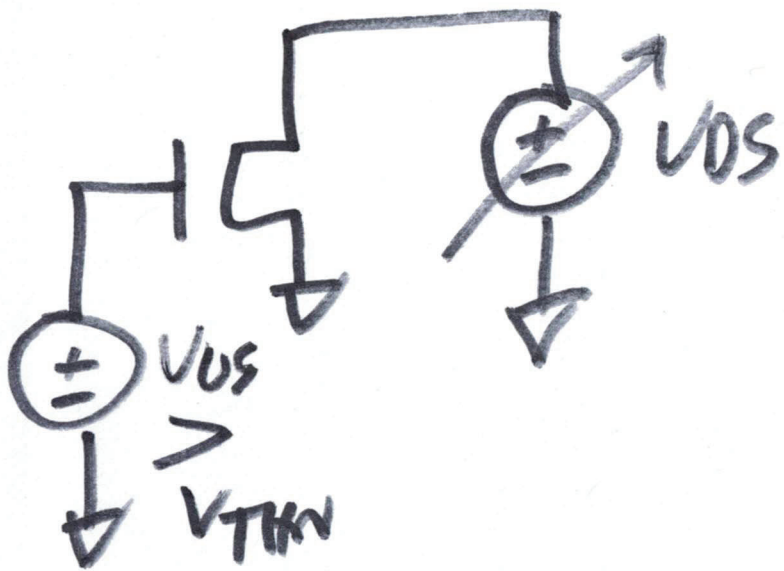
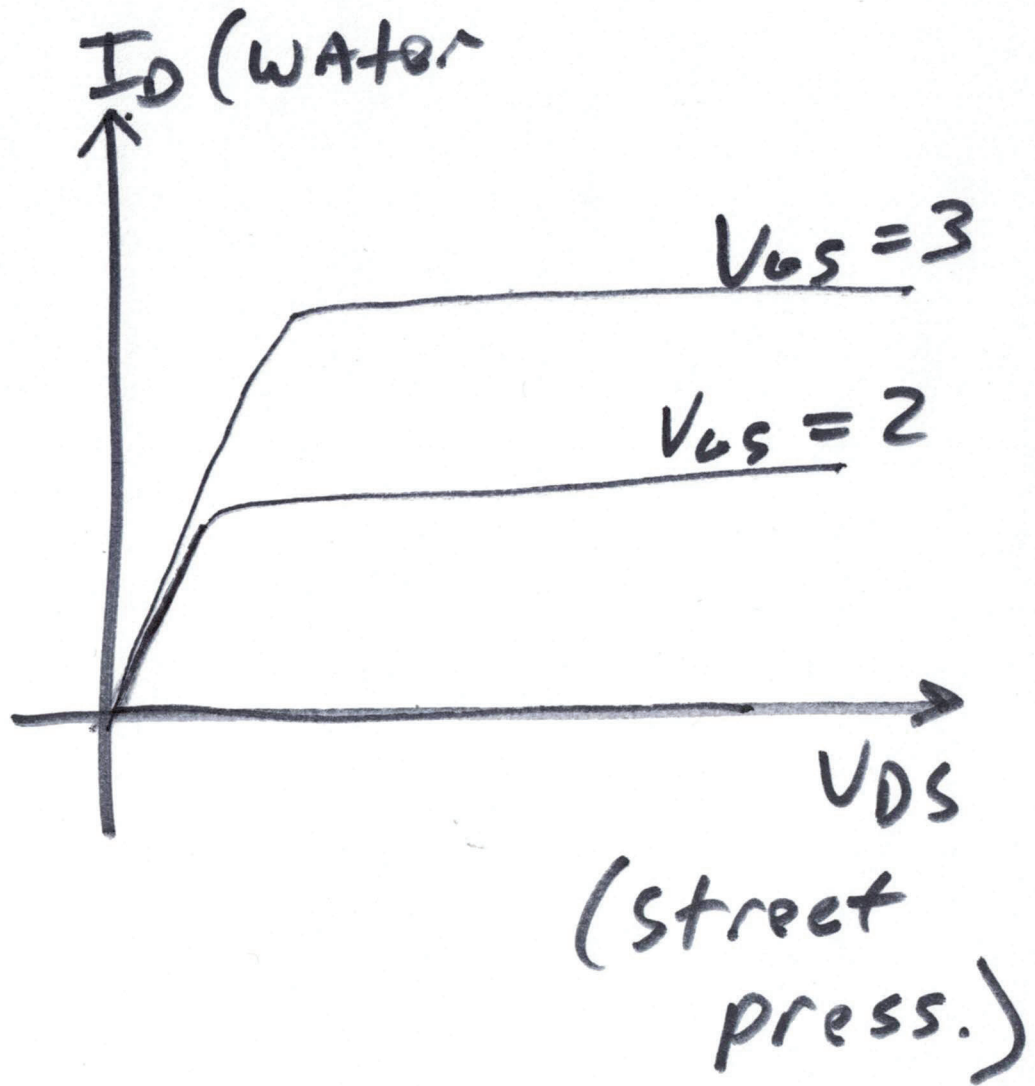
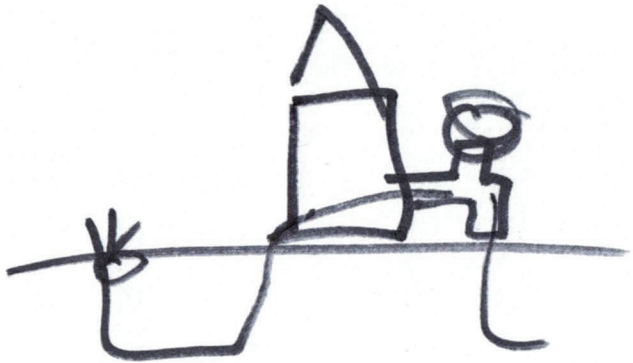
EE 421 / ECG 621

Digital IC Design

Sept. 28, 2020

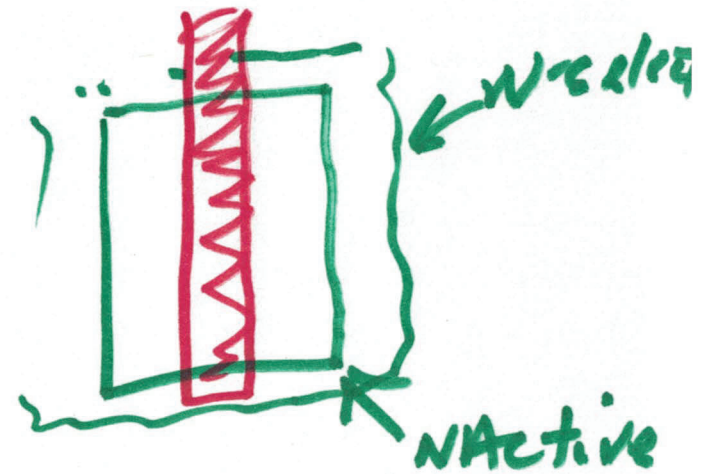
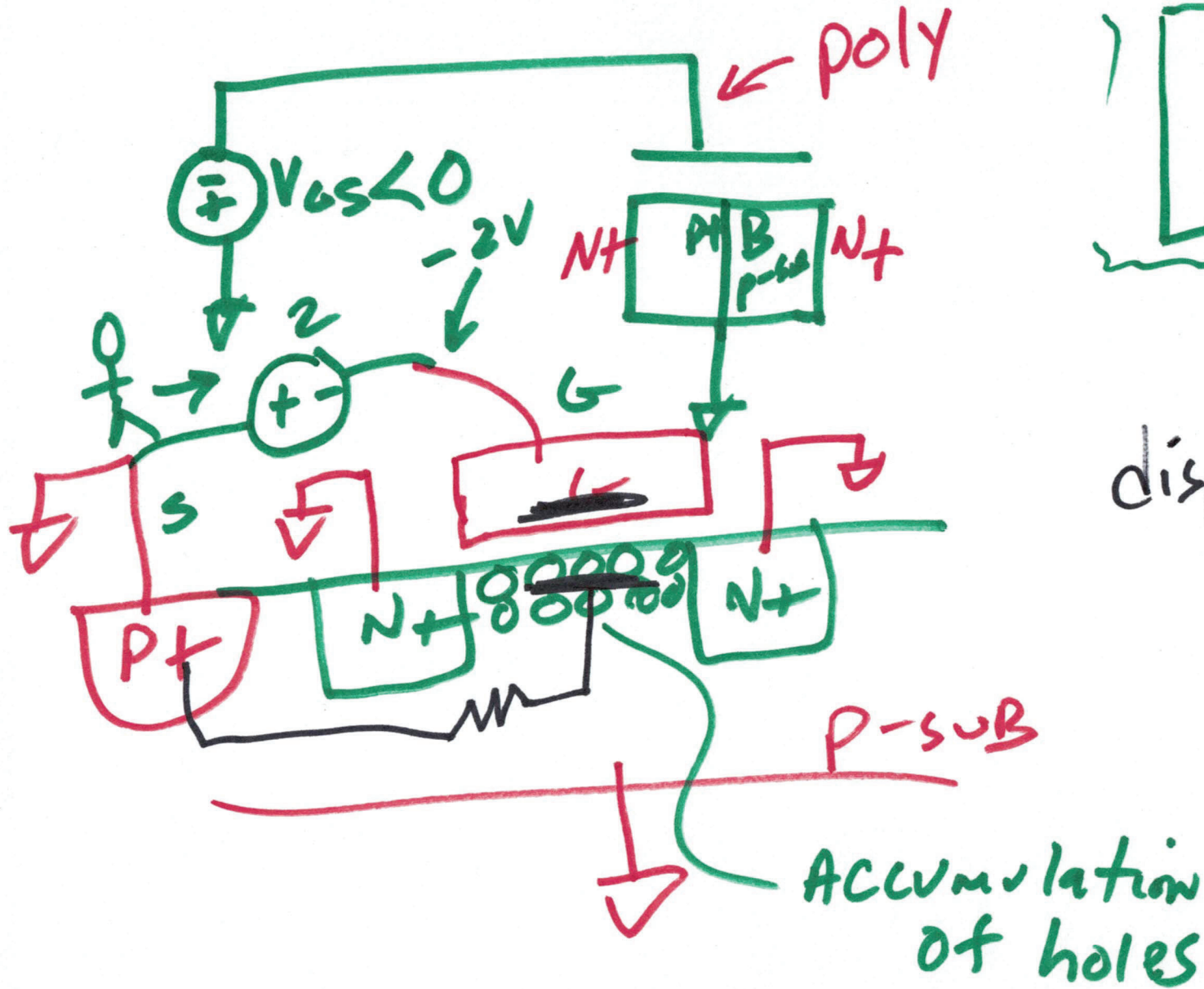
Lecture 10





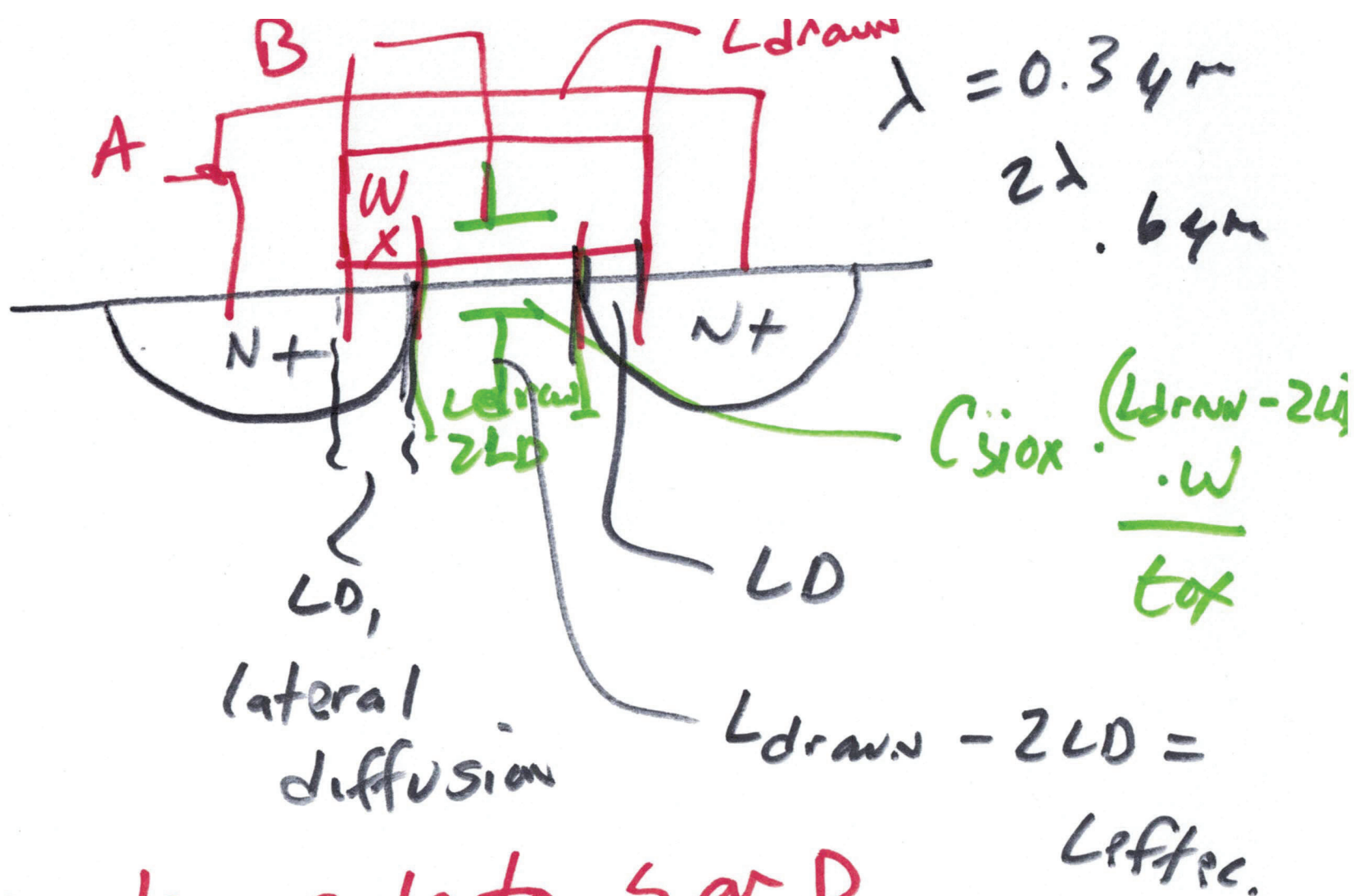
2)

Accumulation



displacement

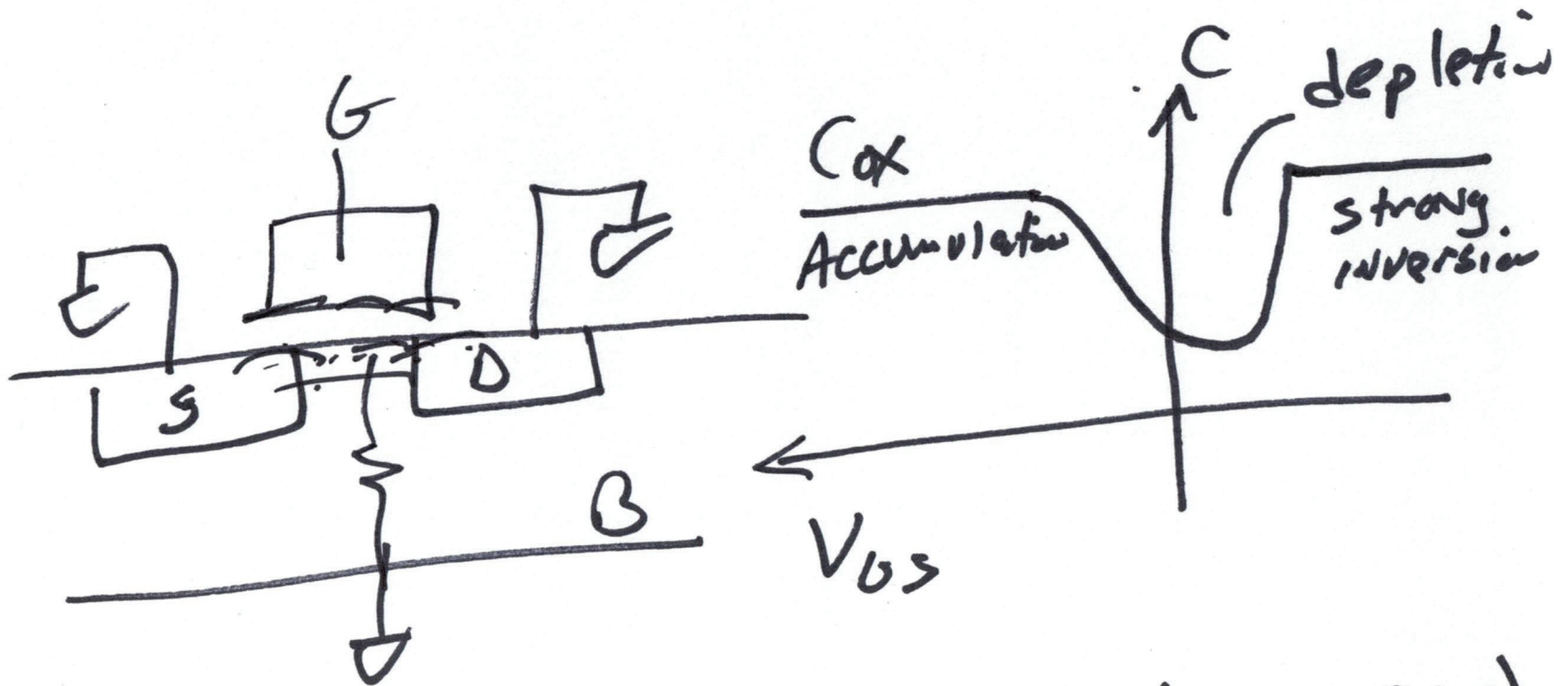




Overlap gate to S or D

$$W \cdot C_{GDO} = C_{SiO_2} \cdot \frac{L_D \cdot W}{t_{ox}} = C_{GDO} \cdot W$$

4)



$$C_{TOT} = \frac{\epsilon_{ox} \cdot W \cdot 2LD}{t_{ox}} + \frac{\epsilon_{ox} \cdot W \cdot (L_{drain} - 2LD)}{t_{ox}}$$

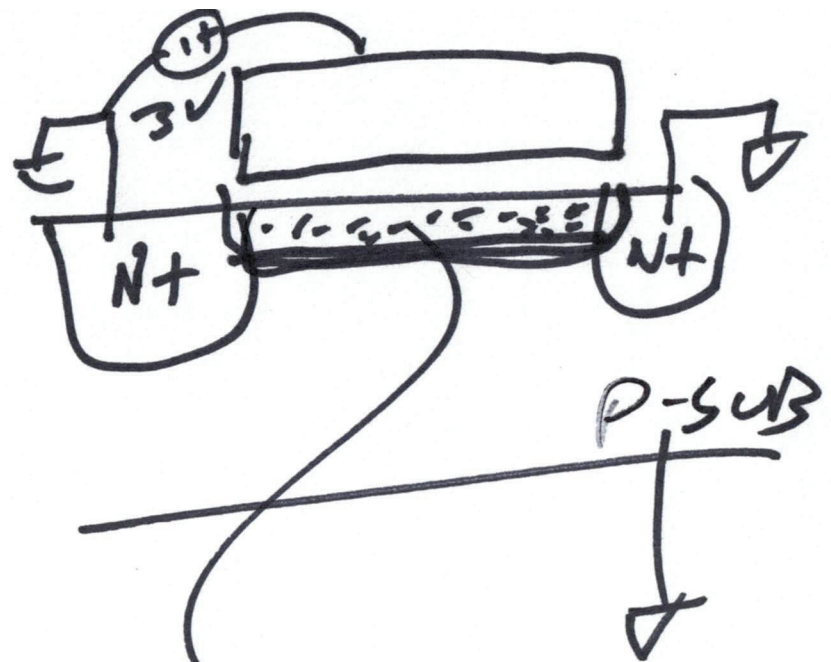
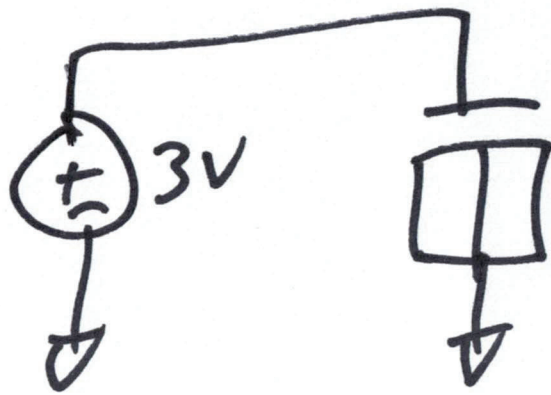
$$C'_{ox} = \frac{3.9 \cdot 8.85 \text{ aF}}{4 \mu\text{m}} \cdot t_{ox}$$

$$C_{ox} = \frac{\epsilon_{ox}}{t_{ox}} \cdot W \cdot L$$

$$C'_{ox} = \frac{2.5 \text{ fF}}{4 \mu\text{m}^2}$$

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5)



Strong inversion $C_{ox} = C'_x \cdot L \cdot W$

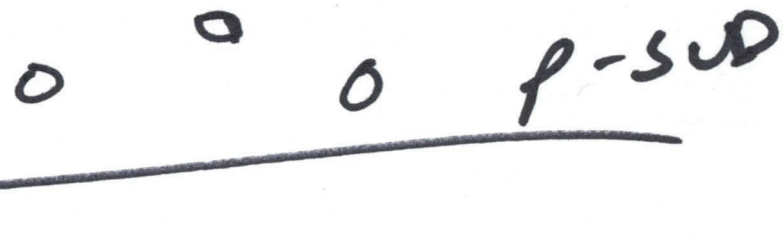
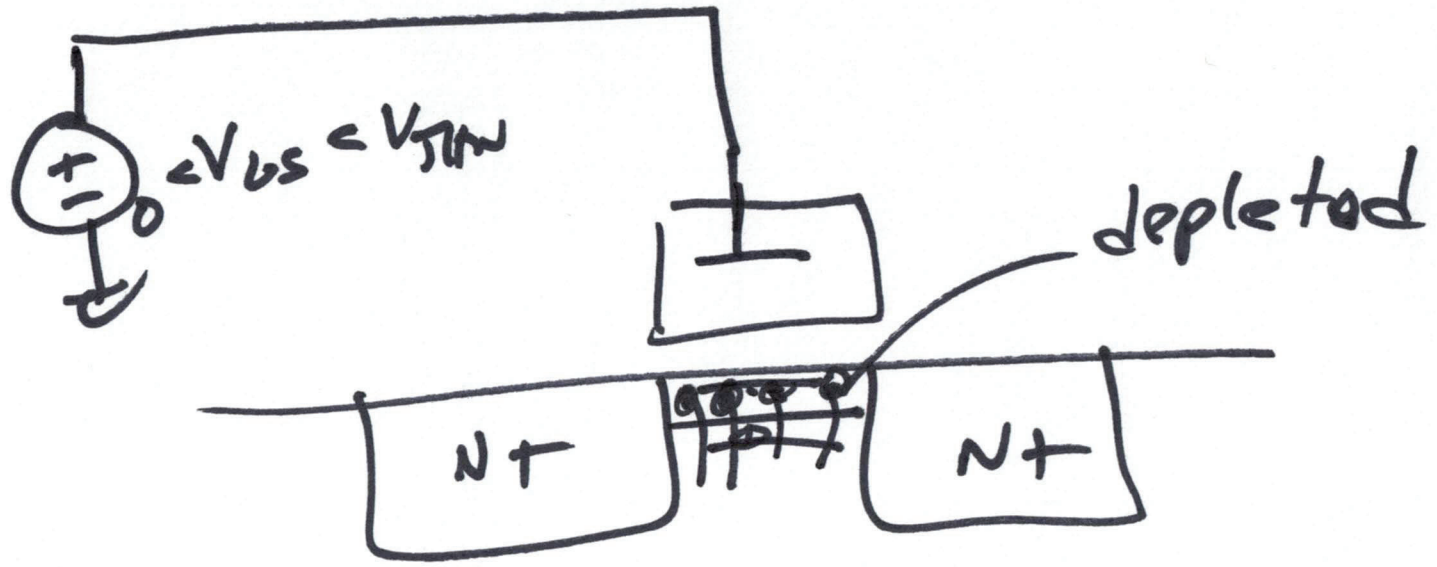
A small schematic of a capacitor with a top plate connected to ground and a bottom plate connected to ground.

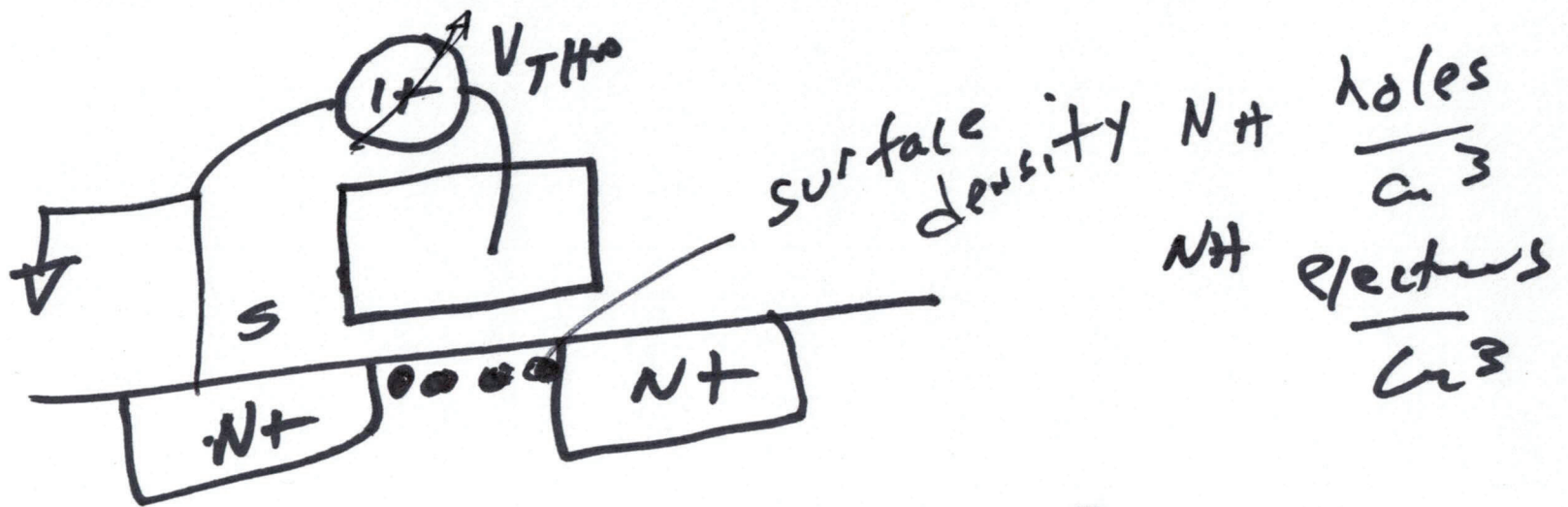
$$100/100 = \frac{W}{L} = \frac{100 \cdot 50nm}{100 \cdot 50nm} = \frac{5\mu}{5\mu}$$

$$C = C'_{ox} \cdot W \cdot L = \frac{25f}{4\mu m^2} \cdot 100 \cdot 100 \cdot 50nm \cdot 50nm$$

$$= 25 \cdot 5 \cdot 5 = fF$$

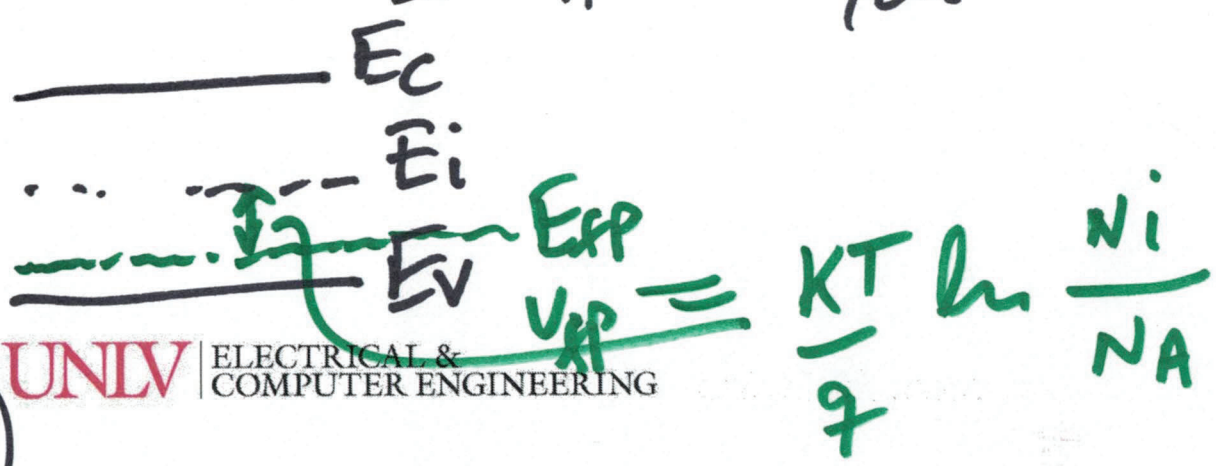
$$625 fF$$



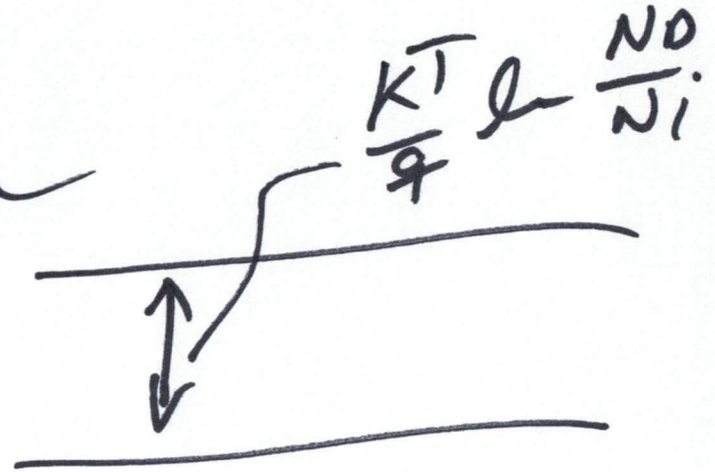
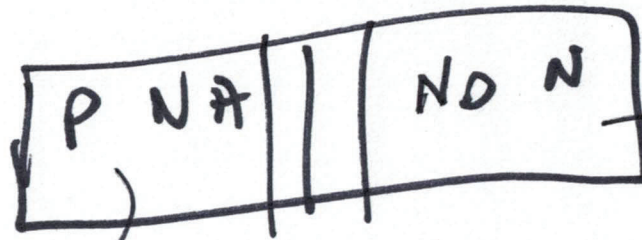


$\rho =$ density of holes
 $= N_A$ holes/cm³
 $N_A =$ doping density of p-sub

e.g. 10^{16} atoms/cm³

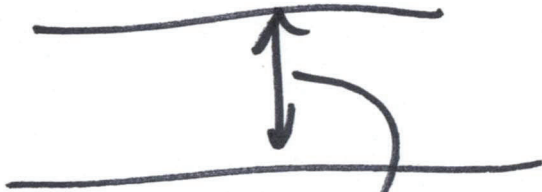


8)



$$\ln A - \ln b$$

$$= \ln \frac{a}{b}$$



$$V_{bi} = V_{FN} - V_{FP} = \frac{KT}{q} \ln \frac{NO}{NA}$$

$$V_{FP} = \frac{KT}{q} \ln \frac{Ni}{NA}$$