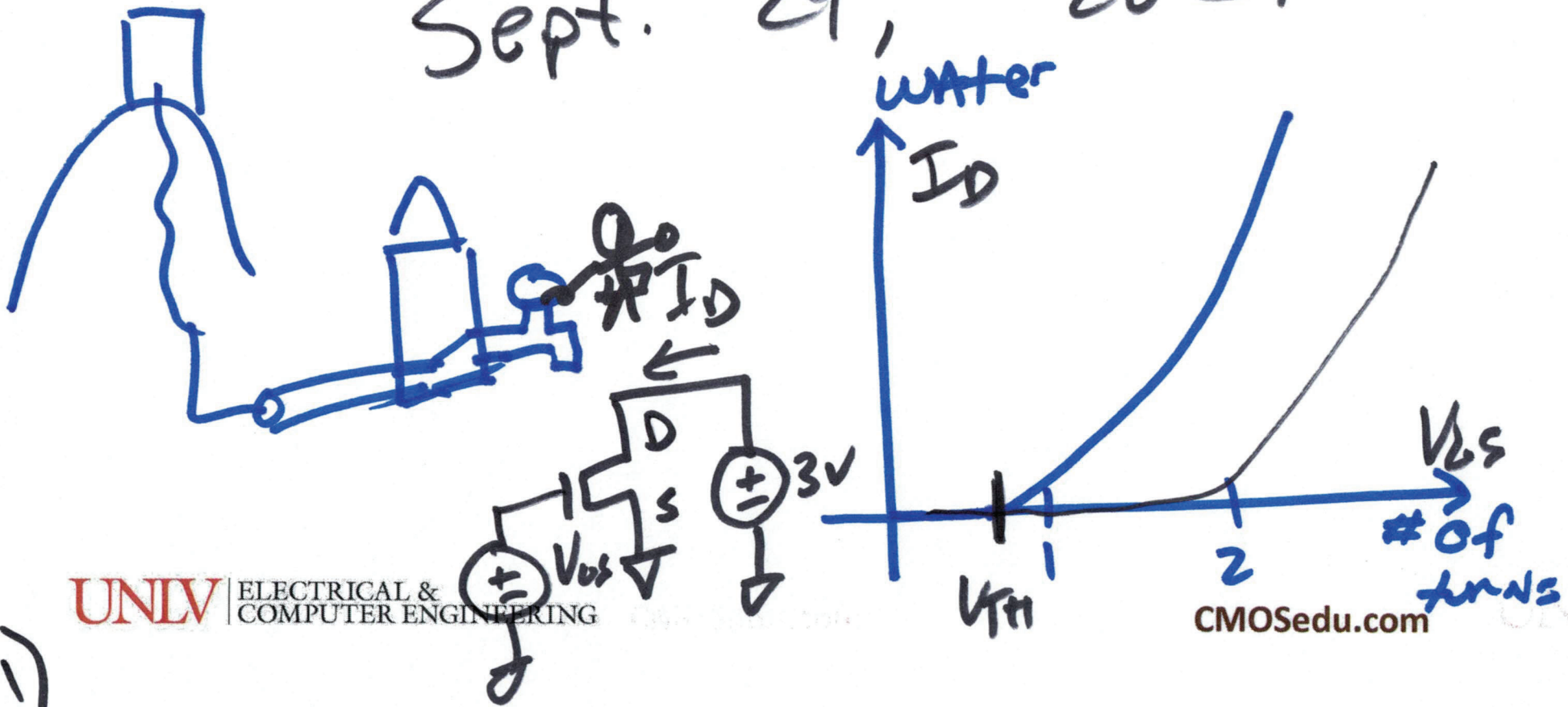


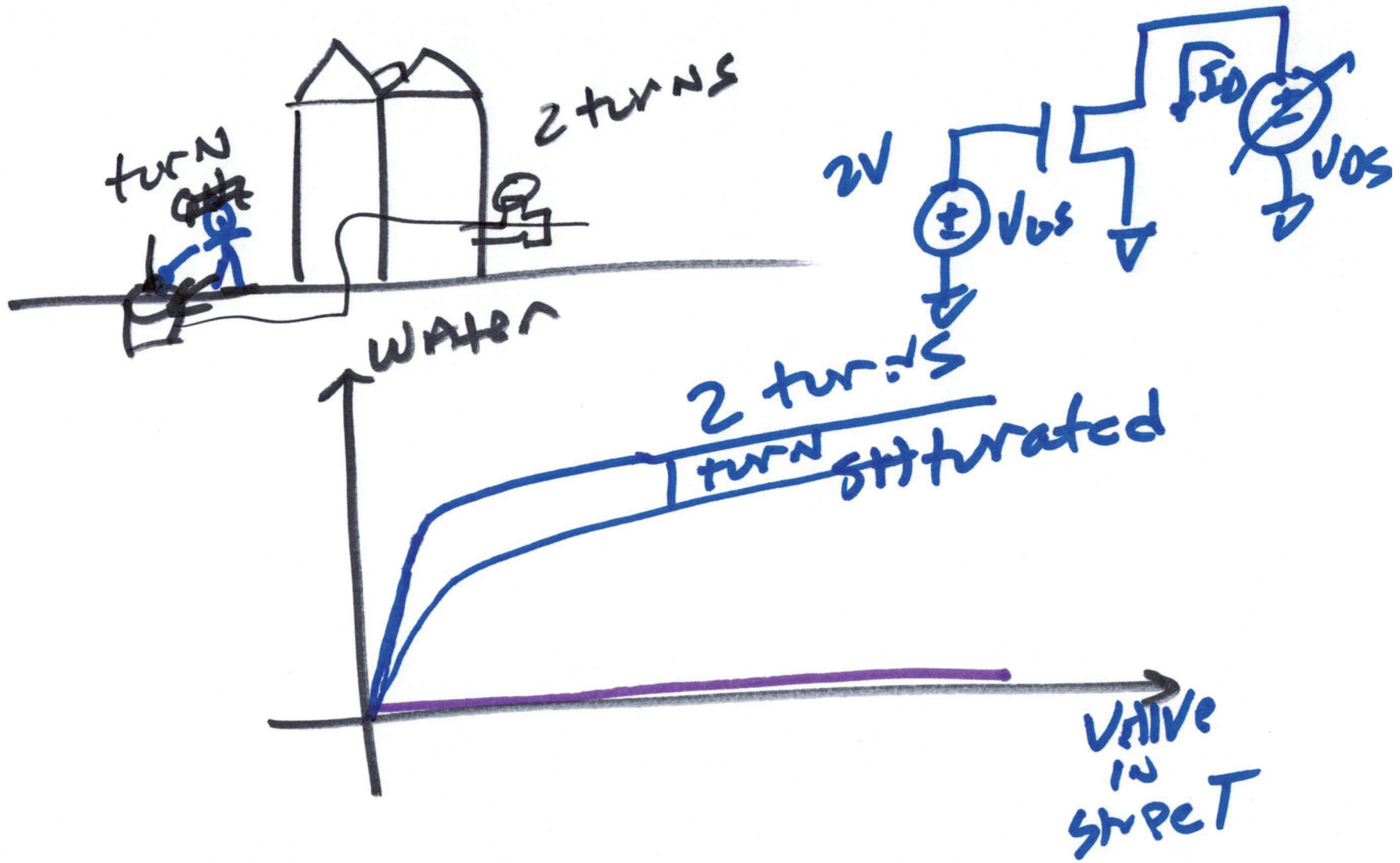
EE 421 / ECG 621

Digital IC Design

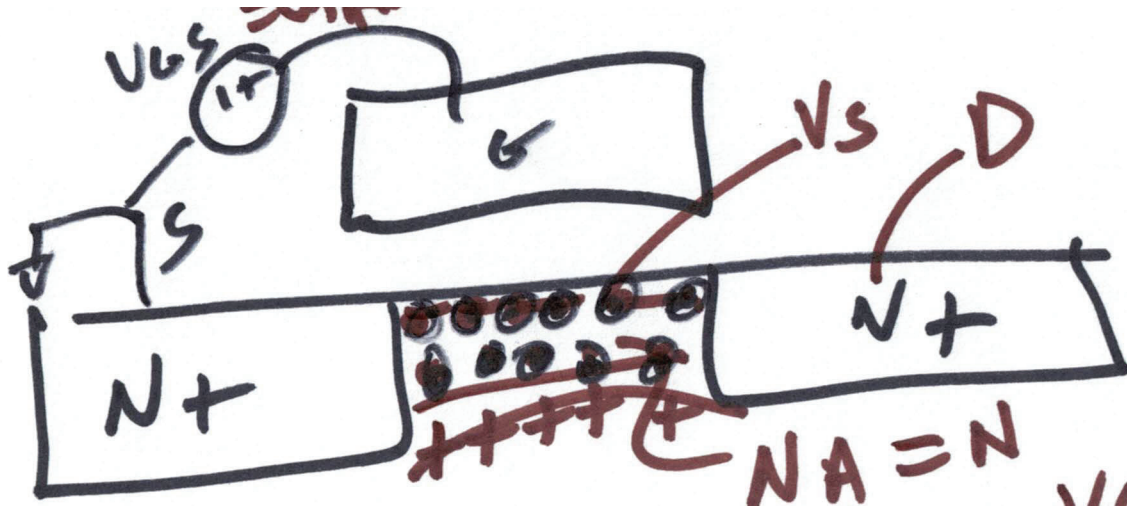
Lecture 11

Sept. 29, 2021





2)



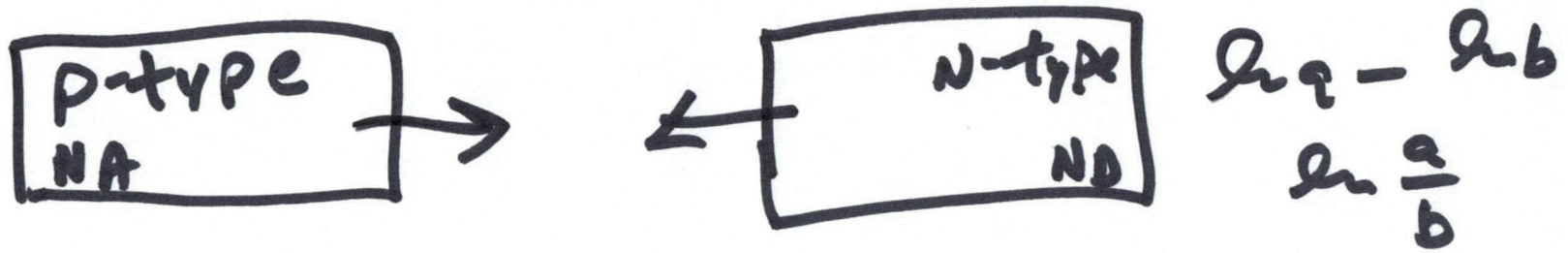
$n_i^2 = p \cdot n$
 Equilibrium
 $V_{FP} = \frac{KT}{q} \ln \frac{N_A}{n_i}$



$V_{FP} = \frac{E_{FP}}{q} = -\frac{KT}{q} \ln \frac{N_A}{n_i}$

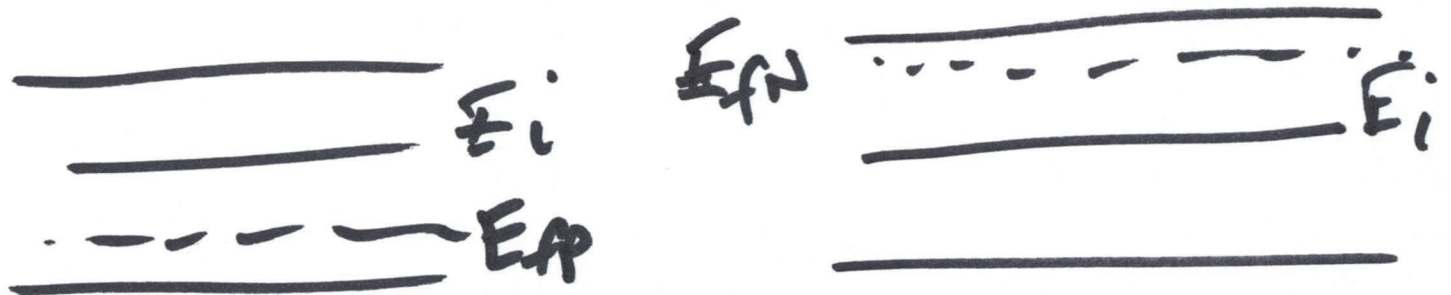
$N_A = \#$ of acceptor atoms / cm^3
 $n_i = p \Rightarrow$ number of holes assuming complete ionization
 intrinsic carrier concentration

3)



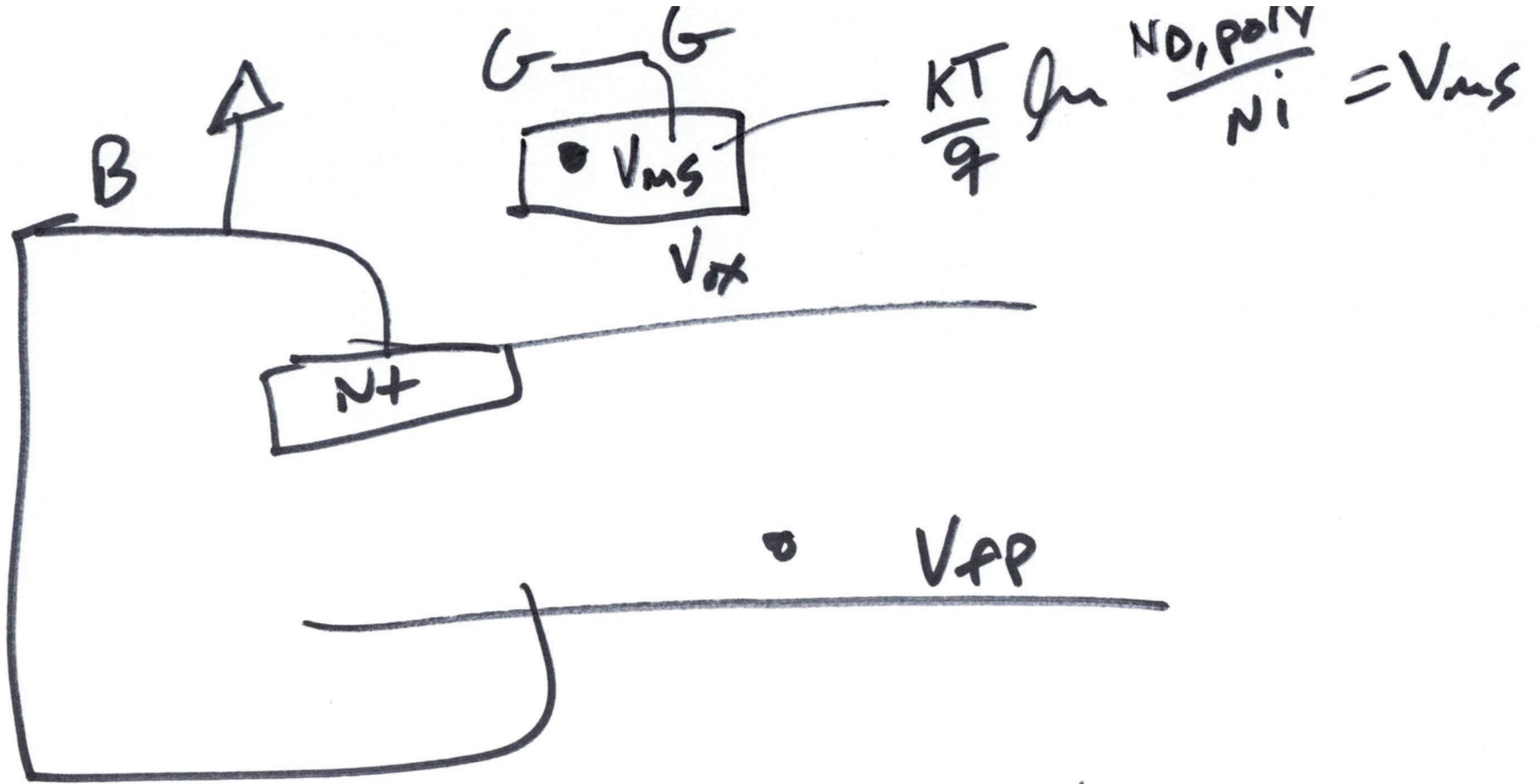
$$V_{fp} = \frac{KT}{q} \ln \frac{N_i}{N_A}$$

$$V_{fn} = \frac{KT}{q} \ln \frac{N_D}{N_i}$$



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$$V_{fn} - V_{fp} = \frac{KT}{q} \ln \frac{N_A N_D}{N_i^2} = V_{bi}$$



$$V_{ms} - V_{ox} + V_{ox} - V_{AP}$$

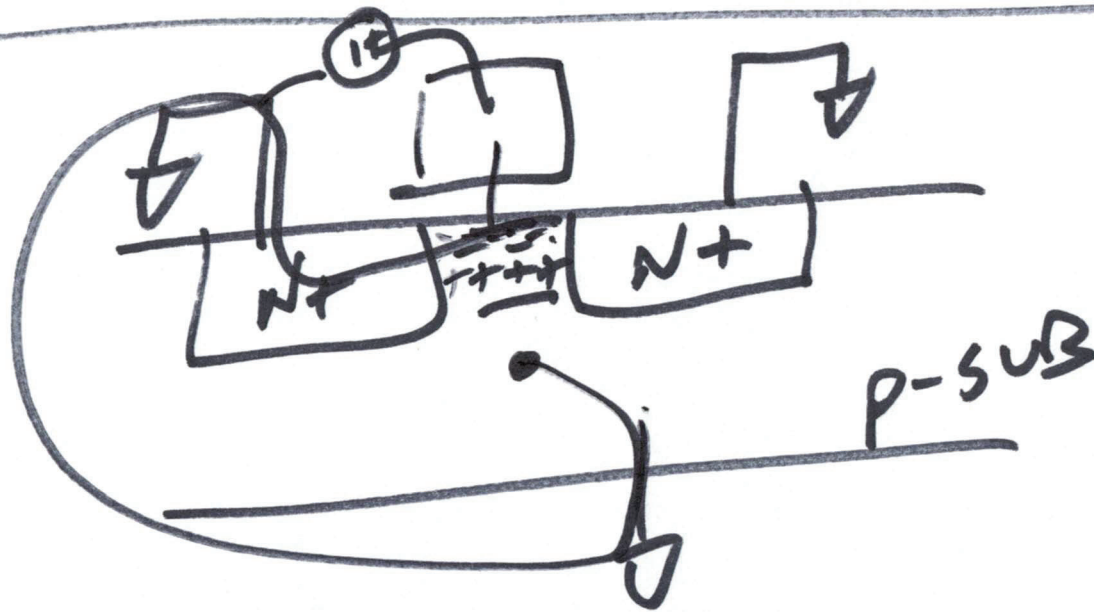
5)

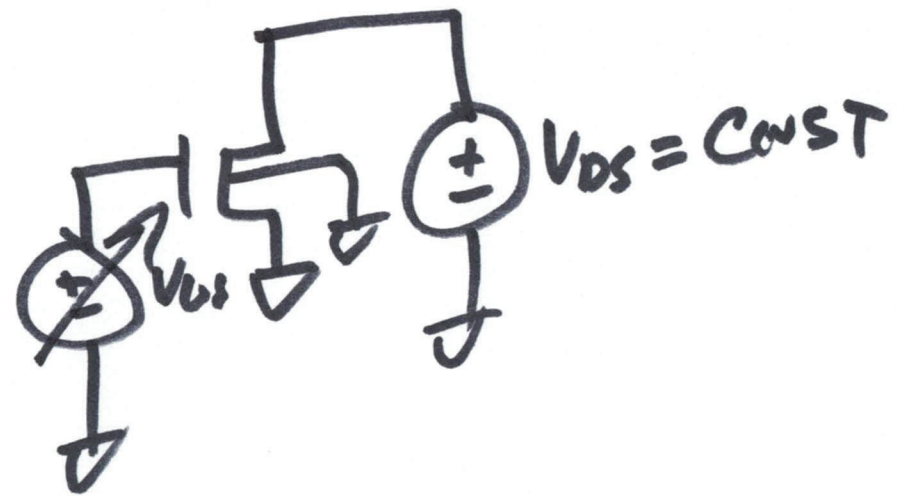
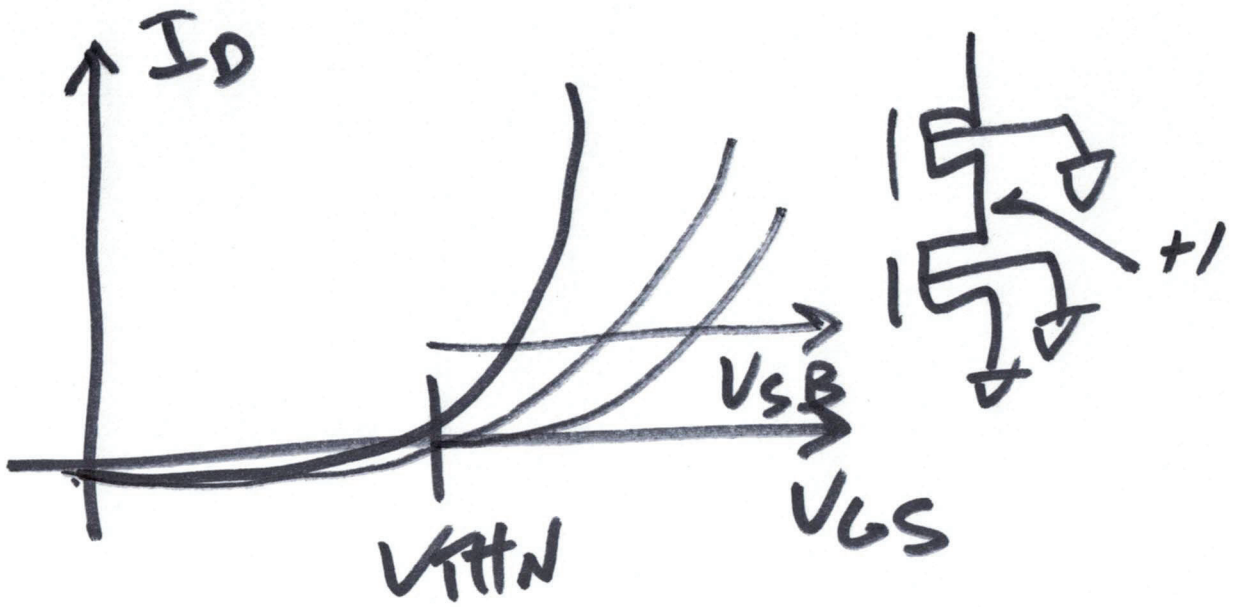
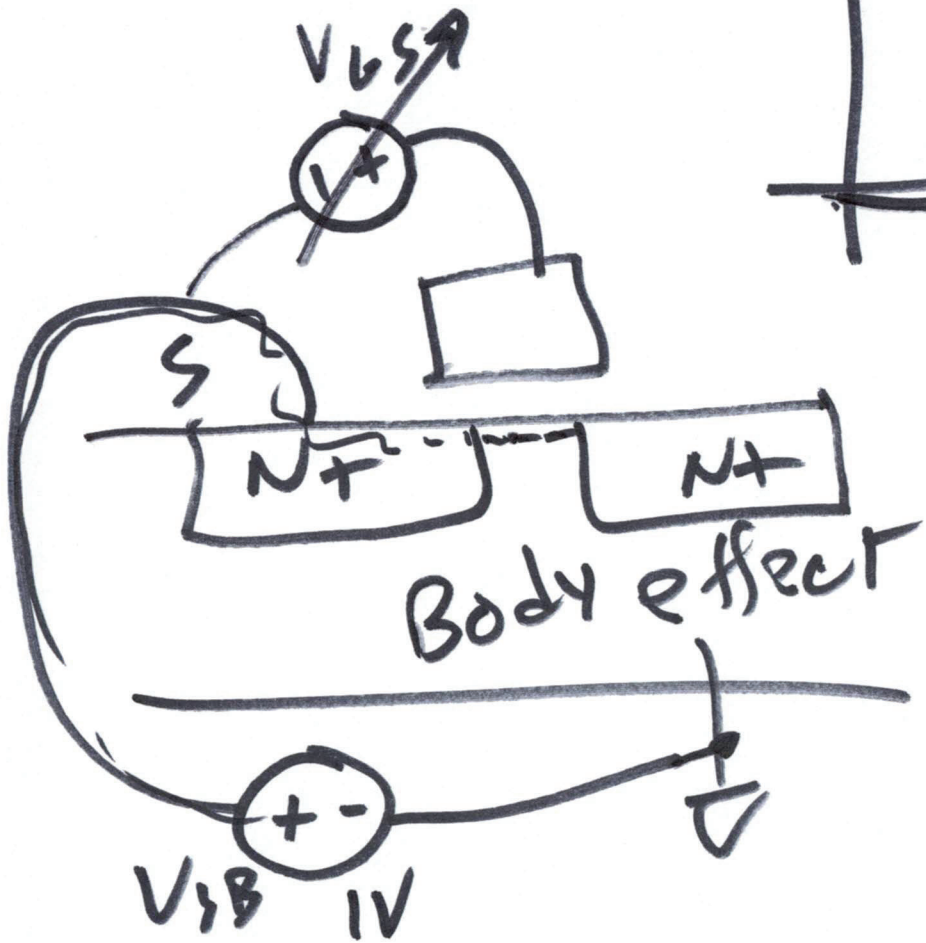
$$V_{THN} = V_{ms} + \frac{Q'_b - Q'_{ss}}{C_{ox}} - 2V_{fp}$$

↑
CONTACT potential



$$V_{fp} = -\frac{kT}{q} \ln \frac{N_A}{N_i}$$





7)

