

EE 421 / ECG 621

Digital IC Design

11/21/2016

Lecture 21

$V_{DD} = 4.5V$

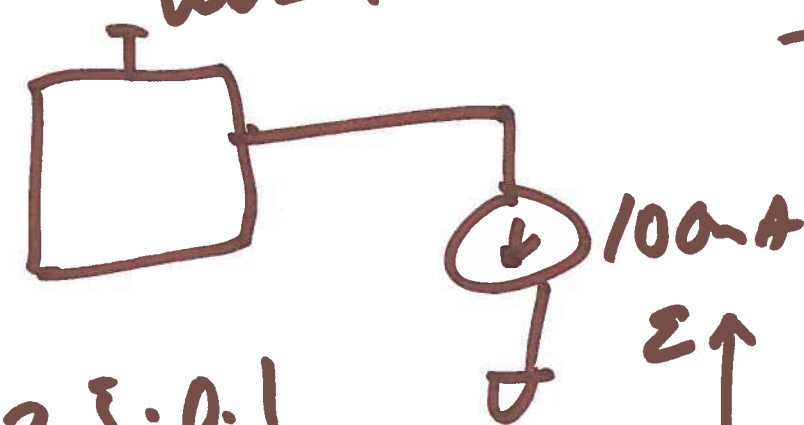
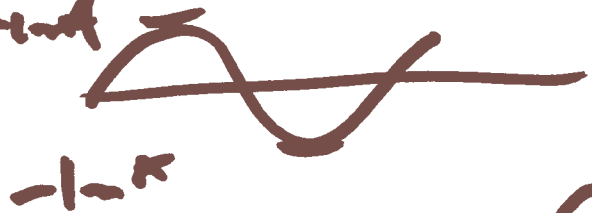
$T = 0^{\circ}C$

MW

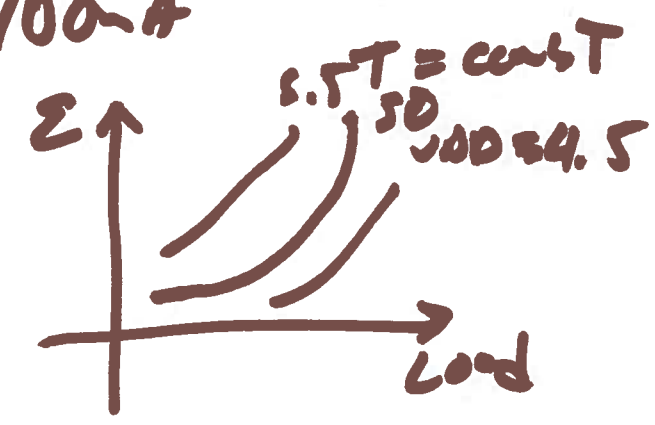
$IV \cdot S \cdot 2\pi \cdot 1k \cdot t$



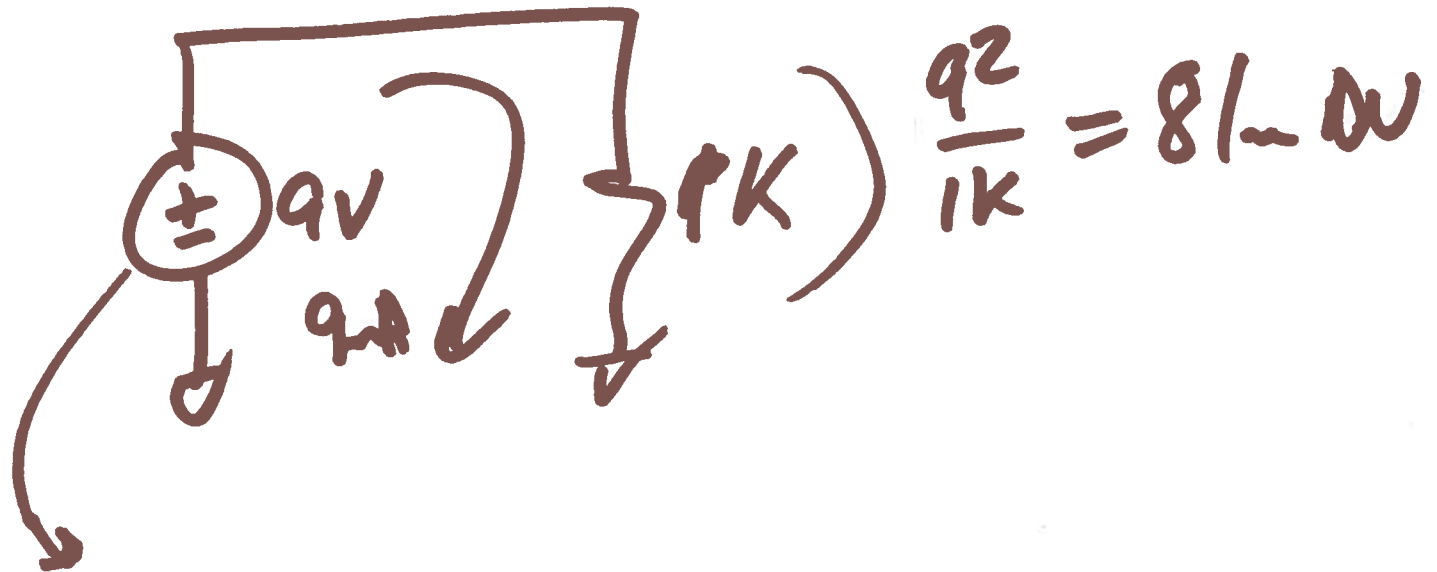
$I_{max} \cdot S \cdot 2\pi \cdot 1k \cdot t$



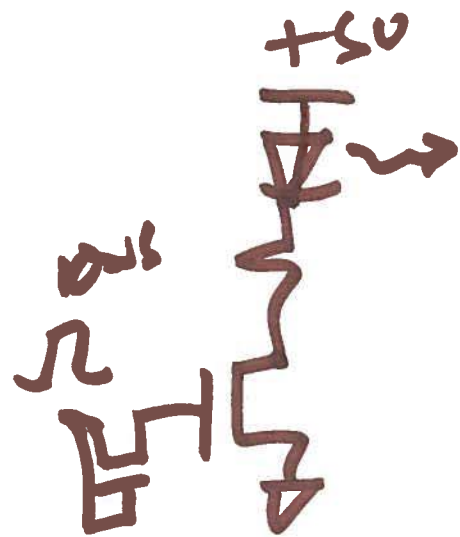
$$\epsilon = \frac{2.3 \cdot 0.1}{4.5 - I_{ens}}$$



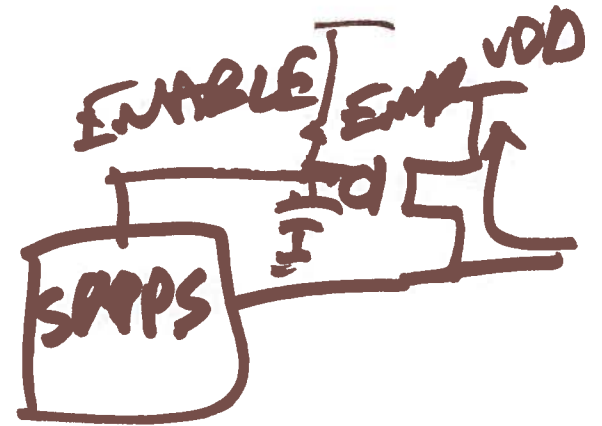
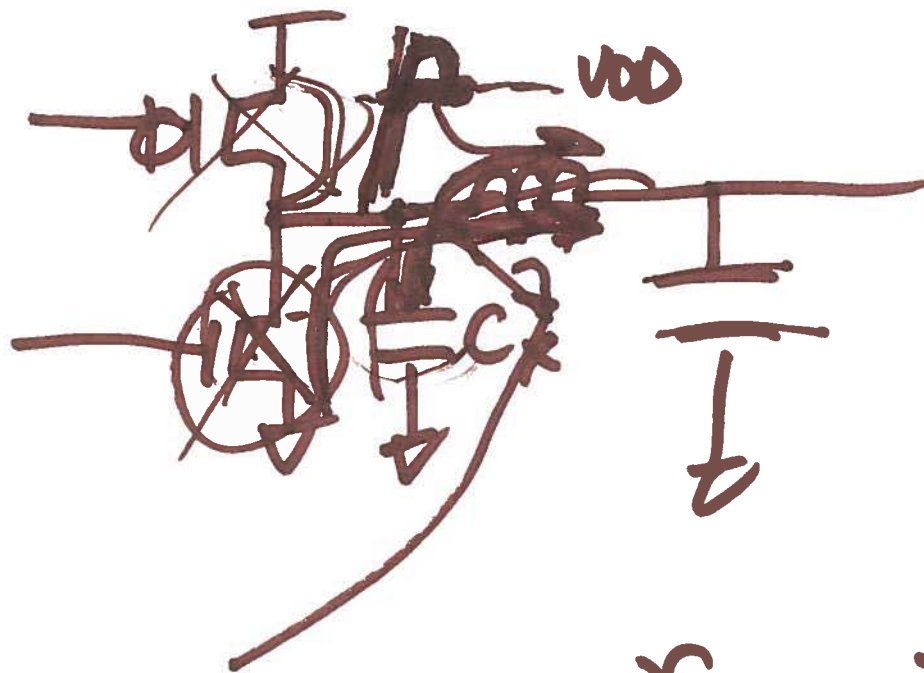
1)



2)

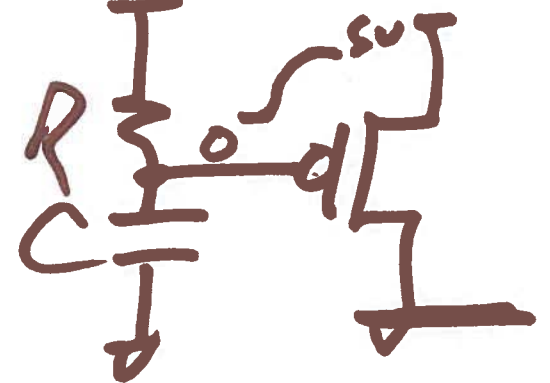


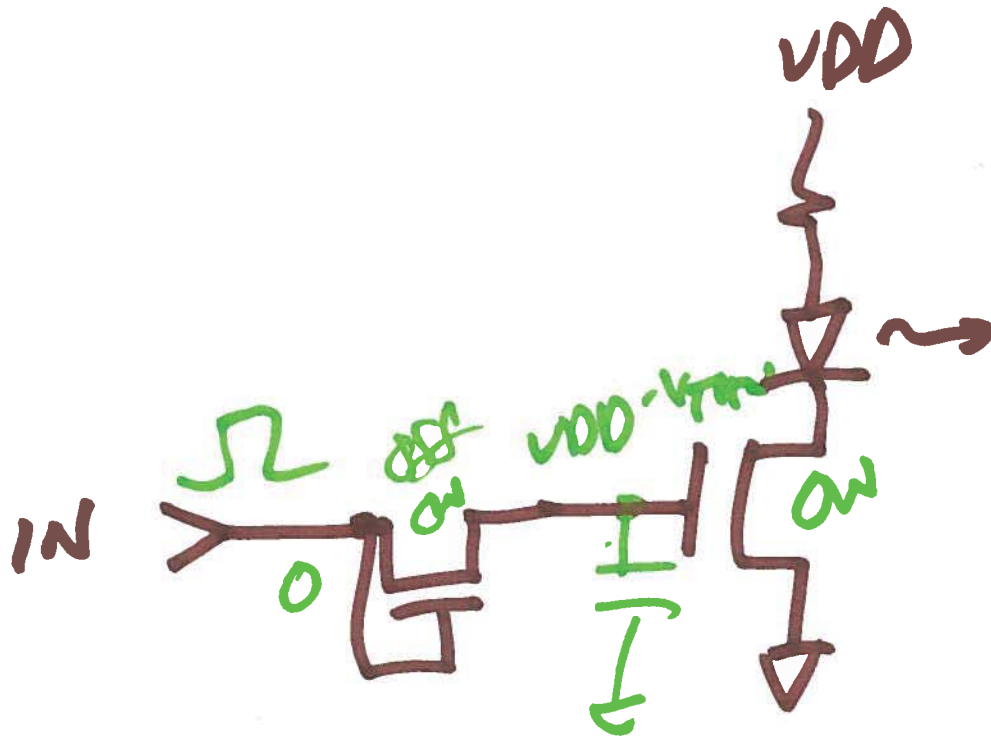
$$\frac{10V}{NS} = \frac{100nA}{10pF} = \frac{dV}{dt}$$



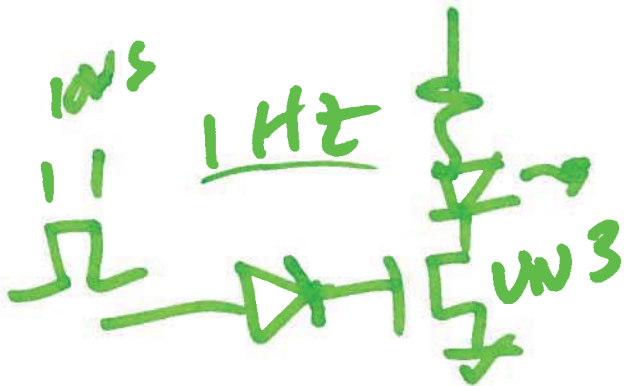
$$\frac{I_{const}}{C_x} = \frac{dV}{dt} f_0 = \frac{1}{2\pi\sqrt{2}R^{0.5}C^{0.5}}$$

$V_{DD} = 5V$





pulse stretcher



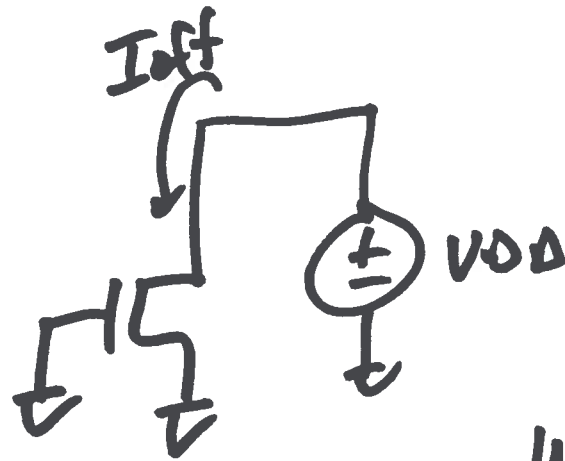
4)

What is off current



$$\sqrt{\frac{1}{T} \int_0^T v_{oc}^2 \cdot dt}$$

$$= v_{oc} \cdot I_{off} = I'_{off} \cdot W$$



$$I'_{off} = \frac{1nA}{4\mu m}$$

Worst off current
(largest)
is at $L = L_{min}$

5)

Rms voltage = ?

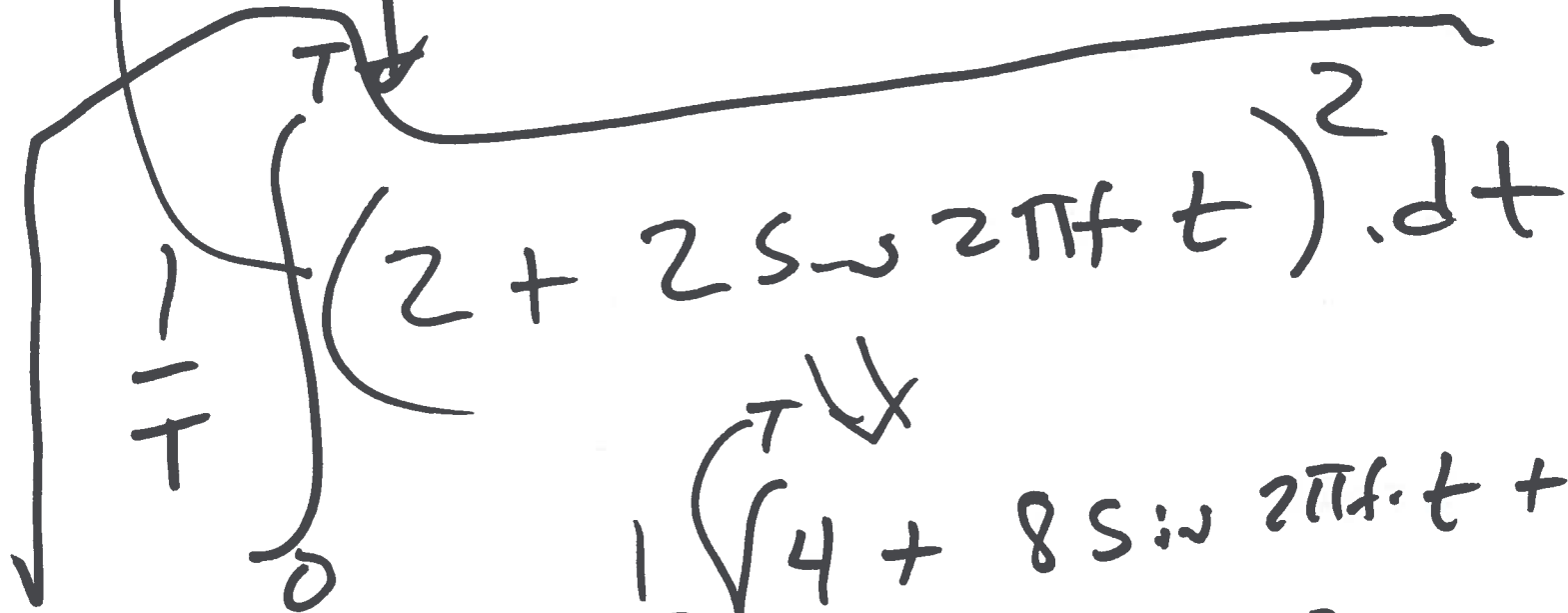
$$\sqrt{\left(\frac{2}{\sqrt{2}}\right)^2 + 2^2}$$

2V $\sin 2\pi f \cdot t$

$$\rightarrow \frac{2}{\sqrt{2}} = V_{rms}$$

2V = V_{rms}

$$\sin^2 x = \frac{1 - \cos 2x}{2}$$



$$\int_0^T (2 + 2 \sin 2\pi f t)^2 dt$$

$$\frac{1}{T} \int_0^T \left[4 + 8 \sin 2\pi f t + 4 \sin^2 2\pi f t \right] dt$$

$$\left(\frac{2}{\sqrt{2}}\right)^2$$

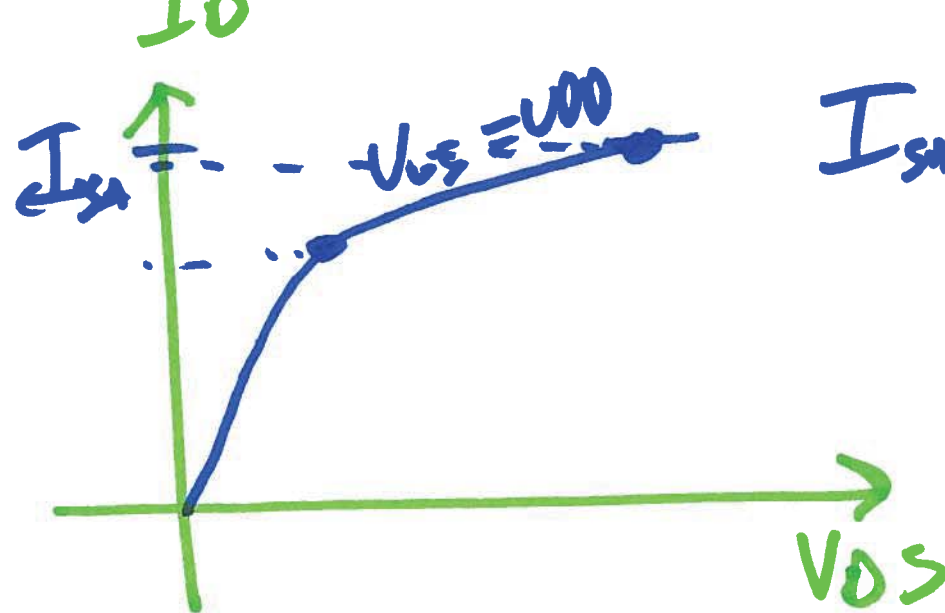
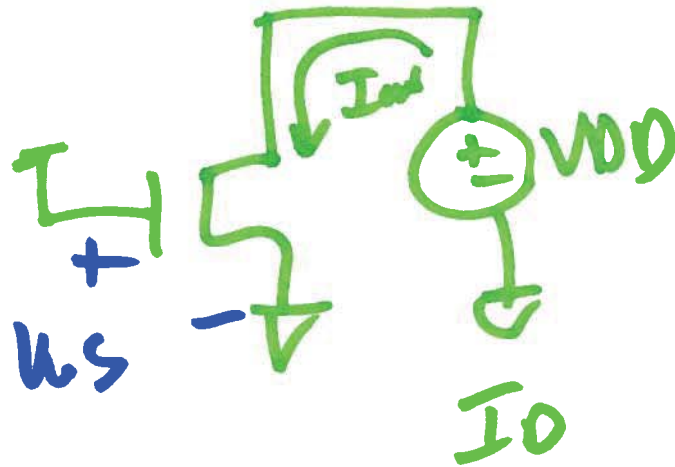
6)

What is on current

$$I'_{on} = \frac{mA}{400} = \frac{4A}{100}$$

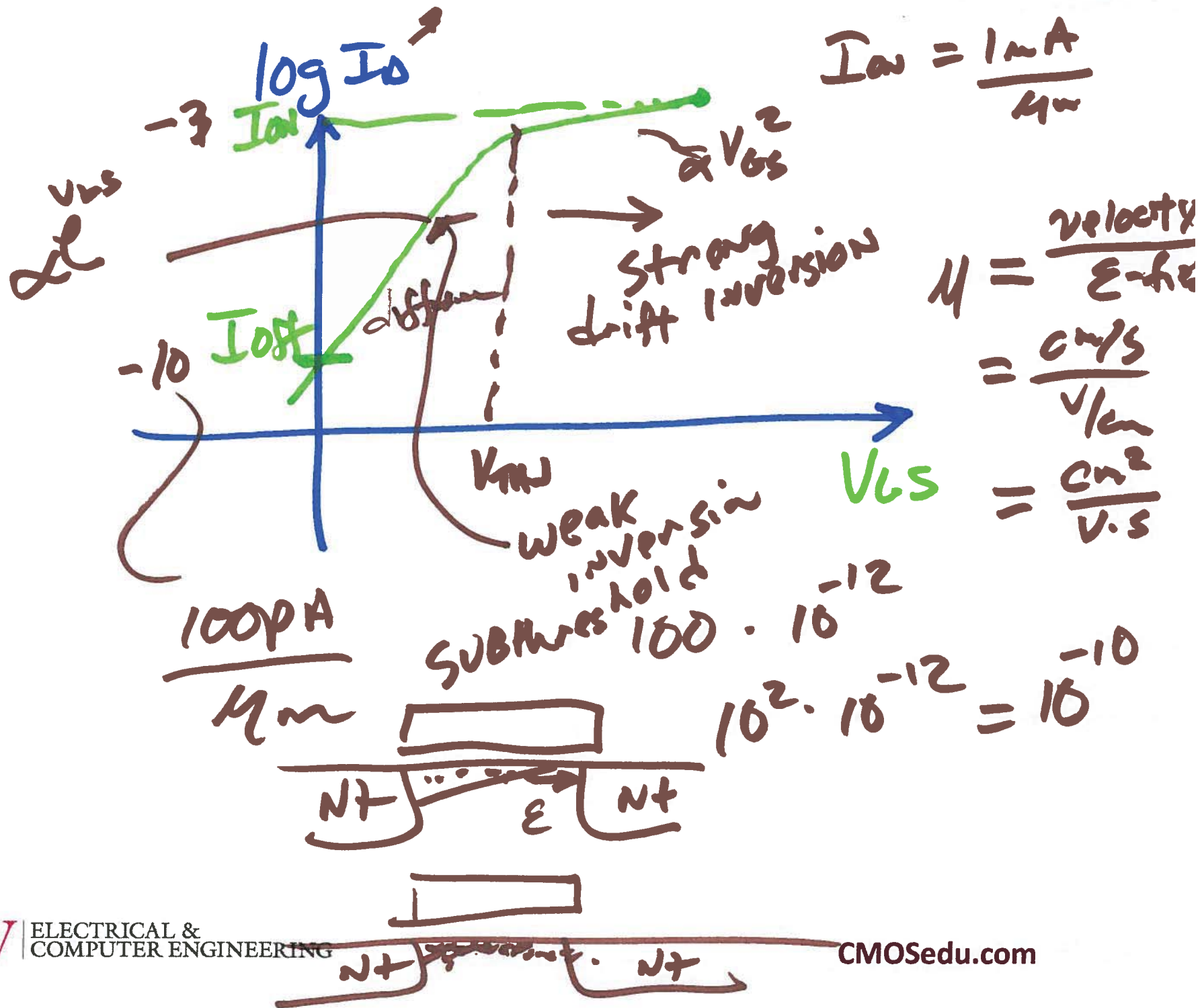
DRIVE CURRENT

I_{SAT}



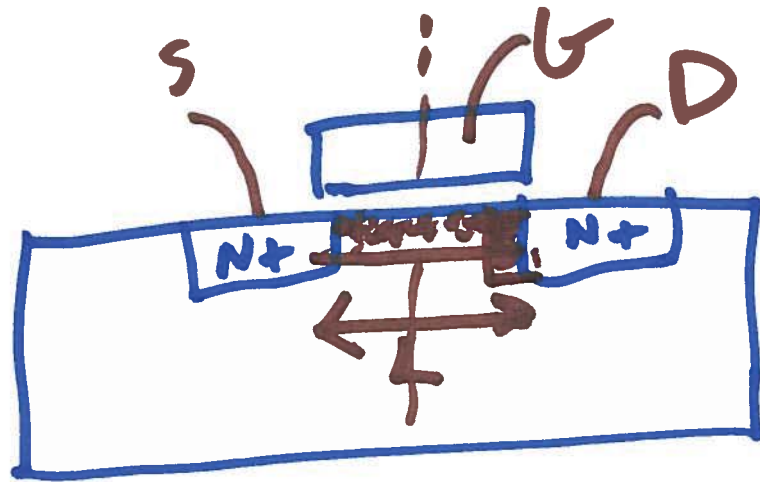
$$I_{SAT} = \frac{400 \mu A}{100}$$





8)

Remind me why in triode
 we model $C_{gs} = C_{gd} = \frac{C'_{ox} \cdot w \cdot L}{2}$



$$R_{in}' = \frac{V_{DD}}{I_{on}}$$

$$C_{gs} = C_{gd} = C'_{ox} \cdot w \cdot \frac{L}{2}$$

in saturation

$$C_{gs} = \frac{2}{3} C'_{ox} \cdot L \cdot w$$

$$C_{gd} = C_{GD0} \cdot W$$