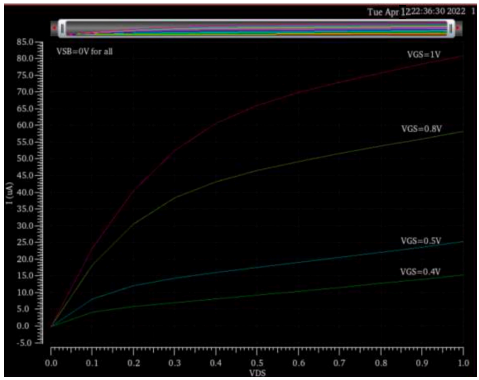
Problem 1



I am not a 189 student

Problem 2:

A) PMOS b/c $I_D=0$ when $V_{GS}>0$. When $V_{GS}<0$, $I_D<0$ when $V_{DS}<0$

B) $|V_{DSAT}|=0.4$ [$|V_{DS}|=0.7V$; $|I_D|=1205mA$; $|V_{GS}|=0.8V$] measurement (1)

$V_{min}=\min(0.7, 0.8-V_T, 0.4)=0.8-V_T$ since $V_T>0$.

$|I_D|=88.98mA$ at $|V_{GS}|=0.7V$ (2)

$V_{min}=\min(0.7, 0.7-V_T, 0.4)=0.4$

$$\frac{I_{DA}}{I_{DB}}=\frac{|V_{GS}-V_T|V_{min}-\frac{(V_{min})^2}{2}}{|V_{GS}-V_T|V_{min}-\frac{(V_{min})^2}{2}} \rightarrow \frac{12.05}{88.98}=\frac{(0.8-V_T)^2-\frac{(0.8-V_T)^2}{2}}{(0.7-V_T)0.4-\frac{0.4^2}{2}}$$

so $V_T=0.403, 0.0890$ But, $V_{DS}>|V_T| \rightarrow V_T>0.0890V$

$\boxed{V_T=-0.0890}$

measurement 3 to 5: both in VSAT region

$$\frac{(I_{DB})}{(I_{DA})}=\frac{(1+\lambda\cdot 0.4}{(1+\lambda\cdot 0.7}=\frac{76.45}{88.98} \rightarrow \boxed{\lambda=0.6991}$$

C)

SAT
OFF
VSAT
SAT
VSAT/LIN
LIN

3. A) PMOS → $C_{gate}=C_{ox}\cdot W_p\cdot L=\frac{14\cdot 10^{-15}}{(10^{-9})^2}\cdot 360\cdot 10^{-9}\cdot 150\cdot 10^{-9}=6.05\cdot 10^{-16}F$

$=\boxed{0.605fF}$

B) NMOS → $C_{gate}=C_{ox}\cdot W_n\cdot L=\frac{5.10^{-15}}{(10^{-9})^2}\cdot 120\cdot 10^{-9}\cdot 120\cdot 10^{-9}=2.16\cdot 10^{-16}F$

$=\boxed{0.216fF}$