

Tutorial Sheet No. 2

1. Calculate the threshold voltage of NMOS with $V_{SB}=0$, for a poly-Si gate. Substrate doping density $=10^{16}/\text{cm}^3$, Poly-Si gate doping density $=2 \times 10^{20}/\text{cm}^3$. Gate oxide thickness $=500\text{\AA}$. Oxide charge density $=4 \times 10^{10}/\text{cm}^2$. ($\epsilon_{ox} = 3.97$, $\epsilon_{Si} = 11.7$)
2. Consider an n+ poly-Si gate and a p type Si substrate doped with $3 \times 10^{16}/\text{cm}^3$. Assume $N_{ox}=10^{11}/\text{cm}^2$. Determine the oxide thickness such that $V_{T0}=0.65\text{V}$. ($\phi_{GC} = -1.13\text{V}$)
3. Calculate the threshold voltage of n-mos with Al gate where $N_A=10^{14}/\text{cm}^3$, $N_{ox}=10^{10}/\text{cm}^2$, $t_{ox}=500\text{\AA}$, $\phi_{GC} = -0.83\text{V}$. Also discuss the answer.
4. Consider a MOS device with following parameters:
poly-Si gate doping density $N_D=10^{20}/\text{cm}^3$, n type substrate $N_D=10^{15}/\text{cm}^3$, $t_{ox}=650\text{\AA}$, $N_{ox}=2 \times 10^{10}/\text{cm}^2$. Find V_{T0} of the transistor.