COLLEGE OF ENGINEERING & TECHNOLOGY

Department: Electronics and Communications Engineering

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Course Title: Advanced Devices

Course No.: EC738 Assignment 4

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MOSFET

For all MOSFETs :

NMOS, L_{drawn} = 3um, W = 10um, $N_{channel}$ = 1E18 cm-3 ,
t_{ox} = 2 nm, u_{eff} = 400 cm^2 V^{-1} sec^{-1},
$V_{supply\ nominal} = V_{dd}$ = 1.8V
Gate: n+ polysilicon (N_d =1 E20cm-3)

Question 1

a – Calculate threshold voltage,V_{th}.
b- Calculate the *body coefficient* "*m*".
c - Find the saturation drain voltage, $V_{DS,\ sat}$.
c - Find the drain current for Vds=0.1V, Vbs=0V
d - Find I_{DS} for V_{ds}=1.8V, V_{bs} = -0.5V

Question 2:

If V_{ds} = 0.5V, V_{gs} = 1.8V, V_{source}=V_{body}=0V (V_{bs}=0V).
Assume quasi-Fermi potential varies linearly between source and drain, and the charge sheet approximation (eqn. 3:9) holds.

a- Calculate V_{th}, and $V_{builtin}$ at both source and drain PN junctions.
b- Plot the quasi-Fermi potential as a function of distance along the channel, for y=0 to y=L.
c- Plot Q'_{inv}(C/cm^2) along the channel, using (3.9)
d- Find an expression for the current density (I_{DS}), using the drift-diffusion equation (3.8)
e- Calculate I_{DS} using equation (3.10)

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