**MOSCAP Lab – Worked out problems 1**

**(**<http://nanohub.org/tools/moscap>)

Saumitra R Mehrotra, Dragica Vasileska and Gerhard Klimeck

Q1) A MOS-C is maintained at T=300K, oxide thickness x0=0.1 µm and the Si doping is NA=1015/cm3. Use n+ poly gate material. Answer the following questions:

1. Plot high frequency and low frequency C-V characteristics. What is the estimated VT for this device?
2. Plot Energy band diagram along with charge density near the semiconductor-oxide interface for the following biases points: Accumulation, near VT and Inversion region of C-V.
3. Compute analytically WT and compare with numerical data.
4. Plot Surface potential v/s Gate bias for the MOS-C.

A1) a)



 Estimated threshold voltage from the CV figure , **VT= 0V.**

 b) (i) Accumulation (VG=-2V)



 (ii) Near threshold voltage VT (VG=0V)



 (iii) Inversion (VG=5V)



c) Analytically maximum attainable depletion width,

$$W\_{T}=\sqrt{2∅\_{F}\left(\frac{2K\_{s}ϵ\_{0}}{qN\_{A}}\right)}=0.894 μm$$

 Numerically WT can be estimated from net charge figure in 2(ii). WT is observed to be **~ 0.7 µm** (distance at which net charge falls 10% of the maximum) which is close to analytical figure.

d)

