6.012 Microelectronic Devices and Circuits

Tutorial #4

Problem 1 – Electrostatics of MOS structure

You are given an MOS capacitor made on silicon, and you are told that its flatband voltage is +0.5V and its threshold voltage V_T is +1.5 V. You are also told that the thickness of the gate insulator is t_{ox} = 100 Angstrom with a relative dielectric constant of 3.9

a) What is the carrier type of the silicon, n-type or p-type?
b) What is the condition of the oxide / silicon interface when V_{GB} = 0 V?
c) For what range of the V_{GB} is the silicon surface in what is termed the depletion condition and is neither accumulated nor inverted?
d) This capacitor is biased such that $|V_{GB} - V_T| = 1.5V$ and the silicon / oxide surface is inverted. What is the sheet charge density in the inversion layer?

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