Essentials of MOSFETs

Lecture 3.3: Gate Voltage and Surface Potential

Short Problem

Mark Lundstrom
Purdue University, Fall 2018

In Lecture 3.3, we established a relation between the gate voltage and surface potential for a P-type semiconductor

$$V_G' = -\frac{Q_S(\psi_S)}{C_{ox}} + \psi_S \qquad (1)$$

Assume a depleted semiconductor with the following parameters:

$t_{ox} = 1.5$ nm $\quad \kappa_{ox} = 3.9 \quad \kappa_{Si} = 11.8$

$V_G' = 1.5$ V $\quad \psi_S = 0.37$ V

and answer the following question.

1a) What is the doping density of the semiconductor?

1b) How does eqn. (1) change for an N-type semiconductor?