

ECEn 450, Winter 2010
Homework # 11
Due March 23, 5:00 pm

From the text Semiconductor Devices, Physics and Technology, do the following problems:

Chapter 6, problems 6, 8, 11

Chapter 12, problems 12, 16

Also complete the following problems:

11.1 Determine the metal-semiconductor work function difference ϕ_{ms} in an MOS structure with p-type silicon for the case when the gate is (a) aluminum, (b) n^+ polysilicon, and (c) p^+ polysilicon. Let $N_A = 6 \times 10^{15} \text{ cm}^{-3}$.

11.2 Consider an aluminum gate-silicon dioxide-p-type silicon MOS structure with $t_{ox} = 45 \text{ nm}$. The silicon doping is $N_A = 2 \times 10^{16} \text{ cm}^{-3}$ and the flat-band voltage is $V_{FB} = -1.0 \text{ V}$. Determine the fixed oxide charge Q'_{ss} .

Homework Helps and Hints:

11.1 The electron affinity of silicon is 4.05eV and bandgap energy is 1.12 eV. Refer to Appendix G. The work function of aluminum is 4.1eV.

11.2 The dielectric constant of silicon dioxide is 3.9.