ECEn 450, Winter 2009
Homework # 11
Due March 24, 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 $N_A = 6 \times 10^{15}$ cm^{-3}.

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