Review Questions

1. Draw an MOS flatband diagram. Indicate the workfunction of the metal and the semiconductor as well as the flatband voltage. Draw it approximately to scale using Φ_M = 4.1 V, c = 4.05 V, E_g = 1.12 eV (silicon) and $N_a = 10^{16}$ cm^{-3}.

2. Derive the metal-semiconductor workfunction for n-type and p-type poly-silicon gate structures. (equation 6.3.2)

3. Explain why the flatband voltage depends on the charge in the oxide or at the oxide-semiconductor interface.

4. Name the three bias regimes of an MOS capacitor and explain what happens in the semiconductor in each of these bias modes.

5. What is the basic assumption regarding the charge in the inversion layer?

6. What are the assumptions of the MOS capacitor analysis?

7. What is the difference between the high frequency and quasi-static capacitance?

8. Why is the high frequency capacitance constant in inversion?

9. Why does the flatband capacitance not equal the oxide capacitance?

10. What is deep depletion?

11. Why does light illumination affect the capacitance of an MOS structure?

12. Name the non-ideal effects in MOS capacitors. What causes them and how do they affect the MOS characteristics?