FYS4239/FYS9239 - Electrical bioimpedance

Textbook: Ø.G. Martinsen and A. Heiskanen. Bioimpedance and Bioelectricity Basics. 4th edition. Academic Press. 2023. Chapters 1 – 10 (approx. 500 pages).

These typical questions or topics will be posed during the oral exam. Other topics may also be brought up and there will probably be follow-up questions as well. It is not necessary to remember complicated equations or tabulated values. It is important that you read and understand all the ten chapters, since many topics are explained in different ways several places in the text and the description is always based on understanding gained in earlier parts of the book. Page numbers given are approximate.

CHAPTER 1

Page 001: Difference bioimpedance / bioelectricity?

Page 003: Is DC simply AC with f → 0 ?

CHAPTER 2

Page 007: Mention some differences between ionic and electronic conduction.

Page 009: What is electronegativity?

Page 010: Five types of molecular bonds

Page 034: What is electro-osmosis?

Page 035: What is streaming potential?

CHAPTER 3

Page 038: What is polarization?

Page 041: Three types of polarization

Page 052: What is (Debye) relaxation?

Page 060: What is Maxwell-Wagner effect?

Page 071: Explain Figure 3.14 (dispersions)

CHAPTER 4

Page 081: Talk about the cell membrane

Page 092: The electrical properties of human skin

Page 095: Explain G in Figure 4.18

Page 105: Explain Figure 4.28

Page 107: What is anisotropy?

CHAPTER 5

Page 119: What is an action potential?

Page 127: How is the action potential signal propagated on an axon?

CHAPTER 6

Page 158: What is transfer impedance?

Pages 158 & 219: Explain the four-electrode system

Page 160: What is (negative) sensitivity?

Page 165: Talk about EIT

Chapter 7

Page 176: Explain (non-)polarized electrode

Page 181: Wet and solid gel

Page 186: Talk about the electric double-layer

Page 212: Explain Figure 7.20

CHAPTER 8

Page 250: Explain impedance and admittance

Page 252: What is reciprocity?

Page 254: What are Kramers-Kronig transforms?

Page 299: What is a lock-in amplifier and how does it work?

CHAPTER 9

Page 358: What is a constant phase element?

Page 362: What is the Cole equation?

Page 389: What is a memristor?

Page 419: Talk about Figure 9.52 (ROC graph)

CHAPTER 10

Having read this chapter you should be able to give a few good examples of applications of bioimpedance methods and describe the basics of how the methods work.