

BME-1157 Biomedical Engineering: Signals and Systems

Exam 21.10.2011

No calculators allowed.

To pass the exam, you must get in total at least 12 points and in every question at least 1/3 of the maximum points (1.3/4, 2/6, or 2.6/8).

- 1.a) **Consider** a concept of a *system* in general. **List and briefly describe** the common characteristics that the systems share. (2 p)
- b) **Apply** those characteristics to a *cardiovascular system* of the body. (2 p)

- 2.a) **Explain** the general principle of a *transducer*? What kind of transducers there are commonly in use in medical measurements? (2 p)
- b) **Explain** how the *electrocardiogram* (ECG) is measured. (2 p)
- c) **Explain** the characteristics of the *ECG signal*. (2 p)
- d) **Explain** how the recording of the *electroencephalogram* (EEG) and the recorded *EEG-signals* differs from those of the ECG? Consider the main differences. (2 p)

3. **Compare** *x-ray imaging* (radiography) and *ultrasound imaging* with each other. Consider the following aspects by describing each of them with few sentences, use also figures to illustrate them:
 - a) Energies used in the methods (2 p)
 - b) Interactions of the energies with the tissue (2 p)
 - c) What can be seen in the images, image information? (2 p)
 - d) Safety of the methods (2 p)

- 4.a) **Explain** the importance and meaning of *modelling* in (1) biology or physiology, and (2) developing the diagnostic methods. (2 p)
- b) **Briefly describe** any model of a *cardiovascular system*. (1 p)
- c) **Briefly describe** what kinds of models are needed in solving so called *inverse problem in ECG*? (1 p)