ELT-61216 Biomedical Engineering: Signals and Systems
Exam 17.10.2016/ Juha Nousiainen

Neither calculators nor materials are allowed.
Give brief and compact answers in each question! Use graphs to clarify your answers.

1. **Describe** as a block diagram a *generalized measurement system* of physiological signals. Describe the data and information flow, name the functional components and state their main function. **Apply** the general schema of the recording system to the ECG recording.

2. **Describe** (**draw**) a typical *ECG signal* wave form, **name** its components and **argue** why this typical wave form is usually observed. **Give examples** what kind of clinical information about the functioning of the heart muscle can be obtained with the ECG?

3. **Clarify, why and how** you as a biomedical engineer must be aware of *noise problem* in the recording of physiological signals.

4. **Describe** how you can model with *intuitive concepts* the generation of the ECG.

5. **Explain** the principle of medical *tomographic* imaging system. **Name** what kinds of tomography imaging modalities there are in clinical use?

6. **Explain** principle of the *pulse-echo ultrasound* imaging system. **State** why ultrasound is so popular (benefits) in medical practice.

7. **Clarify** the concepts of *forward* and *inverse problems* and the role of modelling in solving these problems. **Give** an illustrative example of the use of both problems from biomedical field.

8. **Describe** as a block diagram an *automatic control system* based on a closed-loop negative feedback system. Apply this schema to an artificial cardiac pacemaker.