Course syllabus

Biomedical Signal Processing
Medicinsk signalbehandling

BMEN01, 7.5 credits, A (Second Cycle)

Valid for: 2025/26
Faculty: Faculty of Engineering LTH
Decided by: PLED BME
Date of Decision: 2025-04-11
Effective: 2025-05-05

General Information

Depth of study relative to the degree requirements: Second cycle, in-depth level of the course cannot be classified
Elective for: BME4-sbh, C4, D4, E4-mt, E4-sb, F4, F4-mt, F4-bm, F4-ss, Pi4-biek
Language of instruction: The course will be given in English on demand

Aim

The course provides an overview of methods suitable for solving problems in biomedical signal processing. The student should obtain sufficient insights on the origin on biomedical signals and analysis methods to independently determine suitable methods.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- have knowledge about biomedical signals and methods which are particularly useful for their processing.
- to apply the most common methods on clinical problems (Matlab level)
- to define simple mathematical models and to determine related, optimal methods for estimation of relevant information.

Competences and skills
For a passing grade the student must

- to understand the origin of bioelectrical signals and their manifestation on the body surface.
- to describe the most common clinical applications where such signals are used.
- to describe the most common methods for analysis of both periodic and aperiodic biomedical signals. The description is to be done in catchall terms, i.e., block diagrams and text, as well as with the help of equations.
- to formulate and describe statistical signal models being suitable for modelling of specific signal properties.
- to implement a method and evaluate its performance in clinically relevant terms.
- analyze and solve a specific signal processing problem in the framework of a project.

Judgement and approach
For a passing grade the student must

- be able to analyze, assess, and implement algorithms, and also to interpret and to describe their inherent principles.
- have insight on the fact that seemingly different technical problems can be dealt with using the same methods.

Contents

Bioelectrical signals

- Their origin, especially concerning signals reflecting the activity of the brain, the muscles, and the heart.
- Information-carrying components in bioelectrical signals.
- Common clinical applications of bioelectrical signals.

Brain signals

- Analysis of both spontaneous activity and evoked potentials
- Spectral analysis (nonparametric and parametric) and characterization of power spectra.
- Time-frequency analysis.

Examination details

Grading scale: TH - (U, 3, 4, 5) - (Fail, Three, Four, Five)
Assessment: Exam at the end of the course. A comprehensive, mandatory project pursued from a problem-oriented perspective where the student will have to take considerable responsability in formulating and solving the assigned task.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Modules
Code: 0118. **Name:** Examination.
Credits: 5.5. **Grading scale:** TH - (U, 3, 4, 5). **Assessment:** Passed exam **The module includes:** Written exam
Code: 0218. **Name:** Project.
Credits: 2.0. **Grading scale:** UG - (U, G). **Assessment:** Passed project **The module includes:** Project for max two students

Admission

Assumed prior knowledge: ESS040 /EITF75 Systems and Signals, ETI265 /EITA50 Signal Processing in Multimedia, BMEA05 Signals and Systems or EITF15 Signal Processing - Theory and Applications.
The number of participants is limited to: No
Kursen överlappar följande kurser: ETI160 ETIF15

Reading list

- Sörnmo L, Laguna P: Biomedical Signal Processing in Cardiac and Neurological Applications. Elsevier, 2005, ISBN: 0-12-437552-9.

Contact

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Course homepage: http://www.bme.lth.se

Further information

With less than 16 participants, the course may be given with reduced teaching and more self studies.