

Course syllabus

Neuroengineering Neuroteknik

BMEN30, 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-bdr, F4, F4-mt, N4-nbm, Pi4

Language of instruction: The course will be given in English

Aim

The aim of this course is to give a broad overview of neural engineering concepts and principles for recording outgoing (efferent) and generating ingoing (afferent) neural signals. These concepts form the basis for neural interfaces or human-machine interfaces. This area is interdisciplinary and encompasses the fields of neuroscience, physiology, signalprocessing, machine learning and robotics. The course will give insights into existing and future neural interfaces, neural prostheses and neurorobotics.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- be familiar with the basic anatomy and physiology of the human central and peripheral nervous system
- understand how motor commands translates into muscle actions
- understand how sensation translates into perceptions
- understand and be able to describe basic principles behind human-machine interfaces

Competences and skills

For a passing grade the student must

- be able to use techniques for electroencephalography recordings
- be able to use techniques for electromyography recordings
- be able to use techniques for nerve stimulation
- be able to apply neural engineering in different contexts
- be able to describe human-machine interfaces for the spinal cord, peripheral nerves and muscles

Judgement and approach

For a passing grade the student must

- be able to analyse, evaluate and implement human-machine interfaces
- be able to interpret and discuss information from scientific literature regarding neuroengineering advances
- be able to reflect over the ethical consequences of neuroengineering

Contents

The course will introduce principles and technologies of neuroengineering applications including basic human neurophysiology and -anatomy, brain stimulator, spinal cord stimulation, functional electrical stimulation (FES), neural-machine interface for motor prosthesis control, artificial visual and auditory devices for augmented sensory perception.

Examination details

Grading scale: TH - (U, 3, 4, 5) - (Fail, Three, Four, Five)

Assessment: Compulsory parts to be passed: lab exercises including reports, assignments, project presentation and report and a written exam.

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: 0122. **Name:** Written Exam.

Credits: 4.0. **Grading scale:** TH - (U, 3, 4, 5). **Assessment:** Graded exam **The module includes:** Written exam

Code: 0222. **Name:** Labs, Exercises, Project.

Credits: 3.5. **Grading scale:** UG - (U, G). **Assessment:** Completed laboratory work with approved laboratory report and approved assignments, approved project report and presentation. **The module includes:** Laboratory works with report, assignments, project report and presentation.

Admission

Assumed prior knowledge: Mathematics, Physics and Physiology (eg. EXTG50).

The number of participants is limited to: 32

Selection: Credits taken within the programme. Priority is given to students enrolled on programmes that include the course in their curriculum.

Kursen överlappar följande kurser: BMEF20

Reading list

- lecturerepresentations och labmanuals.
- Journal articles and book chapters (online resources).

Contact

Course coordinator: Christian Antfolk,
christian.antfolk@bme.lth.se

Course coordinator: Nebojsa Malesevic,
nebojsa.malesevic@bme.lth.se

Further information

Expert guest lecturers from other faculties or other universities may appear. With less than 12 participants, the course may be given with reduced teaching and more self studies."