LUND UNIVERSITY

LTH
FACULTY OF ENGINEERING

Course syllabus

Neuroteknik
Neuroengineering

BMEN30, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED BME
Date of Decision: 2023-04-13

General Information

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 recordnings
- 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 informaiton from scientific literature regarding neruoengineering 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.

Parts
Code: 0122. **Name:** Written Exam.
Credits: 4. **Grading scale:** TH. **Assessment:** Graded exam **Contents:** Written exam
Code: 0222. **Name:** Labs, Exercises, Project.
Credits: 3,5. **Grading scale:** UG. **Assessment:** Completed laboratory work with approved laboratory report and approved assignments, approved project report and presentation. **Contents:** 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.
The course overlaps following course/s: BMEF20

Reading list

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

Contact and other information

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.”