GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2018-2019

Neural Interfaces, Neuromodulation and Minimally Invasive Neurotechnology (E092960)

Course size (nominal values; actual values may depend on programme)

Credits 3.0	Study time 90 h	Contact hrs	30.0 h

Course offerings and teaching methods in academic year 2018-2019

A (semester 2)	English	self-reliant study activities	5.0 h
		lecture	20.0 h
		seminar	5.0 h

Lecturers in academic year 2018-2019

Keereman, Vincent	TW06	lecturer-in-charge
Tanghe, Emmeric	TW05	co-lecturer

Offered in the following programmes in 2018-2019	crdts	offering
Master of Science in Biomedical Engineering	3	A
International Master of Science in Biomedical Engineering	3	A
Master of Science in Biomedical Engineering	3	A

Teaching languages

English

Keywords

Neural interfaces, electroencephalography, electromyography, neuromodulation, brain-computer interfaces, neuroprosthetics, wearables, minimally invasive therapy.

Position of the course

This course is aimed at the biomedical engineer that wants to dive deeper into the technological background of advanced diagnostic and therapeutic strategies in neurology and neurosurgery. The course covers the principles and pitfalls of acquisition of electrical signals in the central and peripheral nervous system, neuromodulation, brain-computer interfaces and assistive devices. Sections are also dedicated to the use of wearable technology in the follow-up of neurological diseases, and minimally invasive approaches in neurology and neurosurgery.

Contents

1 Design of neuro-electrical interfaces: circuit model, electrode materials, impedance characteristics, field of view;
2 Acquisition of electrical signals from the central nervous system: signal generators, electroencephalography, electrocorticography, single unit recording;
3 Peripheral nervous system & neuromuscular junction: nerve conduction studies, myography, artefact reduction;
4 Electrical neuromodulation: governing principles, deep brain stimulation, vagus nerve stimulation, transcranial magnetic stimulation;
5 Brain-computer interfaces and neuroprosthetics: input signals, algorithm design, assistive devices, exoskeletons;
6 Wearables: sensors and integration, motion analysis for movement disorders, seizure detection, biofeedback for rehabilitation therapy;
7 Minimally invasive therapy: catheter-based procedures, stereotactic neurosurgery, neuronavigation.

Initial competences

- Principles of anatomy and physiology of the nervous system
- Principles of electromagnetism

- Principles of electronics design

Final competences

1. Design and characterisation of electrical interfaces with neuronal tissue.
2. Optimization of acquisition of electrical signals from the central nervous system and its limitations.
3. Principles of electroneuromyography and the pitfalls in peripheral nerve studies.
4. Modeling of neuromodulation and its different modalities.
5. Principles of brain computer interfaces and assistive devices.
6. Wearable integration strategies and their use for neurological diseases.
7. Minimally invasive therapies (intervential neuroradiology and minimally invasive neurosurgery).

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, seminar, self-reliant study activities

Learning materials and price

References

Course content-related study coaching

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Oral examination

Examination methods in case of periodic evaluation during the second examination period

Oral examination

Examination methods in case of permanent evaluation

Report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

Extra information on the examination methods

Periodic evaluation: oral examination with written preparation
Permanent evaluation: practicum (report)

Calculation of the examination mark

Periodic evaluation (80%) + permanent evaluation (20%).
Second examination period (resit): oral examination only.