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Module EIT-MEA-190-M-6

Analog and Power Electronics in Medicine and Biomedical Research (M, 4.0 LP)

Module Identification

Module Number	Module Name	CP (Effort)
EIT-MEA-190-M-6	<i>Analog and Power Electronics in Medicine and Biomedical Research</i>	4.0 CP (120 h)

Basedata

CP, Effort	4.0 CP = 120 h
Position of the semester	1 Sem. in WiSe
Level	[6] Master (General)
Language	[EN] English
Module Manager	Götz, Stefan, Prof. Dr.-Ing. (PROF DEPT: EIT) (/staff/342/)
Lecturers	Götz, Stefan, Prof. Dr.-Ing. (PROF DEPT: EIT) (/staff/342/)
Area of study	[EIT-MEA] Mechatronics and Electrical Drives
Reference course of study	[EIT-88.781-SG#2010] M.Sc. Electrical and Computer Engineering [2010] (/mhb/FB-EIT/cos-556/)
Lifecycle-State	[NORM] Active

Courses

Type/SWS	Course Number	Choice in Module-Part	SL	PL	CP	Sem.
2V+1U	EIT-MEA-190-K-6 (/mhb/courses/EIT-MEA-190-K-6/)	P	-	no	4.0	WiSe

- About [EIT-MEA-190-K-6]: Title: "Analog and Power Electronics in Medicine and Biomedical Research"; Presence-Time: 42 h; Self-Study: 78 h

Examination achievement PL1

- Form of examination: **oral examination (30 Min.)**
- Examination Frequency: each semester

Evaluation of grades

All partial module examinations have to be passed. The module grade is the weighted average of the partial examination grades according to the following weights:

- grade of exam
- voluntary technical project (up to 50%)
- voluntary presentation about research (up to 33%)

Contents

From [EIT-MEA-190-K-6] Analog and Power Electronics in Medicine and Biomedical Research (/mhb/courses/EIT-MEA-190-K-6/):

Electromagnetic fields play a key role in modern medicine and medical nanotechnology. They allow looking into the body, particularly the brain, measure the anatomy in 3D, detect activation, read but also write signals. Electromagnetic fields can be used for a number of additional applications.

The course will give students from engineering and physics an introduction to the use of technology for medical purposes. The starting point of the course will be the nervous system and the brain as a widely electrical system.

Topics that will be covered:

- neuroengineering and an introduction to basic neurophysiology
- fundamental basic neuroanatomy
- physics of signaling in neurons
- electromagnetic properties of body tissue
- detecting neural signals in the central (brain/spine) and the peripheral nervous system
- cardiac monitoring (electrocardiography, ecg) and stimulation (defibrillation and pace making)
- neurostimulation and neuromodulation: writing signals into the brain (invasively and noninvasively)
- brain-machine interfaces
- design of circuits to detect neural signals as well as to stimulate/modulate neural circuits
- basics of imaging
- magnetic resonance imaging for anatomical, functional, and connectivity scanning
- introduction to medical device standards and device safety

Competencies / intended learning achievements

After completing this module you can...

- ... analyze medical applications of engineering and physics with respect to examples examples from power and analog electronics.
- ... define and explain basic terms and independently explore the field of medical technology.
- ... explain the need in medical applications.
- ... explain the operation of various medical devices.
- ... summarize and explain practical aspects of high-impedance amplifier, component selection, noise aspects, and sources.
- ... summarize and explain practical aspects of power electronics in the medical field (functionality and safety versus efficiency).
- ... design low-noise high-impedance amplifiers for neural signals.
- ... explain aspects of medical device regulations and risk assessment.
- ... read scientific literature and summarize its content.

Requirements for attendance (informal)

- physics (electro- and magnetostatics, electro- and magnetodynamics recommended)
- some knowledge or course on electronics recommended

Requirements for attendance (formal)

References to Module / Module Number [EIT-MEA-190-M-6]

Course of Study	Section	Choice/Obligation
[EIT-88.781-SG#2010] M.Sc. Electrical and Computer Engineering [2010] (/mhb/FB-EIT/cos-556/)	Elective Subjects	[W] Elective Module
[EIT-88.A44-SG#2018] M.Sc. Media and Communication Technology [2018] (/mhb/FB-EIT/cos-568/)	Technical Elective Subjects	[W] Elective Module
[EIT-88.?-SG#2021] M.Sc. Electrical and Computer Engineering [2021] (/mhb/FB-EIT/cos-686/)	Technical Elective Modules	[W] Elective Module
[EIT-88.?-SG#2021] M.Sc. Media and Communication Technology [2021] (/mhb/FB-EIT/cos-688/)	Technical Elective Modules	[W] Elective Module
[EIT-88.?-SG#2021] M.Sc. Automation and Control (A&C) [2021] (/mhb/FB-EIT/cos-676/)	Elective Modules	[W] Elective Module