Module Description, available in: EN

Medical Diagnostics & Devices

General Information

Number of ECTS Credits

3

Module code

TSM_MedDD

Valid for academic year

2020-21

Last modification

2019-08-31

Coordinator of the module

Stephan Scheidegger (ZHAW, scst@zhaw.ch)

Explanations regarding the language definitions for each location:

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Lausanne			Lugano	Zurich		
Instruction					**X** E 100%		
Documentation					**X** E 100%		
Examination					**X** E 100%		

Module Category

TSM Technical scientific module

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

Basics in maths, physics, electricity of BSc engineering programs or similar

Brief course description of module objectives and content

This module gives an introduction to the physical and technical principles and applications of important diagnostic modalities. Starting with an overview of clinically used modalities and their applications, technical requirements and limitations based on the fundamental principles will be discussed. Furthermore, efficient methods for biomedical signal processing and analysis are introduced.

Aims, content, methods

Upon completition of the module, the student will be able to
- gain knowledge in fundamentals of chemical, biological and physical sensors
- achieve basic knowledge in the design of sensor systems
- apply sensors and systems in medical diagnostics
- apply signal processing methods on biosignals for diagnostic purposes
- achieve basic signal processing skills to perform artifact removal, feature extraction, and classification on biological signals.
- explain fundamental principle of medical imaging modalities
- achieve basic knowledge of the most important clinical application of medical imaging modalities
- describe approaches and methods for image quality assessment

Contents of module with emphasis on teaching content

Part 1 Devices & Sensors: Overview of diagnostic instrumentation and modalities:

Generation of X-ray, X-ray detectors, technology and application of Fluoroscopy, CT, PET / SPECTMRI, diagnostic ultra sound; image-guided therapy (interventional radiology, IGRT, theranostics);

Image quality, radiation protection and QA for diagnostic devices,

Chemical, biological, and physical sensors, design requirements for sensors and devices in diagnostics, sensor application in medical diagnostics (ECG, EEG, EMG, optical pulsoxymetrie, (Blood)pressure, flow sensor, otoacoustic emission (OAE), etc.)

Part 2 Signal processing

Measurement in medical diagnostics, amplifier, signal conversion and quantization

Standard methods for biomedical signal processing and analysis, Imaging processing
- Background on time- and frequency-domain characteristics of particular biosignals and common artifacts
- Techniques for artefact removal, event detection, feature extraction, pattern recognition, classification

Teaching and learning methods

Presentations, Excersises and Labs

Literature

Oppelt A (Ed.): Imaging Systems for Medical Diagnostics. Siemens, Publicis Corporate Publishing, Erlangen; ISBN 3-89578-226-2

John D. Enderle, Joseph D. Bronzino, Introduction to Biomedical Engineering, Academic Press

R. A. Wildhaber et al., "Signal detection and discrimination for medical devices using windowed state space filters," 2017 13th IASTED International Conference on Biomedical Engineering (BioMed), Innsbruck, Austria, 2017, pp. 125-133.

R. A. Wildhaber et al., "Windowed State-Space Filters for Signal Detection and Separation," in IEEE Transactions on Signal Processing, vol. 66, no. 14, pp. 3768-3783, 15 July15, 2018.

Assessment

Certification requirements

Module does not use certification requirements

Basic principle for exams

As a rule, all the standard final exams for modules and also all resit exams are to be in written form

Standard final exam for a module and written resit exam

Kind of exam

written

Duration of exam

120 minutes

Permissible aids

No aids permitted

Special case: Resit exam as oral exam

Kind of exam

oral

Duration of exam

30 minutes

Permissible aids

No aids permitted