Module Signal Processing

Module Name: Signal Processing

Module Number	**X4M 1500**	Level Master	Short Name SP
Responsible Lecturers	Prof. Dr. Alfred Mertins		
Department, Facility	UZL, Institut für Signalverarbeitung		
Course of Studies	Biomedical Engineering, Master		
Compulsory/elective	Compulsory	ECTS Credit Points	4
Semester of Studies	1	Semester Hours per Week	4
Length (semesters)	1	Workload (hours)	120
Frequency	WiSe	Presence Hours	50
Teaching Language	English	Self-Study Hours	70
Consideration of Gender and Diversity Issues	☒ Use of gender-neutral language (THL standard) ☐ Target group specific adjustment of didactic methods ☐ Making subject diversity visible (female researchers, cultures etc.)		
Applicability	Biomedical Engineering		
Remarks	The students shall acquire consolidated knowledge of digital signal processing and the relationships between continuous-time and discrete-time signal representations and filtering.		

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Course 1: Signal Processing, Lecture

Course Number		Short Name	SP
Course Type	Lecture	Form of Learning	Presence
Mandatory Attendance	☐	ECTS Credit Points	2
Participation Limit	None	Semester Hours per Week	2
Group Size (practical training, exercises, …)	None	Workload (hours)	60
Teaching Language	English	Presence Hours	25
Study Achievements („Studienleistung“, SL)	None	Self-Study Hours	35
SL Length (minutes)	n. a.	SL Grading System	n. a.
Exam Type	Oral exam	Exam Language	English
Exam Length (minutes)	20	Exam Grading System	One-third Grades
Learning Outcomes	The students know about the basic operations of digital signal processing, they can adopt these operations to selected examples, and they can use them in the field of medical-technology.		
Participation Prerequisites	None		
Contents	• Basic signal processing knowledge • Elementary signals, LTI systems, Dirac pulse • Stability of systems • FIR and IIR filters: Impulse response and difference equation • Fourier transform and z-Transform • Pole-zero plots and the relationship to frequency responses • Discrete and fast Fourier transforms (DFT, FFT) • Sampling • Filter design for selected applications • Gibbs phenomenon		
Literature	• McClellan, J.H., Schafer, R.W., Yoder, M.A.: Signal Processing First. Prentice Hall Signal Processing Series, Englewood Cliffs (2003) • Mertins, A.: Signaltheorie. 4. Ed., Springer, Wiesbaden (2020), in German • Lecture notes		
Remarks	None		

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Course 2: Signal Processing, Lab

Course Number		Short Name	SP
Course Type	Lab	Form of Learning	Presence
Mandatory Attendance	☒	ECTS Credit Points	2
Participation Limit	24	Semester Hours per Week	2
Group Size (practical training, exercises, …)	2	Workload (hours)	60
Teaching Language	English	Presence Hours	25
Study Achievements („Studienleistung“, SL)	Graded lab report	Self-Study Hours	35
SL Length (minutes)	n. a.	SL Grading System	One-third Grades
Exam Type	n. a.	**Exam Language**	n. a.
Exam Length (minutes)	n. a.	**Exam Grading System**	n. a.
Learning Outcomes	The students get an introduction into Matlab. They can apply this program in signal processing. The students get to know the use of digital signal processors and apply their knowledge when solving simple filter tasks.		
Participation Prerequisites	None		
Contents	• Introduction into Matlab • Scripts and functions • Plotting with annotations • Convolution • Fourier Transform • Sampling and discrete-time signals • FIR and IIR filter analysis • Filter design • FFT • Tasks from current research projects		
Literature	see lecture		
Remarks	None		