module code / module title

MN-DSM / Digital Systems Modeling

date / version of the module description	20.02.2023

1	**INFORMATION ON THE MODULE**	
1a	module code	MN-DSM
1b	module title *(German title)*	Klicken Sie hier, um Text einzugeben.
1c	module title *(English title)*	Digital Systems Modeling
1d	credit points	9
1e	responsible for the module	Prof. Dr. Rolf Drechsler
1f	type of module	elective module
1g	programs using the module	M.Sc. Neurosciences
1h	organizational unit offering the module	FB03
1i	content-related prior knowledge or skills	Prior completion of module MN-S1 (Advanced Programming: Data Analysis and Modeling) is highly recommended to ensure that programming skills in Python and basic knowledge in data processing and neural modelling are available. Knowledge of C/C++ is recommended.
1j	learning contents	State-of-the-art experimental paradigms and applications in neuroscience require fast analysis of an increasing numbers of neural signals using sophisticated algorithms, and the ability to communicate directly with miniaturized neurotechnology in low-power environments. This module provides the knowledge for using digital circuit logic (Verilog and HLS flow) to create hardware-based implementations of different data analysis algorithms to decrease their execution time, and for establishing closed-loop paradigms for data acquisition and stimulation control. **Lecture:** • Basics of digital logics • Introduction into Verilog hardware description languages

		• Introduction into FPGA architecture and design process • Fundamentals of C programming language required to learn high-level synthesis (HLS) • Introduction to HLS design flow and its importance in the hardware-based implementation of various applications. **Practical work and exercises:** • Modeling simple digital logic and hardware blocks in Verilog • Modeling hardware blocks related to parallel programming in Verilog • Introduction to HLS tools • Implementing different parallel programming related applications using HLS
1k	learning outcomes/ competencies/ targeted competencies	At the end of this course students • know basics and fundamentals of digital system modeling • have a fundamental background knowledge about FPGA architecture and design process for parallel programming • are able to use hardware description language like Verilog to model hardware blocks of different applications • can understand and use HLS design flow to create the hardware-based implementation of various applications
1l	calculation of student workload *(part a: calculation of presence time and working hours)*	**The total amount of the presence time and working hours of the module has to be calculated additionally in the detailed calculation a) to c).** **a)** detailed calculation: **SWS / presence time/working hours in each course of the module**

☒	1	lecture(s) with	2	SWS/ contact hours	28	hours of presence time
☒	1	seminar(s) with	1	SWS/ contact hours	14	hours of presence time
☐		exercise(s) with		SWS/ contact hours		hours of presence time
☐		internship(s) with		sum of working hours		
☐		seminar(s) with		SWS/ contact hours		total hours of presence time
☒	1	laboratory/laboratories with	3	SWS/ contact hours	42	total hours of presence time
☐		tutorial(s) with		SWS/ contact hours		
☐		excursion(s) with		SWS contact hours in total		working hours

		☐ other form of course (e.g. block seminar), namely this: Klicken Sie hier, um Text einzugeben. with SWS / with totaly contact hours ☐ presence time ☐ working hours = sum of presence time and working hours: 84 hours
	calculation of student workload *(part b: preparation time and follow-up work/self-study)*	**b) working hours for preparation/follow-up work of the course(s) and/or self-study** = sum of working hours: 136h
	calculation of student workload *(part c: exam preparation etc.)*	**c) exam preparation (incl. examination)** = sum of working hours: 50 hours
	calculation of student workload *(total amount of hours including a) - c))*	**Total amount of the presence time and working hours a) to c):** 270 hours
1m	description of possible optional courses in the module	*Can a student choose between different courses within the module?* NO *Short description of selection option* Klicken Sie hier, um Text einzugeben.
1n	language(s) of instruction	☐ German ☒ English ☐ Spanish ☐ French ☐ Other, namely this: Klicken Sie hier, um Text einzugeben.
1o	frequency	*(regular cycle module is offered) e.g.: winter semester, yearly or summer semester, yearly or each semester* summer semester yearly Klicken Sie hier, um Text einzugeben.
1p	duration	one semester module
1q	Literature (*optional*)	Klicken Sie hier, um Text einzugeben.

1r	more information on the module (*optional*)	Klicken Sie hier, um Text einzugeben.
2	**INFORMATION ON THE MODULE EXAMINATION** (see also AT Art. 5 section 8)	
2a	type of examination	☐ module exam; i.e. exam with only one component (MP) ☒ combination exam, i.e. exam with several components (administered by instructors) (KP) ☐ partial exam; i.e. exam with several components (administered by registrar) (TP)
2b	exam components or prerequisites *(type, number)*	***PL*** *= graded component of the examination* ***SL*** *= ungraded component of the examination, coursework* ***PVL*** *= prerequisite of the examination (see AT Art. 5 Section 10)* ☒ PL | 2 ☐ SL | ☐ PVL | justification If necessary, further explanations:
2c	Give this information for combination examinations only: Weights (in percentage) of component grades	PL 1: 50% Portfolio: exercises PL 2: 50% Oral examination PL 3: Klicken Sie hier, um Text einzugeben. PL 4: Klicken Sie hier, um Text einzugeben. If necessary, further comments: Klicken Sie hier, um Text einzugeben.
2d	form of examination (see AT BPO/AT MPO Art. 8, 9 and 10)	☐ Assignment ☒ Oral examination (single) ☐ Presentation, oral ☐ Written examination ☐ Group examination, oral ☐ Presentation and written assignment ☒ Portfolio ☐ Project report ☐ Bachelor Thesis ☐ Internship report ☐ Colloquium ☐ Master Thesis ☐ Other (concrete definition is given in the examination regulations): Klicken Sie hier, um Text einzugeben.
2e	language(s) of instruction	☐ German ☒ English ☐ Spanish ☐ French ☐ Other, namely this: Klicken Sie hier, um Text einzugeben.