module code / module title

MN-NMA / Network Modeling and Analysis

date / version of the module description	20.02.2023

1	**INFORMATION ON THE MODULE**	
1a	module code	MN-NMA
1b	module title *(German title)*	Klicken Sie hier, um Text einzugeben.
1c	module title *(English title)*	Network Modeling and Analysis
1d	credit points	9 CP
1e	responsible for the module	Dr. Udo Ernst
1f	type of module	elective module
1g	programs using the module	M.Sc. Neurosciences
1h	organizational unit offering the module	Computational Neurophysics Lab, Institute for Theoretical Physics, FB01
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 modeling are available. Basic knowledge in statistics, calculus, and linear algebra are recommended.
1j	learning contents	Students will focus on a specific topic in network modeling and analysis as well as pursue a mini research project following a three-staged process for mimicking real lab research (reading & preparation, setup & simulation/analysis, interpretation & dissemination). They will (a) select a specific topic of interest and become acquainted with the fundamental concepts and associated mathematical methods (by reading original literature, lectures, and individual supervision), (b) reproduce key results from the literature by performing a numerical simulation or mathematical analysis of a neural network or computational model, and

		(c) summarize their findings in a concise manner, and present them to their fellow students and supervisors in a comprehensive manner. For their mini-projects, students can select from different topics, like: (a) Collective dynamics in networks of recurrently coupled neurons (e.g. synchronization and oscillations, feature integration, non-linear dynamics of elementary circuits). (b) Computation, inference, and classification (e.g. generative models, efficient coding, Bayesian methods, convolutional networks) **Lecture:** • Advanced concepts and methods in Theoretical Neurosciences, with focus on network dynamics and neural computation. **Seminar:** • Presentation of seminal research articles on the selected topics in mini-projects • Presentation of results of mini-projects **Laboratories:** • Practical project work on a computer (or analytically), closely supervised by supervisors.
1k	learning outcomes/ competencies/ targeted competencies	Students are able to acquire novel computational/mathematical concepts from research literature, and explain these concepts to other scientists Students can set up a suitable neural network model for investigating dynamics or computation in brain networks Students are able to perform numerical simulations of network models on a computer Students can apply appropriate mathematical tools to analyze network dynamics or quantify information processing
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	1	SWS/ contact hours	14	hours of presence time
☒	1	seminar(s) with	2	SWS/ contact hours	28	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	5	SWS/ contact hours	70	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: 112 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: 130 hours
	calculation of student workload *(part c: exam preparation etc.)*	**c) exam preparation (incl. examination)** = sum of working hours: 28 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 The main part of the module is a block course of four weeks, with preparatory/ follow-up-work throughout the whole semester

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 | 1 ☒ SL | 1 ☐ PVL | justification If necessary, further explanations: SL: oral presentation (of the literature relevant for the mini-project selected by the student)
2c	Give this information for combination examinations only: Weights (in percentage) of component grades	PL 1: 100% Presentation and written assignment (of mini-project and its results) PL 2: PL 3: 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):
2e	language(s) of instruction	☐ German ☒ English ☐ Spanish ☐ French ☐ Other, namely this: Klicken Sie hier, um Text einzugeben.