1.	**Field of study**	**Biophysics**
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2022/2023 (winter term), 2023/2024 (winter term), 2024/2025 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Stochastic Methods for Optimization and Simulation

Module code: W4-2BF-MB-21-15

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
MB_15_1	students will be able to devise efficient sampling methods for sampling any multi-dimensional probability distribution	KBF_K02 KBF_U01 KBF_U02 KBF_U14 KBF_W03 KBF_W08	3 4 5 5 4 4
MB_15_2	students will be able to use of stochastic methods for the optimization of complex problems with arbitrary model functions	KBF_K02 KBF_U01 KBF_U02 KBF_U14 KBF_W03 KBF_W08	3 4 5 5 4 4
MB_15_3	students will be able to perform Monte Carlo simulations of both classical and quantum systems	KBF_K02 KBF_U01 KBF_U02 KBF_U14 KBF_W03 KBF_W08	3 4 5 5 4 4

3. Module description

Description	This course will give students an operative knowledge of computational simulation and optimization techniques based on stochastic methods. Course syllabus: (1) Monte-Carlo Integration. Sampling techniques and variance reduction. (2) Stochastic optimization: simulated annealing and genetic algorithms. (3) Dynamic Monte Carlo: random walks and the diffusion equation. (4) Classical Monte Carlo simulations: from simple to molecular systems and biomolecules. (5) Application of Monte Carlo methods to quantum systems.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
MB_15_w_1	credit	the final mark for this course is computed as 0.4 a + 0.4 b + 0.2 c, where a is the mean grade of each practical homework, b is the grade of the final project and c is the rating of written questions concerning the final project	MB_15_1, MB_15_2, MB_15_3

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
MB_15_fs_1	lecture	Detailed discussion by the lecturer of the issues listed in the table "module description" using the table and/or multimedia presentations	24	Supplementary reading, working with the textbook, doing homework	44	MB_15_w_1
MB_15_fs_2	laboratory classes	Performance of exercises on the subject consistent with the issues listed in the table "module description"	12	Acquiring knowledge in the scope of the exercise, preparation of the final report on a given exercise	20	MB_15_w_1