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), 2025/2026 (winter term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Molecular Biophysics

Module code: W4-2BF-MB-21-20

1. Number of the ECTS credits: 5

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
MB_20_1	The student understands the physical basis of known research techniques used in molecular biophysics	KBF_K07 KBF_U03 KBF_W01 KBF_W02	4 4 4 4
MB_20_2	The student can characterize and develop the results of research obtained for biological systems	KBF_K05 KBF_W02 KBF_W03	3 3 3
MB_20_3	The student knows the principles of operation, capabilities and specificity of high-class research equipment	KBF_K03 KBF_U03 KBF_W02 KBF_W04 KBF_W08	3 3 3 3 3
MB_20_4	The student knows how to use mathematical and statistical methods of developing experimental results	KBF_K09 KBF_W02 KBF_W04	3 3 3
MB_20_5	Student through acquired knowledge from physics and biology knows how to propose a method of research of various biological systems, thanks to which he becomes a natural partner of biologists and doctors	KBF_K03 KBF_U07 KBF_U08	3 3 3

		KBF_W02 KBF_W03	3 3

3. Module description	
Description	By participating in the classes, the student will deepen their knowledge in the field of biophysics by performing research on various biological objects, from single molecules, through subcellular complexes and structures, to the structures of living matter using methodology and physics methods. It will be an opportunity to understand the basics of many advanced research techniques and take part in experiments performed using them. Familiarize yourself with, among others with the following research methods: 1) Spectroscopy and fluorescence microscopy used to observe the structure and follow cell life processes. 2) Multidimensional nuclear magnetic resonance (NMR) in imaging of tissue structure and observation of cellular changes. 3) Atomic force microscopy (AFM) in the study of individual molecules, forces of interaction between them and the structure of molecular and cellular systems as well as characteristics of their mechanical (viscoelastic) properties. 4) Microscale Raman spectroscopy - Raman mapping and surface enhanced Raman spectroscopy (SERS). 5) Electron cryomicroscopy of single molecules and molecular systems. 6) Mass spectrometry in the study of the atomic and molecular composition of substances and tissues (ToF-SIMS). 7) Analytical centrifugation. 8) Theoretical methods for modeling the structure, spectra and properties of molecules and their systems - the use of molecular dynamics and ab-initio modeling methods.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
MB_20_w_1	exam	Written exam/oral exam. The scope of the exam will be announced 3 weeks before the end of the semester	MB_20_1, MB_20_2, MB_20_3, MB_20_4, MB_20_5
MB_20_w_2	credit	Passing the preliminary test before each new exercise, performing the exercise, preparing a report	MB_20_1, MB_20_2, MB_20_3, MB_20_4, MB_20_5

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_20_fs_1	lecture	Detailed discussion by the lecturer of the issues listed in the table "module description" using the table and/or multimedia presentations	15	Supplementary reading, working with the textbook, trying to find answers to simple problem questions asked during the lecture	20	MB_20_w_1
MB_20_fs_2	laboratory classes	Performance of exercises on professional research equipment	30	Acquiring knowledge in the scope of the exercise. Preparation of the final report on a given exercise	45	MB_20_w_2