COURSE DESCRIPTION (SYLLABUS)

1.	Course: **Experimental Techniques in Structural Biology**
2.	Language of instruction: **English**
3.	Faculty: **Faculty of Biotechnology**
4.	Course/module code: **29-BT-S2-E1-EngEXTS**
5.	Course/module type (*mandatory* or *elective*): **mandatory**
6.	Programme: **Medical Biotechnology**
7.	Study cycle: **2nd cycle**
8.	Year: **1st**
9.	Semester (*autumn* or *spring*): **spring**
10.	Form of tuition and number of hours: **Lecture, 15 h**
11.	Name, Surname, academic title: **Daniel Krowarsch, PhD**
12.	Initial requirements (knowledge, skills, social competences) regarding the course/module and its completion: **Knowledge in the field of structure and function of proteins, biophysics, mathematics.**
13.	Objectives: **This course provides the theory and application of X-ray crystallography, NMR spectroscopy and cryogenic electron microscopy.**
14.	Content: **Why do we need a high-resolution structure? Introduction to experimental methods of determining macromolecular structures with atomic resolution, historical background. Quality requirements for samples intended for structural research. Methods of cytosolic and membrane proteins crystallization, factors influencing macromolecule crystallization. Two-dimensional and three-dimensional crystals. Crystal structure, symmetry, symmetry operations, crystallographic systems, Bravais lattice. Physical basis of diffraction, methods of collecting diffraction data. Methods for solving the phase problem. Model building and refinement. Magnetic Nuclear Resonance (NMR), fundamentals of the method, spin-spin coupling, chemical shifts, Nuclear Overhauser Effect. One, two and multidimensional spectra. Enrichment of samples with**

	radioisotopes. Heteronuclear spectra. Assignment of signals and determination of protein structure. Analysis of the quality of structural data obtained by X-ray diffraction and NMR. Low-temperature electron microscopy, introduction. Methods of sample preparation, image collection and data analysis.	
15.	Learning outcomes: Students: • **provide qualitative and quantitative descriptions of complex biological phenomena and processes on atomic level;** • **possess advanced knowledge of medical and biological sciences, namely structural biology;** • **possess in-depth knowledge of structural biology essential in understanding relationships and interrelations in biological systems;** • **possess knowledge of the current issues prevailing in scientific literature in scope of structural biology;** • **efficiently make use of scientific literature in the field of structural biology; read professional literature in English.** • **show ability in critically analysing and selecting information in the field of structural biology, especially from electronic resources, including literature and sequential databases;** • **show ability to formulate legitimate opinions in the field of structural biology on the basis of data derived from different sources;** • **collaborate and work as part of a team in order to plan research and solve problems in the field of structural biology;** • **adequately prioritise in order to carry out specific research projects in the field of structural biology;** • **understand the need for a systematic review of professional literature in order to broaden and deepen his or her knowledge in the field of structural biology.**	Outcome symbols: K_W01, K_W03, K_W04, K_W05 K_U02, K_U03, K_U07 K_K02, K_K03, K_K05
16.	Recommended literature: • **Protein Crystallography Methods and Protocols; Alexander Wlodawer, Zbigniew Dauter, Mariusz Jaskolski, 2017 Humana Press.** • **X-Ray Crystallography of Biomacromolecules: A Practical Guide; Albrecht Messerschmidt, 2007 Wiley-VCH Verlag.** • **Protein NMR Spectroscopy; John Cavanagh, Wayne J. Fairbrother, Arthur G. Palmer III, Mark Rance, Nicholas J. Skelton, 2007 Elsevier.**	

17.	Methods of verification of the assumed learning outcomes: • **written test**	
18.	Conditions of earning credits: • **written test**	
19.	Student's workload:	
	Activity	Number of hours for the activity
	Hours of instruction (as stipulated in study programme): **lecture**	15 h
	Student's own work: **preparation for lectures and exam**	15 h
	Total number of hours:	**30 h**
	Number of ECTS:	**2 ECTS**