MODULE DESCRIPTION (SYLLABUS)

1.	Module: **Biophysical Chemistry**
2.	Language of instruction: **English**
3.	Faculty **Faculty of Biotechnology**
4.	Course/module code: **29-BT-S1-E3-EnBCh** (Lect.) **29-BT-S1-E3-EnBChc** (Lab.)
5.	Course/module type (*mandatory* or *elective*): **mandatory**
6.	Programme: **Biotechnology**
7.	Study cycle (*1st/2nd*): **1st cycle**
8.	Year: **2nd**
9.	Semester *(autumn* or *spring):* **autumn**
10.	Form of tuition and number of hours: Lecture: **30 h** Laboratory: **30 h**
11.	Coordinator(s): **Adam Pomorski, PhD**
12.	Initial requirements *(knowledge, skills, social competences):* **Knowledge in the area of general chemistry, organic chemistry, chemical analysis. Student should freely calculate basic thermodynamic constants, such as dissociation and association constants, enthalpy, buffers composition. Student should know principles of the widely used physicochemical methods in analytical biochemistry.**
13.	Objectives: **The main objective of the course is to know principles of physical and biophysical chemistry, basic rules of thermodynamics, chemical kinetics, chemical equilibria (acid-base, association, dissociation and complex equilibria). The objective is also to understand the basics of methods used in laboratory to describe biomacromolecules and their interactions in cells and on single-molecule level.**

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<tr><td>14.</td><td colspan="2">Content:
Principles of physical chemistry (basic rules and constants).
Thermodynamics (I-III thermodynamic laws, enthalpy, entropy, Gibbs energy) and its application in characterization of proteins by ITC and DSC calorimetries.
Chemical equilibria with special attantion to acid-base equilibria of peptides and proteins and association/dissociation constant in biochemistry.
Chemical kinetics with enzymology.
Methods dedicated to study protein conformation – circular dichroism, cryoEM, NMR.
Mass spectrometry - principles of operations and application in macromolecules analysis.
Principles of electrochemistry and nanopore based measurements.
Fluorimetry and its applications from cell imaging to single-molecule measurements.</td></tr>
<tr><td>15.</td><td>Learning outcomes:
Student:
knows principles of biophysical chemistry and their application in thermodynamic characterization and analysis of macromolecules
determines and calculates association/dissociation constants and kinetic constants with the use of known physicochemical methods.
is aware of biophysical methods to study the biomolecules in bulk and at single-molecule level
makes the synthesis of information from various sources and is capable of correct conclusions based on them;
understands the need for careful planning of tasks and scientific experiments;
knows and follows the rules of health and safety at work.</td><td>Outcome symbols:

K1_W02, K1_W04, K1_W08, K1_W10, K1_U01, K1_U07, K1_U08, K1-K03, K1_K05</td></tr>
<tr><td>16.</td><td colspan="2">Recommended literature:
Biophysical Chemistry, A. Cooper (RSC Publishing).
Biological thermodynamics, D.T. Haynie (Cambridge University Press).
Physical Chemistry, A.G. Whittaker, A.R. Mount, M.R. Heal (Physical Chemistry, A.G. Whittaker, A.R. Mount, M.R. Heal).
An Introduction to Single Molecule Biophysics Yuri L. Lyubchenko (CRC Press)</td></tr>
<tr><td>17.</td><td colspan="2">Methods of verification of the assumed learning outcomes
Lect.: presentation of a report prepared in groups on a new laboratory method and written exam.
Lab.: evaluation of the student’s work in the lab; reports, final test.</td></tr>
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<tr><td>18.</td><td colspan="2">Conditions of earning credits:
• Active participation in laboratory classes.
• Completion of the laboratory classes is based on final test and laboratory report results.
• Presentation of a report prepared in groups on a new laboratory method.
• Completion of the lecture is based on a written exam result.</td></tr>
<tr><td rowspan="6">19.</td><td colspan="2">Student’s workload:</td></tr>
<tr><td>Activity</td><td>Number of hours for the activity</td></tr>
<tr><td>Hours of instruction (as stipulated in study programme) :
• Lect.: 30 h
• Lab.: 30 h
• Consultations: 5 h</td><td>65 h</td></tr>
<tr><td>Student’s own work:
• reading the literature
• preparation before classes
• writing reports
• preparation for the final test and exam</td><td>65 h</td></tr>
<tr><td>Total number of hours</td><td>130 h</td></tr>
<tr><td>Number of ECTS:
• Lect.: 4 ECTS
• Lab.: 2 ECTS</td><td>6 ECTS</td></tr>
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