COURSE DESCRIPTION (SYLLABUS)

1.	Course: **Enzymology**
2.	Language of instruction: **English**
3.	Faculty: **Faculty of Biotechnology**
4.	Course/module code: **29-BT-S1-E6-EnENc**
5.	Course/module type (*mandatory* or *elective*): **mandatory**
6.	Programme: **Biotechnology**
7.	Study cycle (*1st/2nd*) **1st cycle**
8.	Year: **3rd**
9.	Semester *(autumn* or *spring):* **spring**
10.	Form of tuition and number of hours: Laboratory: **45 h** Learning methods: **Designing experiments, performing experiments, solving computational tasks, working in groups, analyzing results and solving problems.**
11.	Coordinator(s): **Aleksandra Sokołowska-Wędzina, PhD**
12.	Initial requirements (knowledge, skills, social competences) **The student understands the concepts of general chemistry and protein structure. The student distinguishes and knows how to use the basic biophysical methods in the study of protein structure and function (including spectrophotometry). The student has the ability to perform chemical and biochemical calculations. The student should have some experience in working in the laboratory (including preparation of samples and buffers). Student is familiar with Microsoft Word and Microsoft Excel or equivalent.**
13.	Objectives: **The aim of the exercises is to familiarize students with the practical application of methods for determining kinetic parameters of enzymatic reactions, determining**

	the equilibrium constant interactions between enzymes and inhibitors, and chemical modifications of the active enzyme center.	
14.	Content: Enzymology laboratory practice includes: • **Preparation of all necessary reagents including buffers, enzyme solutions, inhibitors and substrates;** • **Determination of kinetic parameters (KM, kcat, kcat / KM) of the hydrolysis of the synthetic substrate (BApNA) catalyzed by trypsin.** • **Determination of the concentration of active trypsin inhibitor (BPTI) by titration of the designated trypsin with an inhibitor.** • **Measurement of the association constant (Ka) of the chymotrypsin - BPTI interaction by the determination of residual enzyme activity of chymotrypsin.** • **Specific, chemical modification of the side chains of Ser residues in trypsin and chymotrypsin with PMSF (phenylmethylsulfofluoride) and TLCK and its effect on enzyme activity.**	
15.	Learning outcomes: Knowledge: • **The student explains the issues of enzymology, enzymatic kinetics and enzyme interactions with inhibitors.** • **The student is able to make a qualitative and quantitative description of the basic phenomena and processes in the field of enzyme activity** • **The student recognizes and selects the appropriate biochemical, mathematical, statistical and IT methods required for examination, description and interpretation of kinetic parameters of enzyme activities and their interaction with inhibitors.** Skills: • **The student selects, compares and applies appropriate physicochemical and biochemical techniques necessary for studying enzyme kinetics and enzyme-inhibitor interactions.** • **The student conducts experiments under the guidance of a scientific supervisor in the field of enzymology and prepare the necessary physicochemical measurements. The student obtains additional experience in the planning and careful implementation of individual steps of the experiment. The student increase his/her manual dexterity in laboratory work and builds the ability to manage his/her workspace in the laboratory.** • **The student uses computational methods, as well as statistical and IT tools (including Microsoft Excel), which enable him to analyze the data and**	Outcome symbols: K1_W05 K1_W01 K1_W02 / K1_W04 K1_U01 K1_U05 / K1_U07 K1_U06

	interpret the obtained results in the field of enzymology. • **The student is able to organize, analyze and properly describe the results of the experiments. Student can draw conclusions based on the results obtained and propose solutions in case of problems. The student is able to present his/her results in the form of a coherent, structured and complete scientific report.** • **The student builds his efficiency of communication and cooperation with other team members.** Social competences: • **Student understands the need for accurate planning of tasks and scientific experiments based on available knowledge. The student have in mind that the knowledge, skills and materials that he developed within this course will serve him/her in further research work - student feels the purpose and the need to do high quality work.** • **The student acquires the ability to freely discuss the results of his work with another scientist (eg. the teacher), as well as presenting his own reasoning, which gives him confidence and courage to propose his own solutions.** • **The student develops the ability to perform tasks autonomously and carefully, at the same time understands that the difficulties, errors and failures that sometimes happen in research work should be treated as an important feedback. Thanks to this, the student is not afraid to take the necessary risk, looks for appropriate solutions and develops his creativity, which often lead to important scientific discoveries and further implementations.**	K1_U08 / K1_U09 K1_U13 K1_K03 K1_K01/ K1_K02 K1_K06
16.	Recommended literature: • ***Enzymes*: Catalysis, Kinetics and Mechanisms. Punekar, N.S., Springer-Verlag Gmbh, 2018;** Additionally: • ***Structure and Mechanism in Protein Science: A Guide to Enzyme Catalysis and Protein Folding*. Alan Fersht, W. H. Freeman, 1998;** • ***Enzyme Kinetics: Behavior and Analysis of Rapid Equilibrium and Steady-State Enzyme Systems*, Irwin H. Segel, Wiley-Interscience; New Ed edition 1993.**	

<table>
<tr><td>17.</td><td>Methods of verification of the assumed learning outcomes:

1) Consultation during laboratory practice. During the course of the exercises the student consults with the teacher his/her calculations, presents the reasoning and discusses the results of the experiment. On the basis of the acquired skills, together with the teacher student discusses possible solutions to problems that arise during the conducted experiments. This approach allows the teacher to assess the student's correct understanding of the topic.

2) Scientific report. The student prepares an individual scientific report based on experiments performed. Preparing the report allows the student to structure the acquired knowledge and skills, whereas teacher gains the possibility to follow student reasoning, check the correctness of calculations and the level of understanding of the conducted experiments. Each report should be made in such a way that the student can use the information contained therein in his further research. Each report is consulted individually with the teacher (by email or in person).

3) Self-verification. The student has the opportunity to independently verify his/her ability to apply the acquired knowledge from the enzymology field by solving additional tasks prepared by the teacher (student's own work). If students face difficulties to find a solution the trainer encourages students to cooperate and conduct the brainstorm approach to find the right answer.

4) Colloquium. The final test contains questions and tasks that are aimed at tracing the reasoning and the level of material understanding by the student. The tasks included in the colloquium give the teacher the opportunity to check how the student uses the acquired skills to solve tasks and problems characteristic of the subject of enzymology. During the course of the colloquium the student has the right to use the material (scientific report) that he prepared and consulted with the teacher. The result of the colloquium is consulted individually with the student. The student has the right to re-enter the colloquium if he decides he wants to re-verify his skills and improve his score.</td></tr>
<tr><td>18.</td><td>Conditions of earning credits:

Conditions for crediting the subject include: preparation of a scientific report, individual consultation with the teacher (personal or by email) and a positive result from the written colloquium (more than 50%).

The student's assessment is influenced by: colloquium result, scientific report and involvement in a laboratory work, and is individually discussed with the student.</td></tr>
<tr><td rowspan="4">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):
• Laboratory practice and consultations</td><td>45 h</td></tr>
<tr><td>Student’s own work:
• Preparation for classes, preparation of a scientific report, preparation for the colloquium - including solving</td><td>25 h</td></tr>
</table>

	additional tasks provided by the teacher.	
	Total number of hours:	**70 h**
	Number of ECTS:	**2 ECTS**