MODULE DESCRIPTION (SYLLABUS)

1.	Module: **Organic Chemistry**
2.	Language of instruction: **English**
3.	Faculty: **Faculty of Biotechnology**
4.	Course/module code: **29-BT-S1-E2-EnOCh** **29-BT-S1-E2-EnOChc**
5.	Course/module type (*mandatory* or *elective*): **mandatory**
6.	Programme: **Biotechnology**
7.	Study cycle (*1st/2nd*): **1st cycle**
8.	Year: **1st**
9.	Semester *(autumn* or *spring):* **spring**
10.	Form of tuition and number of hours Lecture: **45 h** Laboratory: **45 h**
11.	Course coordinator(s): **Natasza Sprutta, PhD**
12.	Initial requirements (knowledge, skills, social competences): **Fundamental chemistry on the basic level.**
13.	Objectives: **To present and properly describe fundamental aspects of organic chemistry theoretically (lecture) and practically (laboratory). In addition the teaching labs focus on bringing a practical knowledge of basic organic reactions leading to formation of target molecules on a way of traditional synthetic approach, and show a correlation between theoretical predictions and a real product. The quality/purity of the obtained compounds verified with spectroscopic methodology (NMR).**

14.	Content: Lect.: **IUPAC system of the organic compounds naming; structure and properties (chemical and physicochemical) of the organic compounds; synthetic methodology; appearance in Nature; applications in medicine, laboratory and industry. The structure of organic molecules. Chemical bonds in organic compounds. Structure and reactivity. Acids and bases in organic chemistry. Polar and nonpolar organic compounds. Alkanes – construction and reactivity. Free radical halogenations. Cycloalkanes. Stereoisomerism. Properties and reactivity of alkane halogens. Nucleophilic substitution – SN1 and SN2 mechanisms. Elimination reactions. Alcohols – properties and synthetic strategies. Ethers, crown ethers and epoxides. The nuclear magnetic resonance as a tool for determining organic molecules structure. Alkenes. The oscillation spectroscopy in organic chemistry. Alkynes. The electron spectroscopy In the UV-Vis for organic compounds. Benzen and aromaticity – electrophilic substitution (substituents influence on regioselectivity). Carbonyl group – aldehydes and ketones. Enols – reactivity of an enolate ion. Aldol condensation (a,b-unsaturated aldehydes and ketones). Carboxylic acids. Mass spectrometry In organic chemistry. Amines and their derivatives. Benzene derivatives (aromatic amines, phenoles, alkilbenzenes etc.) and their reactivity. Heterocyclic compounds – furan, thiophene, pyrrole, pyridine, porphyrin). Strategy in organic synthesis – basic principles. Aminoacids, peptides, proteins and nucleic acids (biopolymers). Organometallic compounds – synthesis, structure, properties and applications. Polymers – synthetic methodology, structure, properties and applications. Resins – phenol, epoxide and polyester. Biodegradable polymers.** Lab.: **Reaction with bromine, oxidation reactions with $KMnO_4$, Lucas test, iodoform test, Fehling test, Tollens' test, reactions of amines and amino acids with HNO_2, hydrolysis of carboxylic acid derivatives; synthesis, purification and ^1H NMR of aspirin; separation of organic compounds mixture; *n*-butyl acetate synthesis; synthesis and isolation of *meso*-tetraphenylporphyrin (chromatography); isolation of limonene.**	
15.	Learning outcomes: Knowledge: • **Student has a fundamental knowledge about organic molecules.** • **Student knows and understands a terminology and nomenclature of organic compounds.** • **Student is familiar with fundamentals of the analysis of organic compounds.** • **Student characterizes basic types of organic reactions and understands their mechanisms.** • **Student determines basic properties and reactivity of organic compounds.** • **Student knows and understands the safety procedures necessary in the lab work and applies disposal rules.**	Outcome symbols: K1_W01, K1_W04,K1_W10

	Skills: • **an analysis of a basic synthetic approaches and results of spectroscopic analysis of organic molecules.** • **synthesizes chemical compounds with a usage of proper glassware.** • **writes reports from a research and adopts correct tools to do so.** • **describes and discuss chemical problems with a vocabulary characteristic for a scientific approach.** • **assesses results of an experiment and verifies them with a literature data.** Personal and Social Competence: • **a self-reliant in extending the chemical knowledge.** • **a responsibility for the work that has been done especially for and interpretation of results with an extra accent at the scientific reliability.** • **a responsibility for a safety in lab-work.**	K1_U01, K1_U05, K1_U08, K1_U09 K1_K01, K1_K05
16.	Recommended literature: Lect.: • **J. McMurry, "Fundamentals of organic chemistry", Brooks/Cole Publishing Company;** • **J. McMurry, "Organic Chemistry With Biological Applications", Brooks/Cole Publishing Company;** • **K. P. C. Vollhardt, N. E. Schore, "Organic Chemistry Structure and Function", W.H Freeman and Company, New York, fifth edition.** Lab.: • **R. J. Fessenden, J. S. Fessenden, P. Feist, "Organic Laboratory Techniques" Brooks/Cole Publishing Company;** • **Zubrick, J. W. *The Organic Chemistry Lab Survival Manual: A Student's Guide to Techniques*, John Wiley & Sons, 9th Edition, 2012;** • **Vogel`s *Textbook of Practical Organic Chemistry* - any edition.**	
17.	Methods of verification of the assumed learning outcomes: Lect.: **written exam at the end of the semester summarizing the presented aspects of organic chemistry.** Lab.: **written tests at the end of the semester, evaluation of the student's work in the lab.**	
18.	Conditions of earning credits: • **The presence and active participation in laboratory classes;** • **Completion of the laboratory classes is based on a written test;** • **Completion of the lecture is based on a written exam.**	

19.	Student's workload:	
	Activity	Number of hours for the activity
	Hours of instruction (as stipulated in study programme) : • Lect.: **45 h** • Lab.: **45 h**	90 h
	Student's own work • preparation before classes; • preparation for the test and final exam.	90 h
	Total number of hours:	**180 h**
	Number of ECTS: • Lect.: **5 ECTS** • Lab.: **3 ECTS**	**8 ECTS**