COURSE DESCRIPTION (SYLLABUS)

1.	Course: **Techniques in Molecular Biology**
2.	Language of instruction: **English**
3.	Faculty: **Faculty of Biotechnology**
4.	Course/module code: **29-BT-S1-E4-EnTMBc**
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):* **spring**
10.	Form of tuition and number of hours: **Laboratory: 45 h** Learning methods: **Laboratory classes are preceded with introductions (multimedia presentations).**
11.	Coordinator(s): **Małgorzata Heidorn-Czarna, PhD**
12.	Initial requirements (knowledge, skills, social competences): **Knowledge about the structure of nucleic acids, genome organization in prokaryotic and eukaryotic organisms as well as basic knowledge about gene expression.**
13.	Objectives: **The aim of the course is to learn the basic techniques of molecular biology and their application to solve a specific research problem. The students will examine whether the plant gene has a similar role in yeast cells. For this purpose, the students will learn the basic techniques related to nucleic acids, such as isolation of RNA from plant tissues, reverse transcription, polymerase chain reaction, digestion with restriction enzymes, ligation, transformation of bacterial and yeast cells, plasmid isolation, electrophoretic separation of RNA and DNA in the agarose gel.**

14.	Content: **1. Isolation of total RNA from *Arabidopsis thaliana* leaves.** **2. Spectrophotometric quantitative and qualitative analysis of nucleic acids.** **3. Reverse transcription and Polymerase Chain Reaction (PCR). Primer design for PCR.** **4. Agarose gel electrophoresis of nucleic acids.** **5. Digestion of insert and vector with restriction enzymes.** **6. Purification of nucleic acids after enzymatic digestion and gel electrophoresis using commercially available DNA purification kit.** **7. Ligation of the vector and insert.** **8. Transformation of chemically competent *Escherichia coli* cells with recombinant vector.** **9. Transformation of yeast *Saccharomyces cerevisiae* cells with recombinant vector.** **10. Plasmid isolation by alkaline lysis method.** **11. Functional complementation of yeast cells.** **12. Preparation of Petri dishes with Luria-Bertani (LB) broth and ampicillin.**	
15.	Learning outcomes: Student: • **makes a qualitative and quantitative description of the basic biological phenomena and processes connected with nucleic acids and gene expression;** • **has extensive knowledge in the field of biochemistry; knows the structure, function and metabolism of nucleic acids; understands transfer of genetic information; can integrate the knowledge gained at the level of the whole cell metabolism;** • **knows the basic concepts, terms, and techniques used in biochemistry and molecular biology regarding nucleic acids and gene expression;** • **is versed in the development of the above-mentioned fields;** • **has knowledge of the basic techniques and research tools used in molecular biology;** • **is familiar with the basic principles of health and safety procedures in the laboratory, knows procedures of work with genetically modified organisms;** • **carries out simple experiments under the**	Outcome symbols: K1_W01 K1_W05 K1_W06, K1_W08 K1_W10 K1_U05

	guidance of a tutor in the field of molecular biology/biotechnology, describes the results and presents them in the form of a work report; • **learns a given subject by himself;** • **knows how to work as a part of team, works together to solve problems and perform scientific experiments;** • **understands the need for careful planning of tasks and scientific experiments.**	K1_U12 K1_U13 K1_K03
16.	Obligatory and recommended literature: • **Script prepared for the actual practical course by the teacher - obligatory.** • **Genomes. T.A. Brown. *Garland Science; 3rd Edition, 2006*.** • **Biochemistry. J.M. Berg, J.L. Tymoczko. L. Stryer. *W.H. Freeman, 7th Edition, 2010*.** • **Molecular Biology Techniques: A Classroom Laboratory Manual. H. Miller, D. S. Witherow, S. Carson. *Academic Press, 3rd Edition, 2011*.** • **From Genes to Genomes: Concepts and Applications of DNA Technology. J.W. Dale, M. von Schantz, N. Plant. *Willey, 3rd Edition, 2011.*** • **Short Protocols in Molecular Biology. F.M. Ausubel, R. Brent, R.E. Kingston, D.D. Moore, J.G. Seidman, J.A. Smith, K. Struhl. *Wiley, 5th Edition, 2002*.** • **Molecular cloning. A laboratory manual. J. Sambrook, E.F. Fritsh, T. Maniatis. *Cold Spring Harbour Laboratory Press*, *2nd Edition, New York 1989.*** •	
17.	Methods of verification of the assumed learning outcomes: • **evaluation of the student's work in the lab** • **final test** • **work report**	
18.	Conditions of earning credits: • **positive test result;** • **active participation in laboratory classes;** • **proper preparation of written reports.**	
19.	Student's workload:	
	Activity	Number of hours for the activity
	Hours of instruction (as stipulated in study programme): • laboratories: **45 h** • consultations: **2 h**	47 h
	Student's own work: • reading script/recommended literature: **2 h** • preparation for the final test: **8 h** • preparation of work report: **8 h**	18 h

	Total number of hours:	**65 h**
	Number of ECTS:	**2 ECTS**