

Course Syllabus

Course from study programme for the cycle: 2025/2026

I. General Information

Course name	Experimental work methodology
Programme	Biotechnology
Level of studies (BA, BSc, MA, MSc, long-cycle MA)	MSc
Form of studies (full-time, part-time)	full-time
Discipline	Biological sciences
Language of instruction	English

Course coordinator	Artur Banach
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Type of class (<i>use only the types mentioned below</i>)	Number of teaching hours	Semester	ECTS Points
lecture	20	I, II	5
tutorial			
classes	30	I, II	
laboratory classes			
workshops			
seminar			
introductory seminar			
foreign language classes			
practical placement			
field work			
diploma laboratory			
translation classes			
study visit			

Course pre-requisites	Knowledge in mathematic with elements of statistic for biology, Logic Desirable skill in using spreadsheet (Excel), text editor (Word) and presentation editor (Power Point).
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II. Course Objectives

Introducing students to the principles of planning laboratory experiments.
Teaching students how to use literature databases and apply correct citation systems.
Familiarizing students with the most important statistical and bioinformatics software packages.
Introducing students to the basics of validation of measurement and analytical methods.
Preparing students for delivering public presentations.
Developing skills in presenting research results.

III. Course learning outcomes with reference to programme learning outcomes

Symbol	Description of course learning outcome	Reference to
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		programme learning outcome
KNOWLEDGE		
W_01	The student possesses knowledge enabling the design of a simple experimental workflow.	K_W05
W_02	The student has knowledge of data visualization, statistical analysis, and bioinformatics tools.	K_W04
W_03	The student is familiar with principles of planning experimental work in accordance with health, safety, and ergonomics regulations.	K_W07
SKILLS		
U_01	The student develops an experimental plan, including a work schedule with prioritized tasks, and presents it to peers.	K_U05, K_U18
U_02	The student performs basic statistical analyses (one-way ANOVA, simple regression) and correctly interprets the results.	K_U04
U_03	The student is able to write a scientific abstract describing a laboratory experiment within a specified word limit and present it to peers.	K_U05
U_04	The student correctly cites scientific literature both in-text and in references and prepares a short scientific presentation with multimedia support.	K_U05
U_05	The student ensures safe working conditions in the laboratory, incorporates safety considerations when planning research, and is open to modern research techniques in biotechnology.	K_U15, K_U17
SOCIAL COMPETENCIES		
K_01	The student adheres to ethical principles when planning and conducting research experiments.	K_K04

IV. Course Content

Lecture:

1. Searching for scientific literature. **U_03** (1 hour)
2. Scientific databases. **U_03** (1 hour)
3. Citation and plagiarism. **U_04, K_01** (1 hour)
4. The Philadelphia List. Citation systems. **U_04** (1 hour)
5. Formulating initial hypotheses. **U_03** (1 hour)
6. Sample collection. Experimental design. **W_01, W_03, U_05, K_01** (1 hour)
7. Structure of a scientific paper. **U_03** (1 hour)
8. Principles of writing scientific abstracts. **U_03** (1 hour)
9. Fundamentals of statistics and error theory. **U_02** (2 hours)
10. Methods of presenting research results. **U_01** (2 hours)
11. Construction of tables and graphs. **W_02** (1 hour)
12. Basics of regression. Analysis of variance. **W_02, U_02** (1 hours)
13. Analysis of results and graphs. **W_02, U_02** (2 hour)
14. Fundamentals of method validation – data cleaning, distribution assessment and verification of assumptions, evaluation of accuracy and stability. **U_02** (2 hours)

15. Validation of analytical methods – assessment of accuracy, precision, repeatability, reproducibility, linearity, limit of quantification and limit of detection. Introduction to bioinformatic analyses – elements of basic NGS data analysis. **U_02** (2 hours)

Classes:

1. Updating the current state of knowledge for a selected research area – principles of literature searching (online databases). **U_03** (3 hours)
2. Formulating hypotheses and research objectives. **U_03** (2 hours)
3. Designing an experimental study – preparing a work schedule, determining the number of samples for analysis, repetitions, and rules for collecting environmental samples. **W_01, W_03, U_05, K_01** (4 hours)
4. Structure of scientific work – review articles, methodological papers, short communications. (**W_01**, 2 hours)
5. Principles of preparing an abstract. **W_02, U_03** (4 hours)
6. Preparing data for publication – graphical presentation of results (Excel), proper construction of tables, learning how to interpret results. **W_02** (4 hours)
7. Introduction to statistical analysis methods (ANOVA, simple regression) using statistical software (e.g., Statgraphics, Statistica). **W_02** (5 hours)
8. Principles of preparing multimedia presentations and public speaking. **W_02, U_01** (4 hours)
9. Rules for correct citation of scientific works. **U_04** (2 hours)

V. Didactic methods used and forms of assessment of learning outcomes

Symbol	Didactic methods <i>(choose from the list)</i>	Forms of assessment <i>(choose from the list)</i>	Documentation type <i>(choose from the list)</i>
KNOWLEDGE			
W_01	Conventional lecture	Exam	Graded written exam
W_02	Conventional lecture	Exam	Graded written exam
W_03	Conventional lecture	Exam	Graded written exam
SKILLS			
U_01	Practical classes, design thinking	Multimedia presentation, Report	Graded multimedia presentation and student report sheet in electronic version
U_02	Case study	Statistical analysis report	Graded statistical analysis report in electronic version
U_03	Text analysis	Written assignment	Graded written assignment in electronic version
U_04	Analiza tekstu/ćwiczenia praktyczne	Written assignment	Graded written assignment in electronic version
U_05	Practical classes,	Multimedia presentation	Graded multimedia presentation
SOCIAL COMPETENCIES			

K_01	Ćwiczenia praktyczne	Multimedia presentation	Graded multimedia presentation
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VI. Grading criteria, weighting factors

- a. Criterion: The 1 absence is allowed on lectures and classes. All absences should be made up in the manner indicated by the teacher. It is advisable, that students use electronic devices with internet connection.
- b. Lectures: Exam - 90%, attendance at lectures- 10%

Classes:

I semester: Filling out the student report (aim of the studies, hypothesis, basic literature and Experimental scheme- 50%, scientific abstract - 50%

II semester: preparation of an oral presentation with a multimedia presentation for colleagues (50%) and preparation short scientific text with correct literature citation (50%)

Very good (5)	91-100 %
More than good (4,5)	86-90 %
good (4)	71-85%
Good enough (3,5)	66-70%
sufficient (3)	51-65%

VII. Student workload

Form of activity	
Number of contact hours (with the teacher)	50
Number of hours of individual student work	75

VIII. Literature

Basic literature
1. Jamalludin Bin Ab Rahman. Brief Guidelines for Methods and Statistics in Medical Research. SpringerBriefs in Statistics 2015. DOI: https://doi.org/10.1007/978-981-287-925-7
Supplementary Literature
1. Glen McPherson. Applying and Interpreting Statistics. A Comprehensive Guide. Springer New York, NY 2011. DOI: https://doi.org/10.1007/978-1-4757-3435-5
2. Olive Jean Dunn, Virginia A. Clark. Basic Statistics. John Wiley & Sons 2009. https://doi.org/10.1002/9780470496862