Course Syllabus

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)	part-time
Discipline	Biological sciences
Language of instruction	English

Course coordinator/person responsible	dr hab. Agnieszka Wolińska

Type of class *(use only the types mentioned below)*	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	Passing courses: Mathematics with statistics in biology, Logic Desired skill in using a spreadsheet (Excel)

II. Course Objectives

To acquaint students with the principles of planning the laboratory experiments.
Learning to use literature databases and the use of proper citation system works.
To acquaint students with the most important statistical and bioinformatic packages.
To acquaint students with the basics of measurement and analytical methods validation.

III. Course learning outcomes with reference to programme learning outcomes

Symbol	Description of course learning outcome	Reference to programme learning outcome
KNOWLEDGE		
W_01	Student has knowledge in the field of research planning using the experimental methods used in biotechnology	K_W05
W_02	Knows the basics of bioinformatics, statistics and error theory	K_W04
W_03	Knows the fundamental principles o H&S	K_W07
SKILLS		
U_01	Student creates a scheme of the experience along with the work schedule (sets the priorities) on the topic of his choice and presents it to other students, he works in a team in various roles, including the leader	K_U05, K_U18
U_02	Performs basic statistical analyzes (one-way analysis of ANOVA variance, simple regression) and correctly interprets the obtained data	K_U04
U_03	Can write a scientific abstract describing the laboratory experiment of the assumed limit of words and present it to the other students	K_U05
U_04	Is able to cite scientific papers correctly in footnotes and in the text of the work and prepares a short scientific speech with a multimedia presentation	K_U05
U_05	Shows responsibility for creating the H&S conditions in the laboratory, which includes planning a research experiment, is open to modern research techniques used in biotechnology	K_U15, K_U17
SOCIAL COMPETENCIES		
K_01	When planning a research experiment, it takes into account the principles of ethical behavior, he is ready to critically evaluate his knowledge and received content	K_K04

IV. Course Content

Lecture: Searching for scientific literature. Scientific databases. Quoting and plagiarism. Preparation of initial hypotheses. Sampling. Planning the experiment. The basics of statistics and error theory. Structure of scientific work. Methods for presenting test results. Principles of writing scientific abstracts. Construction of tables and charts. Basics of regression. Analysis of variance. Analysis of results and charts. Basics of validation of measurement methods - data cleaning, distribution testing and verification of assumptions, evaluation of accuracy and stability. Validation of analytical methods - evaluation of accuracy, precision, repeatability, reproducibility, linearity, limit of quantification and detectability. Introduction to bioinformatic analyzes - elements of the basic analysis of NGS data. Philadelphia list. Citations.
Classes: Update of the state of knowledge for the selected research area - literature search rules (online databases). Setting hypotheses and research goals. Planning a research experiment - setting a work schedule, number of samples for analyzes, repetitions, rules for taking environmental tests. The structure of the scientific papers - review articles, original, methodical, short communications. Principles of abstract preparing. Preparation of data for publication - graphic presentation of results (Excel), correct table construction, learning how to interpret results. Introduction to statistical

analysis methods (ANOVA, simple regression) using Statgraphics and/or Statistica software. Rules for the preparation of multimedia presentations and public appearances. The rules of correct citation of scientific papers.

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

Symbol	Didactic methods *(choose from the list)*	Forms of assessment *(choose from the list)*	Documentation type *(choose from the list)*
KNOWLEDGE			
W_01	Conventional lecture	Exam	Written exam
W_02	Conventional lecture	Exam	Written exam
W_03	Conventional lecture	Exam	Written exam
SKILLS			
U_01	Practical exercises	Credit on the basis of presentation	Multimedia presentation
U_02	Text analysis	Checking practical skills	Rated text of the written work
U_03	Text analysis	Checking practical skills	Rated text of the written work
U_04	Text analysis / Practical exercises	Checking practical skills	Rated text of the written work /Multimedia prezentation
U_05	Practical exercises	Credit on the basis of presentation	Multimedia presentation
SOCIAL COMPETENCIES			
K_01	Practical exercises	Credit based on the presentation	Multimedia presentation

VI. Grading criteria, weighting factors.....

Lecture: Written exam in the form of a single choice test - 90%, participation in lectures - 10%
Classes:
winter semester: Evaluation for the preparation of the scheme of experience and its presentation to other students (50%) and evaluation for the preparation of the scientific abstract (50%)
summer semester: Assessment for preparing a multimedia presentation and presenting it to other students (50%) and evaluation for preparing a short scientific text in which the literature is correctly quoted together with proper references (50%)

Mark	**Evaluation criteria**	
very good (5)	the student realizes the assumed learning outcomes at a very good level	the student demonstrates knowledge of the education content at the level of 91-100%
over good (4.5)	the student accomplishes the assumed learning outcomes an over good level	the student demonstrates knowledge of the education content at the level of 86-90 %

good (4)	the student accomplishes the assumed learning outcomes at a good level	the student demonstrates knowledge of the education content at the level of 71-85%
quite good (3.5)	the student accomplishes the assumed learning outcomes at a quite good level	the student demonstrates knowledge of the education content at the level of 66-70%
sufficient (3)	the student accomplishes the assumed learning outcomes at a sufficient level	the student demonstrates knowledge of the education content at the level of 51-65%
insufficient (2)	the student accomplishes the assumed learning outcomes at an insufficient level	the student demonstrates knowledge of the education content below the level of 51%

VII. Student workload

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

VIII. Literature

Basic literature
Pandey P., Pandey M.M. 2015. Research methodology: tools and techniques. Bridge Center, Romania. Berendsen H.J.C. 2011. A student's guide to data and error analysis. Cambridge University Press, New York.
Additional literature
Box G.E.P., Hunter J.S., Hunter W.G. 2005. Statistics for experimenters. 2nd Edition. Wiley&Sons. Selected scientific papers from the current scientific journals. Script for classes.