SYLLABUS

Name of the course (as specified in the approved curriculum) Module 4 – Data Science and Bioinformatics				Number of ECTS credits 10
Name of the course in Polish Analiza Danych i Bioinformatyka				
Unit providing the course Department of Genetics and Animal Breeding				
Course co-ordinator prof. dr hab. Maciej Szydłowski				
Field of study Animal Production Management		Level II – master studies	Profile Academic-general	Semester 1

TYPE OF CLASSES AND COURSE LOAD
(Classes with teacher and student's own work)

Mode of studies: full-time		Mode of studies: part-time	-
- lectures	30	- lectures	-
- practical classes	70	- practical classes	-
- field classes	0	- field classes	-
- labs	0	- labs	-
- consultations	5	- consultations	-
- own student's work	100	- own student's work	-
- others	45	- others	-
Total number of hours	250	Total number of hours	-

OBJECTIVE OF THE COURSE

This module demonstrates how modern computer-aided methods in statistics and bioinformatics can be applied to analyze records on animal phenotypes and genomes. Students will develop skills to analyse animal data.

TEACHING METHODS

Lectures:
- Presentation with the use of a multimedia projector
- Interactive Q&A

Classes:
- Hands-on experience: students get direct practice with software and coding
- Peer-to-peer support: Students learn from and help each other, fostering collaboration

Preparation of a phased project verified by the teacher

	Course learning outcomes	The reference to the study field learning outcomes
Knowledge	O1: Student knows and understands the advanced aspects of statistics O2: Student knows and understands the rules of experimental data analysis, hypothesis testing, and experimental design O3: Students know and understand selected methods of bioinformatics	AP2A_W01 AP2A_W03
Skills	O4: Student is able to plan, design, and statistically analyze experiments on animals and assess the significance of the examined factors. The student elaborates on and analyzes observational data on animals. O5: Student is able to design simple experiments on farm animals, analyze experimental data, and perform basic statistical inference O6: The student uses scientific reports that include statistical analyses of data collected from animals. O7: Student is able to critically analyze and interpret information from archives of DNA and protein sequences	AP2A_U01 AP2A_U02 AP2A_U03 AP2A_U12

Social competences	O8: The graduate is aware of the importance of statistical methods in the objective assessment of the effects of environmental and genetic factors on animal health and performance.	AP2A_K01

Methods for verifying learning outcomes	Symbols of course learning outcomes
Formative	
- oral summary of what has been explained	O1-O3
- phased project	O2-O7
Summative:	
- Written exam	O1-O8

TEACHING CONTENTS

Lectures: Data Management: R Environment. Data management in R. Graphics in R.
Experimental design: Variables and probability distributions. Measures of central tendency and variability. Estimation. Statistical hypothesis. Selected parametric and nonparametric tests. Power of some statistical tests and determining sample size. Statistical models and inference on their parameters. Matrix algebra. Analysis of variance and regression. Data transformations.
Principles of bioinformatics: Sequence alignment. BLAST. Patterns, motifs, and domains. Genotyping by resequencing. ENSEMBL. Prediction of RNA structure.
Classes:
Data Management: R Environment. Data management in R. Graphics in R.
Experimental design: Descriptive statistics. Estimation. Selected statistical tests. Determining sample size. Matrix algebra. Analysis of variance and regression.
Principles of bioinformatics: Sequence alignment. BLAST. Patterns, motifs, and domains. ENSEMBL. Prediction of RNA structure.

Forms and criteria for completing the course	Percentage of a final grade
Summative evaluation:	
- final phased project assignment	50%
- written exam	50%

Literature list

Core literature
Ott L. An introduction to statistical methods and data analysis. PWS Publishers, Boston
Andreas D. Baxevanis (Ed), B. F. Francis Ouellette (Ed): Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. Publisher: Wiley, John & Sons, Incorporated

Additional sources
printed and electronic material provided by lecturers
R manuals
NCBI online training materials in HTML, PDF and Video formats