SYLLABUS

Name of the course (as specified in the approved curriculum) **Module 7 – Animal Improvement Methods and Genomics**	Number of ECTS credits 7
Name of the course in Polish **Metody Doskonalenia Zwierząt i Genomika**	
Unit providing the course **Department of Genetics and Animal Breeding** **Department of Biochemistry and Biotechnology (Faculty of Agriculture and Biotechnology)**	
Course co-ordinator **Prof. UPP. dr hab. Piotr Pawlak**	

Field of study	Level	Profile	Semester
Animal Production Management	II – master studies	Academic-general	**3**

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	65	- practical classes	-
- field classes	0	- field classes	-
- labs	0	- labs	-
- consultations	5	- consultations	-
- own student's work	55	- own student's work	-
- others	20	- others	-
Total number of hours	175	Total number of hours	-

OBJECTIVE OF THE COURSE

Introduction to animal improvement methods using genetics of quantitative traits, genomic analyses, and genetic engineering. Presentation on modern knowledge on inheritance and the genetic background of polygenic traits, and the methods used in quantitative genetics. The molecular basis of inheritance processes and variability of traits in domestic animals, as well as the demonstration that advances in genomics are practically and widely used in animal production. Introduction to current molecular techniques used in the production and detection of genetically modified organisms

TEACHING METHODS

Lectures – presentation with the use of multimedia projectors
Classes – Molecular genetics lab, preparing and presenting presentations, and individual/group projects. Preparation of a phased project verified by the teacher.
Classes can be held using tools and platforms that facilitate remote organization of meetings, distance learning, and verification of learning outcomes.

	Course learning outcomes	The reference to the study field learning outcomes
Knowledge	**O1 –** the advanced aspects of statistics, planning and executing animal breeding programs; knows the factors affecting breeding progress, as well as the practical application of animal husbandry knowledge **O2 –** the advanced methodology used in animal breeding and production, as well as the rules of processing and marketing of animal origin products **O3 –** selected aspects of the quantitative traits genetics and methods used in genetic engineering and obtaining genetically modified organisms **O4 –** methods of animal improvement including genomic selection, usefulness of phenotypic, pedigree and molecular data in livestock breeding; consequences of animal selection including alternative strategies of genetic improvement concerning socio-economic circumstances	AP2A_W01 AP2A_W02 AP2A_W04 AP2A_W05

Skills	**O5 –** search, critically analyze and interpret information from literature, databases and other sources related to animal science, present this knowledge and communicate with various stakeholders in oral, written, and graphical form **O6 –** fluently use scientific literature in selected areas of animal science and discuss these topics with specialists from various fields using foreign congress language according to requirements set out for B2+ level of the Common European Framework of Reference for Languages, with particular reference to vocabulary in the field of animal science **O7 –** plan and perform scientific experiments, carry research and implementation projects in the field of zootechny; elaborate and statistically analyze experiments as well as assess the significance of the examined factors	AP2A_U01 AP2A_U02 AP2A_U03
Social competences	**O8 –** lifelong learning and updating the cognitive skills, as well as to inspire and organize the learning process of other people; to demonstrate a creative attitude; to think and act in an entrepreneurial way **O9 –** take the ethical and social responsibility for the effects of the activities in the field of animal production with particular reference to domestic animals **O10 –** assess the risk of the business impact, personal threats and the safety of colleagues and the environment	AP2A_K01 AP2A_K03 AP2A_K04

Methods for verifying learning outcomes	Symbols of course learning outcomes
Two writing tests. Exam. Presentation of the breeding program – phased project based on the real operating example and its evaluation.	O1-O10

TEACHING CONTENTS

Lectures:

Genetics of Quantitative traits: Properties of a single locus and the HW equilibrium. Breeding value of mono and polygenic traits. Coefficients of relationship and inbreeding. Heterosis and inbred depression. Partitioning of phenotypic variance, genetic parameters, and methods of estimation. Selection and genetic progress.

Animal Genomics: History of genome research; the organization of animal genomes; methods used in analysis of genome organization, functional genomics: gene expression; epigenetic mechanisms; genomics tools, including DNA sequencing to identify mutations/polymorphisms responsible for the phenotypic variability of production traits and the occurrence of hereditary diseases.

Genetic Engineering: Usefulness of genetically modified organisms in agriculture. Gene constructs – how are they arranged? Transfection of animal cells.

Labs:

Genetics of Quantitative traits: Properties of a single locus and the HW equilibrium. Breeding value of mono and polygenic traits. Coefficients of relationship and inbreeding. Heterosis and inbred depression. Partitioning of phenotypic variance, genetic parameters, and methods of estimation. Selection and genetic progress.

Animal Genomics: recognition of domestic animal chromosome sets, Sanger sequencing, gene expression analysis, presentation prepared by students (based on publications in scientific journals) concerning the development of genomics in domestic animals and the usage of these achievements.

Genetic Engineering: Biosafety Guidelines. Nucleic acid isolation and purification. Nucleic acids storage and quantification. DNA Sequencing and Cloning Strategies. Genetic engineering enzymes. Nucleic acid detection methods. Polymerase Chain Reaction (PCR) and Its Applications. Ligation of vector and insert DNA. Competent cell preparation. E.coli transformation and transformant screening. Vectors and molecular cloning. Molecular detection of GMO. Cytogenetic characterization of GMO.

Methods of verification	Percentage of a final grade
To complete the module, each of the elements listed below has to be completed 1. Genetics of Quantitative Traits (2 tests and phased project presentation) 2. Animal Genomics (test) 3. Genetic Engineering (test)	1. 40% 2. 30% 3. 30%

Literature

Core literature:

T.A. Brown Genomes 4 (2017)
Douglas S. Falconer and Trudy F.C. 1996. Introduction to Quantitative Genetics
Bourdon R.M. 2000. Understanding Animal Breeding.

Additional sources:

Scientific articles (for example Journal of Animal Science, Journal of Applied Genetics)
An introduction to molecular biotechnology. Molecular fundamentals, methods and applications in modern biotechnology. Red. M. Wink, Wiley-VCH, 2006, Weinheim, 1-768, ISBN 3-527-31412-1
Biotechnology. Genetic fundamentals and genetic engineering. 2. H-J. Rehm, G. Reed, A. Puhler, P. Stadler, VCH, Weinheim, 1993, 1-880, ISBN 3-527-28312-9
Gene biotechnology. W. Wu, M.J. Welsh, P.B. Kauffman, H.H. Zhang
Targeted Genome Editing Using Site-Specific Nucleases ZFNs, TALENs, and the CRISPR/Cas9 System. Editors: Yamamoto, Takashi, SPRINGER, 2015, ISBN: 978-4- 431-55226- 0
Genetically engineered organisms. Assessing environmental and Human Health effects. D.K. Letourneau, B.E. Burrows, CRC Press, Boca Raton, 2002, 1-438, ISBN 0-8493-0439-3