Course name:

DECISION SUPPORT SYSTEMS IN ANIMAL MANAGEMENT

ECTS	5
Course status	**complementary**
Course final assessement/evaluation of outcomes	**exam**
Prerequisites	**linear algebra, statistics, basic biological knowledge, computer skill**

Main field of study:

ANIMAL SCIENCE

Profile of study	**General-academic**
The code of studies (education level)	**MSc (master)**
Semester of studies	**summer**
Language of instruction	**English**

Course offered by:

Name of faculty offering the course	**Faculty of Animal Sciences**
Name of department offering the course	**Department of Genetics, Animal Breeding and Ethology**
Course coordinator	**prof. dr hab. Joanna Makulska**

Learning outcomes of the course:

Symbol of outcome	Description of learning outcome	Reference to	
		main field of study outcomes	discipline#
KNOWLEDGE – student knows and/or understands:			
DEC_W1	Able to define the goals in herd management and can describe the methods of data recording and processing	ZOO2_W11	RZ
DEC_W2	Describes the rules and the methods of constructing mathematical models used in the support of the decisions on farm and wild animals' management	ZOO2_W11	RZ
DEC_W3	Can choose the appropriate techniques of mathematical programming or simulation for solving a decision problem	ZOO2_W11	RZ
DEC_W4	Describes the examples of decision problems and the methods of their solution in farm and wild animals' management	ZOO2_W11	RZ
SKILLS – student is able to:			
DEC_U1	Able to construct and solve simple optimization and simulation models for support decisions in farm and wild animals' management	ZOO2_U04 ZOO2_U14	RZ
DEC_U2	Verifies the correctness of the model assumptions and the methods of getting solutions, interprets the obtained solutions	ZOO2_U04 ZOO2_U14	RZ
DEC_U3	Able to use standard and specialized computer tools to support decision processes in farm and wild animals' management	ZOO2_U04 ZOO2_U14	RZ
SOCIAL COMPETENCE- student is ready to:			
DEC_K1	Conscious of the practical utility of the mathematical methods in solving the decision problems and the need for a critical evaluation of the obtained model solutions	ZOO2_K04 ZOO2_K05	RZ
DEC_K2	Able to work in a team in the implementation of tasks requiring individual knowledge and creativity	ZOO2_K03	RZ

Teaching contents:

Lectures		15	hours

Topics of the lectures	Basic concepts of animal management science - definition of various utility functions, classical production theory
	Methods of monitoring, control and prediction in herd management
	Modeling technique in the herd management support - phases of modeling
	Mathematical programming in the support of the herd management decisions, part I: linear programming - simplex method
	Mathematical programming in the support of the herd management decisions, part II: dynamic programming - hierarchic Markov processes
	Mathematical programming in the support of the herd management decisions, part III: Bayesian networks, decision graphs (influence diagrams)
	Simulation methods in the herd decision support (e.g. Monte Carlo method)
	Examples of decision problems in management of farm and wild animals (replacement and marketing problem, feeding strategies, organization of production and reproduction cycles, livestock health problems, management of wild animals)
	Bio-economical and ecological modeling - examples of the models
	Simulation computer game of a mixed crop-livestock farm oriented in dairy production (SEGAE)

Accomplished learning outcomes	DEC_W1; DEC_W2; DEC_W3; DEC_W4; DEC_K1
Verification methods, rules and criteria of outcome assessment	*Fail (F)* *the student have obtained less than 60% of the required educational results* *Suficcient (E)* *the student have obtained at least 60% of the required educational results* *Satisfactory* *fair but with significant shortcomings; the student have obtained 61-70% of the required educational results* *Good* *generally sound work with a number of notable errors; the student have obtained 71-85% of the required educational results* *Very good* *above the average standard but with some errors; the student have obtained 86-95% of the required educational results* *Excellent* *outstanding performance with only minor errors; the student have obtained >95% of the required educational results*

Classes		30	hours

Topics of the classes	Linear and dynamic programming - application of standard software (e.g. Solver, Optimization Toolbox MATLAB)
	Linear and dynamic programming - application of BuFat software in optimization of bull fattening
	Hierarchic Markov processes - application of Multi-Level Hierarchic Markov Processes software in optimization of replacement beef heifer management
	Hierarchic Markov processes - application of Multi-Level Hierarchic Markov Processes software in optimization dairy cow management
	Hierarchic Markov processes - replacement problems in dairy, sow and ewe herd, optimization of steer fattening
	Simulation methods - application of standard software (e.g. Simulation Analysis/Excel, Simulink/MATLAB, SimFlock)
	Simulation methods in decision support - Monte Carlo method (SimHerd software in dairy cow management)
	Application of computer decision support methods in livestock health management

	Application of STELLA software to determine the optimal management strategy for selected species of wild animals
	Simulation of agroecological practices in crop and livestock management with computer serious game (SEGAE)
	Improvement of a dairy farm sustainability by implementing agroecological practices (various scenarios) - SEGAE game sessions in a virtual classroom
Accomplished learning outcomes	*DEC_U1; DEC_U2; DEC_U3; DEC_K1; DEC_K2*
Verification methods, rules and criteria of outcome assessment	*Fail (F)* *the student have obtained less than 60% of the required educational results* *Suficcient (E)* *the student have obtained at least 60% of the required educational results* *Satisfactory* *fair but with significant shortcomings; the student have obtained 61-70% of the required educational results* *Good* *generally sound work with a number of notable errors; the student have obtained 71-85% of the required educational results* *Very good* *above the average standard but with some errors; the student have obtained 86-95% of the required educational results* *Excellent* *outstanding performance with only minor errors; the student have obtained >95% of the required educational results*

Seminars   …   **hours**

Topics of the seminars	
Accomplished learning outcomes	*symbol of learning outcomesof the seminars*
Verification methods, rules and criteria of outcome assessment	*together with participation in the final asessement (in %)*

References:

Basic	1. Kennedy J.O.S.: Dynamic programming. Applications to Agriculture and Natural Resources. Elsevier, London-New York. 1986. 2. Kristensen A.R., Jørgensen E., Toft N.: Herd management science. University of Copenhagen. 2009. 3. Thornley J.H.M., France J.: Mathematical Models in Agriculture. 2nd Edition. CAB International. 2007.
Supplementary	1. Dijkhuizen A.A., Morris R.S.: Animal Health Economics. Principles and Applications. Post-Graduate Found. in Vet. Sci., University of Sydney. 1997. 2. Owen-Smith N.: Introduction to modeling in wildlife and resource conservation. Blackwell Publishing. 2007. 3. Stygar A., Makulska J. Application of mathematical modelling in beef herd management – a review. Ann. Anim. Sci., Vol. 10, No. 3, 2010, 333–348

Structure of learning outcomes:

Discipline: RZ			*5*	ECTS[**]
Discipline: # (*provide appripriate symbol - if the course relates to more than one academic discipline*)			*0*	ECTS[**]

Structure of student activities:

Contact hours		57	hours	2,3	ECTS[**]
including:	lectures	15	hours		
	classes and seminars	30	hours		
	consultations	10	hours		

	participation in research	0	hours		
	mandatory trainerships	0	hours		
	participation in examinations	2	hours		
e-learning		5	hours	0,2	ECTS**
student own work		68	hours	2,5	ECTS**

* where 10 hours of classes = 1 ECTC (in case of 15 h → 2 ECTS)

** stated with an accuracy to 0.1 ECTS, where 1 ECTS = 25 - 30 hours of classes

academic discipline code: RZ - animal science and fishery, PB - biological sciences, etc.