5.2.a Book of subjects - MSc studies program Environmental protection in agriculture

ID Number	Code	Subject	Narrow science, art or applied field	Term.	Lectures	Practical	SIR	Other classes	ECTS
1	EKAG	Ecology and agroecosystems	Agroecology	1	2	1	1		6
2	EKMI	Microbial ecology	Microbial ecology	1	2	1	1		6
3	EPRS	Environmental and natural resource economics	General economic theory	1	2	1	1		6
4		Electives 1		1	2	1	1		6
	PREK	Applied ecophysiology	Plant physiology						
	EKOT	Ecotoxicology	Pesticides						
	GIS	GIS and precision farming	Agricultural Engineering						
5		Electives 2		1	2	1	1		6
	ZBOS	Plant protection and environment	Plant Pathology						
	ZSRP	Environmental protection in field crop and vegetable production	Agroecology						
	ZSBS	Environmental protection and biodiversity in animal production	Animal higene and health care of domestic and other farmed animals						
	ZSVV	Environmental fruit growing and viticulture	Agroecology						
6	BPBR	Biodiversity and natural plant resources in agriculture	Agricultural Botany	2	2	1	1		5
7	ZZR	Soil pollution and remediation	Agrochemistry	2	2	1	1		5
8	AEM	Aquatic ecology and monitoring	Animal ecology	2	2	1	1		5
9		Electives 3		2	2	1	1		4
	EKGB	Ecological farming of invertebrates	Animal ecology						
	EKAK	Ecological aquaculture	Animal higene and health care of domestic and other farmed animals						
	TOTV	Wastewater treatment	Microbial ecology						
	EPZO	Environmental epizootiology	Animal higene and health care of						

			domestic and other farmed animals						
10		Practical work		2				6	3
11	MAS 1	Master thesis					4		4
	MAS 2	Мастер рад израда и одбрана						4	4

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: ECOLOGY AND AGROECOSYSTEMS

Teacher (s): Oljača I. Snežana

Subject status: obligatory

ECTS: 6

Aims of the subject

To enable students acheiving:

a) Knowledge/understanding in principles of regulation within natural and agricultural ecosystems and to demonstrate the complex interconnections between natural landscape and agricultural production; how applying ecological concepts and principles to the design and management of agroecosystems improve long-term reliability in agricultural production.

b) Skills in sampling for analysis, measuring of different climatic and soil properties, establishment and management of the sustainable agroecosystems.

Learning outcomes

At the end of the subject student should show knowledge/understanding of the ecological problems in agriculture, to show ability of outlining, projecting and applicating of knowledge in area of agroecology. Student should have ability to apply new ecological technologies for the purpose of natural resources preservation in agricultural production and creation of functional agroecosystems.

At the end of the subject student should be qualified for: critical analysis, evaluation, and synthesis of the new ideas in the field of agroecology, presentation of accomplishment, to be able to give over professional knowledge and ideas to the colleagues and broader academic community, to be able to use informational techlologies in the area of applied ecology in agriculture.

Content

Lectures: Problems in sustainable use of natural resources in agriculture. Plants and environmental factors. The agroecosystems concept. Introduction to basic ecosystem functions with regard to organization of biocoenosis and metabolism. Population processes in agriculture. Species interactions in crop communities. Agroecosystem diversity and stability. The energy in agroecosystems. Elaboration of possibilities and constraints to manage and utilize agroecosystems. Description of relationships and dependencies between different ecosystems in view of land use. Achieving sustainability in agriculture.

Practicals, field work, seminars: Each theoretical subject will be covered with practical workshops. Students research work will include individual work on seminar and research papers.

Literature

Oljaca S. (2010): Ecology and agroecosystems. Ed. Faculty of Agriculture, University of Belgrade 180 pp.
Kastori, R. (1995): Agroecosystem protection. Feljton d.o.o., Novi Sad.
Selected papers from journal Agriculture, ecosystems and environment

Number of contact hours 60			Other -
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

lecture, class discussions, laboratory and field work, small group work, project creation, and electronic discussion (email and website).

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 50	**Final exam**	Points: 50
Activity during lectures		Written	50
Practical work		Oral	
Coloquia			
Tests	30		
Seminars	20		
Other			

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: MICROBIAL ECOLOGY

Teacher(s): Vera B. Raicevic

Subject status: obligatory

ECTS: 6

Aims of the subject

To enable students examine and udnerstand the microbial divesity in ecosystems, significanse and possibilities of microorganisms application in safe food production, but also its role in bioremediation and bioconversion of agroindustrial waste. The aim of the subject includes multidisciplinary approach to the study and characterization of ecosystems and giving insight into the modern and reliable methods for detection of saprophytic and pathogenic microorganisms in the environment and for application in agriculture and in reparation of damaged ecosystems.

Learning outcomes

At the end of the subject student should describe mutual interactions between microbial populations as well as plant-microbial interactions, to understand the effect of environmental factors on microorganisms, to associate ecological problems in agriculture and soil and water contamination with possibility of practical application of microorganisms in bioremediation, biofertilization and safe food production.

At the end of the subject, student should be able to: perceive environmental problems in agriculture and analyse the role of microorganisms in ecosystems, to present possibilities да прикаже possibilities of microorganisms application in modern agriculture using examples, to present acquired knowledge individually or in group, to develop the capacity of critical thinking, evaluation of the learning process and outcomes.

Content

Lectures: Biodiversity of microbial populations, Microbial interactions, Plant-microbe interactions, Rhizosphere, Plant growth promoting bacteria, Microorganisms in bioremediation and bioconversion of agroindustrial waste, Composting, Microorganisms as contaminants of fresh fruit and vegetables.

Practicals: Methods of isolation and identification of saprophytic and pathogenic microorganisms from the environment, detection of human pathogens in the food production chain, as well as overview of advantages and disadvantages of microorganisms application in bioremediation.

Literature:

Lalević B., Jovičić Petrović J., Bojana Vujović (2015) Praktikum Biotehnologija u zaštiti životne sredine, Poljoprivredni fakultet Beograd-Zemun, ISBN 978-86-7834-229-5

Raicevic, V., Lalevic, B., Kljujev, I., Petrovic, J. (2010) Ekoloska mikrobiologija, Faculty of Agriculture, Belgrade, ISBN 978-86-7834-091-8

Vaun McArthur (2006): Microbial Ecology, Elsevier, ISBN 13:978-0-12-369491-1

D.Sylvia, J.Fuhrmann., P.Hartel., D.Zuberer(2005): Principles and Applications of Soil Microbiology, ISBN 0-13-094117-4

Number of contact hours 60			Other: -
Lectures: 2	Practicals:1	SIR: 1	

Teaching methodology

Lectures, case study, practical, laboratory work, interactive classes, e-learning using platform of Faculty of Agriculture : http://imoodle.agrif.bg.ac.rs / amended for communication with students, organisation of team work, and announcements of activities.

Evaluation of knowledge (maximum 100)

Activity during lectures	Points 60	Final exam	Points 40
Practical work		written	40
Activity during lectures		oral	-
Coloquia	5		
Tests	10		
Seminars	45		

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS

Teacher (s): Radmilo Pesic

Subject status: obligatory

ECTS: 6

Aims of the subject

To enable students acheiving a profound knowledge of:
a) the sustainable development, b) the global environmental problems and the role of agriculture c) economic elements it environmental policy mix, d) climate change economics, and e) international and interregional policy institutions.

Learning outcomes

At the end of the course students should have knowledge/understanding of the theory and policy of optimal renewable and nonrenewable resource use, policy instruments of environmental and resources protection, environmetal valuation and economic aspects of environmental impact assessment.
Students should also acquaire skils of independent and critical analysis of the current environmetal problems and policies, application of environmental valuation techniques, and the optimal use of natural resources in agribusines sector according to the international standards.

Content

Lectures: The sustainable development. Renewable resource economics. Non-renewable resource economics. Economics of pollution. Environmental macroeconomic accounting. Environmental valuation techniques. Climate change economics.

Literature

Pešić, Radmilo (2020) Ekonomika životne sredine i prirodnih resursa. on-line pdf www.radmilopesic.com/books/
J.M. Alier and I Ropke (2008) "Recent Developments in Ecological Economics" Edward Elgar Publ
Perman, R. Ma, Y. and McGilvray J. (1996) "Natural Resource and Environmental Economics" Longman: London and New York.
Quentin Grafton R., Adamowicz W., Dupont, D., Nelson H., Hill, R.J., Renzetti, S. (2004) "The Economics of the Environment and Natural Resources" Blackwell Publ.

Number of contact hours **60**			Other -
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

lecturing, class discussions, small group work, project creation, and electronic debate (email and website).

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 40	**Final exam**	Points: 60
Activity during lectures	20	Written	60
Practical work		Oral	
Coloquia			
Tests			
Seminars	20		
Other			

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: APPLIED ECOPHYSIOLOGY

Teacher: Marina P. Mačukanović-Jocić, Ilinka Pećinar

Subject status: elective

ECTS: 6

Aims of the subject

The subject should enable students acheiving:

a) knowledge/comprehension of: significance of abiotic environmental factors (temperature, water, light, air, soil, relief) for plants, the abiotic stress factors affecting plants, morpho-physiological adaptive plant responses to abiotic stress, the phenomenon of plant resistance to suboptimal environmental conditions; characteristics of ecological groups of plants in relation to abiotic factors.

b) Skills in: recognizing and describing the symptoms of abiotic stress factors affecting plants, as well as plant adaptive responses to abiotic stress from the molecular to the physiological and morpho-anatomical level**,** and assessment of abiotic stress impact on crop production.

Learning outcomes:

Upon complition of this course student should show knowledge/understanding of:
the complex action of abiotic ecological factors, especially, stress factors on plants, as well as morpho-physiological adaptations of cultivated plants grown under suboptimal environmental conditions.

Upon complition of this course student should be qualified to: define abiotic stress, analyze and recognize the specific ecological adaptations of plants to environmental conditions that reduce growth and yield below optimum levels, use and search literature individually, present the acquired knowledge, use e-learning method.

Content

Lectures: Abiotic ecological factors: definition and classification - climatic (water, temperature, light, air), edaphic (physico-chemical and biological properties of the soil) and orographic (relief features, exposure, inclination and altitude) factors; Ecological characteristics of cultivated plants related to abiotic ecological factors; Effects of abiotic stress factors (drought, flooding, cold, heat and salt stress, soil and air pollution, etc.) on cultivated plants and their adaptive responses;

Selected thematic units will be interpreted through interactive teaching, e-learning and practical training.

Practical training, seminars: organized according to the principle of e-learning; study research work, organized individually, covers the use and interpretation of relevant results from contemporary scientific literature, and writing a seminar paper with a presentation.

Literature:

Mačukanović-Jocić M., Pekić Quarrie, S., 2017. Applied ecophysiology. Faculty of Agriculture, University of Belgrade.
Schulze E-D., Beck, E., Muller-Hohenstein, K., 2005. Plant Ecology, Springer-Verlag Berlin Heidelberg NY.
Stevanović B., Janković, M. 2001. Plant ecology with the basics of plant physiological ecology, NNK International, Beograd.
Larcher, W. 1995. Physiological Plant Ecology. Springer-Verlag,.
Fitter, A H., Hay R.K.M.1993. Environmental Physiology of Plants. Academic Press.
Smith, J.A., Griffiths, H. 1993. Water deficits: plant responses from cell to community. Bios
Pekić, S. 1988. Ecophysiological basis of resistance of maize to drought, Naučna knjiga, Beograd.

Number of contact hours 60			Other -
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

"Ex cathedra" lectures combined with interactive teaching, e-learning (Moodle), small group work, presentation of seminar paper, class discussion, consultation and mentoring students.

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 40	**Final exam**	Points: 60
Activity during lectures		Written	**60**
Practical work		Oral	
Coloquia			
Tests	**10**		
Seminars	**30**		
Other			

Study program: Environmental Protection in Agriculture

Type and level of studies: Master academic studies

Course name: ECOTOXICOLOGY

Teacher: Dragica V. Brkić

Subject status: elective

ECTS: 6

Requirement: -

Course aim

To enable students gaining understanding and knowlege of ecotoxicological studies in environmental protection, based on the acquired knowledge about the parameters for characterization of acute and chronic effects of pollutants, parameters for characterization of exposure, hazards and risks. Students should learn to analyze and evaluate knowledge and skills in the field of ecotoxicology in a multidisciplinary approach to solving the problem of environmental pollution with the most important pollutants from the process of agricultural production.

Course outcome

Student should demonstrate knowledge of ecotoxicological principles based on the dose / concentration - response relationship; basic and derived parameters of pesticide toxicity for different organisms and their significance; general principles for hazard and risk assessment for beneficial organisms in aquatic and terrestrial ecosystems. He should also show readiness and ability for critical thinking, presentation of acquired knowledge, evaluation of learning outcomes and teaching process and be trained to work in a multidisciplinary team that analyzes and evaluates the effects of pollutants on the environment.

Course Content

Lectures: Overview of basic concepts, subjects of study and protection objectives in ecotoxicology; the importance of ecotoxicology in environmental protection; the most important pollutants from the process of agricultural production and the ways of reaching the populations in the soil and aquatic ecosystems; processes of biotransformation, bioaccumulation, biomagnification; legislation in the field of ecotoxicology, laws and bylaws related to plant protection products, biocidal products and industrial chemicals; direct and indirect effects of pesticides at different levels of biological organization, important for environmental risk assessment.

Practicals: Determination of mean lethal / effective dose / concentration, (LD-50, LC-50, EC-50), predicted no-effect concentration (PNEC) for ecosystems, determination of hazard Quotient (HQ), toxicity-exposure ratio (TER) and interpretation of the obtained results. The study research work will be organized individually, and will include the seminar and professional papers related to models for environmental effects assessment, hazards and risks assessment of chemicals.

Literature:

1. Teodorović, I., Kaišarević, S. (2014): Εκotoksikologija. Prirodno-matematički fakultet, Novi Sad;
2. Karan, V. (2010). Ekotoksikologija, Austrian Development Cooperation, WUS Austria, Poljoprivredni fakultet, Belgrade-Zemun;
3. Selected papers professional and scientific papers in Serbian and English;
4. Newman, M.C., Unger, M.A. (2014): Fundamentals of Ecotoxicology - The Science of Pollution. Lewis Publishers, CRC Press LLC, Florida, USA.

Number of classes of active teaching 60			Other classes: -
Lectures: 2	Practice: 1	SIR: 1	

Teaching methods

Theoretic lectures, interactive lectures, class discussions and work in the groups, project creation and e-learning.

Evaluation of knowledge (maximum 100)

Pre-exam obligations	Points: **40**	**Final exam**	Points: **60**
activity during lectures	**5**	Written	**60**
practical work	**-**	Oral	
Tests	**20**		
Seminars	**15**		
Other			

Study programme: Environmental protection in agriculture

Type of study programe: Master academic studies

Subject: GIS AND PRECISION AGRICULTURE

Teacher: Goran Topisirović

Subject status: elective

ECTS: 6

Aims of the subject

To enable students to achieve:

a. Knowledge and understanding of: possibilities and importance of application of GIS and precision agriculture (PA) principles, GIS and PA methods and techniques, basic GIS project working procedures, spatial data infrastructure and visualization, data bases structure, functional connecting of spatial data and corresponding data bases, possibilities of the results analysis and visual presentation.

b. Skills of: GIS applications in practice, selection and collecting attributes for data base, spatial data mapping and visualization, applications of principles of precision agriculture, GIS applications as a tools for precision agriculture.

Learning outcomes

At the end of the course students should show a thorough understanding and knowledge on possibilities and importance of application of GIS and precision agriculture (PA) principles, GIS and PA methods and techniques, basic GIS project working procedures, spatial data infrastructure and visualization, data bases structure, functional connecting of spatial data and corresponding data bases, possibilities of analysis and visual presentation of the results.

Content

Lectures: Introduction, Possibilities of application in agriculture, Systems and application of visual presentations, Data bases, Data analysis and results presentation.

Practical work: Exercises, Discussions, Study and research work.

Literature

1. Pierce, F.J., Clay, D. 2007. GIS Applications in Agriculture. CRC Press. Taylor and Francis Group. Boca Raton, USA.

2. Brase, A.T. 2006. Precision Agriculture. Thomson Delmar Learning, Clifton Park New York, USA.

3. Burrough, A.P., McDonnel, A.R. 2000. Principles of Geographical Information Systems. Oxford University Press Inc., New York. USA.

4. Heywood, I., Cornelius, Sarah, Carver, S. 1998. An Introduction to Geographical Information Systems. Pearson Education Limited, Essex, England.

5. Longley, A.P., Goodchild, F.M., Maguire, J.D., Rhind, W.D. 2001. Geographic Information Systems and Science. John Wiley and Sons, Ltd. Chichester, England.

6. Lojo, A., Ponjavić, M. 2004. GIS u gazdovanju prirodnim resursima. Gauss d.o.o. Tuzla. Bosna i Hercegovina.

7. Чукалиев, О., Вукелић Шутоска, Марија, Арнаудова, Жулиета, Иванов, И. 2005. Геоматски техники во земјоделството. Медиана д.о.о. Скопје. Македонија.

8. Ormsby, T., Napoleon, E., Burke, R., Groess, Carolyn, Feaster, Laura. 2001. Getting to Know ArcGIS desktop. ESRI Press. Redlands, California. Recommended Internet sites

Number of contact hours: 60			Other
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

Oral presentations with interactive lectures, video presentations and simulations, problem based discussions.

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 50	**Final exam**	Points: 50
Activity during lectures	20	Written	50
Practical work		Oral	
Coloquia			
Tests			
Seminars	30		

Study program/study programs: Environment Protection in Agriculture

Type and level of studies: Master academic studies

Subject: PLANT PROTECTION AND ENVIRONMENT

Teachers: Aleksa Ž. Obradović

Course status: elective

ECTS: 6

Requirement: -

Course aim

a) Knowledge/understanding of general principles of plant protection and various strategies that provide environment friendly control of pathogens and pests; b) Skills in contributing to a team work with plant protection specialists in designing ecologically acceptable and consumer safe protection strategy with reduced risk for environment pollution.

Course outcome

Knowledge and understanding of: a) role of plant protection in agriculture; b) major groups of plant pathogens and pests; plant protection principles and variety of pest control measures; consequences of inadequate plant protection; integration of different measures preventing occurrence of harmful organisms and reducing use of pesticides in order to protect environment.

Course content

Lectures: Importance of plant protection in agriculture; Biotic and abiotic factors affecting plant production; Control of harmful organisms; Integrated pest management; Specificity of plant protection in different production systems; Effect of intensive plant protection on environment; Risk management of plant protection negative effects on environment.

Practice: Practical classes, OFT, SRW

Principles of detection and determination of plant pathogens and pests; Good plant protection practice; Plant protection safety; Plant protection waste management.

Literature

1. Mijatović M., Obradović A., Ivanović M. (2007): Zaštita povrća od bolesti, štetočina i korova. Agro-Mivas, Smederevska Palanka.
2. Ivanović, M., Ivanović, M. (2017): Bolesti voćaka i vinove loze, Poljoprivredni fakultet Univerziteta u Beogradu.
3. Babović, M. (2003): Osnovi patologije biljaka. Poljoprivredni fakultet Univerziteta u Beogradu.
4. Šinžar, B., Janjić, V. (1995): Korovske biljke. Poljoknjiga, Beograd.
5. EPPO (2005): Good Plant Protection Practice. EPPO Standards PP2
6. Marić, A., Jevtić, R. (2005): Atlas bolesti ratarskih biljaka. Poljoprivredni fakultet Novi Sad.
7. Janjić, V. (2005): Fitofarmacija. Društvo za zaštitu bilja Srbije, Beograd.

Number of classes of active teaching 60			Other classes -
Lectures: 2	Practice: 1	SIR: 1	

Teaching methods

Lecturing with active participation of students, seminars. Knowledge acquired during classes will be tested by written test. Final oral exam.

Assessment of knowledge (maximum of 100 points)

Pre-exam obligations	**Points 70**	Final exam	**Points 30**
practical work	**10**	written exam	
seminar	**10**	oral exam	**30**
written test	**50**	.....	

Study programme: Environmental protection in agriculture

Type of study programe: Master academic studies

Subject: ENVIRONMENTAL PROTECTION IN FIELD CROP AND VEGETABLE PRODUCTION

Teacher (s): Zeljko K. Dolijanovic

Subject status: elective

ECTS: 6

Aims of the subject

To enable students acheiving:

Knowledge/understanding of: soil fertility, degradation, cultural measures in field and vegetable production in different farming systems (conventional, LEISA and Organic) and their effects to pollution environment, reason for modifying cultural practices and their reflections to the environment.

Skills: Establishment and management of environmental friendly field and vegetable production.

Capability and skill for teamwork; capability for developing critical thought + problem solving, decision making, evaluation of LO and of the teaching process.

Learning outcomes

At the end of the subject student should show knowledge/understanding problems in agriculture and environment.. Student should have ability to apply new agricultural technologies from conventional agronomy to organic farming. The major innovations will be done in the area of some cultural practices in different farming systems. Many of them must be modified from ecological point of view.

At the end of the subject student should be qualified for: critical analysis, evaluation, and synthesis of the new ideas in the field of general principles protection field and vegetable crop production in different farming systems agroecology.

Content

Lectures:.Type of farming systems. Conventional, Conservation and organic farming systems. Their effect on enviromental protection. Changes in crop production practice. Field and vegetable crop production i Serbia. Pollution in agriculture. Tillage. Climate changes. GMO. Cultural practeces and their effects on environment in different farming systems from conventional to organic. Farming systems - challenges and future directions.

Practicals, field work: Establishment and management in field and vegetable production in different farming system.

References

Dusan Kovacevic (2011): Environmental protection in field and vegetable crops, Monography. Ed. Faculty of Agriculture, University of Belgrade. (in Serbian).

Kovacevic, D., Oljaca Snezana eds. (2005): Organic agriculture. Monography. Faculty of agriculture -Zemun pp 323.

Kovačević, D. (2010): General Farming. Ed. Faculty of Agriculture, University of Belgrade, Second edition, 780 pp.

*** IFOAM Training Manual on Organic Agriculture in the Tropics.

"Agriculture, ecosystems and environment" Elsevire.

Number of contact hours 60			Other -
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

lecture, class discussions, laboratory and field work, small group work, project creation, and electronic discussion (email and website).

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 60	**Final exam**	Points: 40
Activity during lectures	10	Written	-
Practical work		Oral	40
Coloquia			
Tests	20		
Seminars	30		
Other	-		

Study programme: Environmental protection in agriculture

Type of study programe: Master academic studies

Subject: ENVIRONMENTAL PROTECTION AND BIODIVERSITY IN ANIMAL PRODUCTION

Teacher (s): Vladan T. Bogdanović

Subject status: elective

ECTS: 6

Prerequest: -

Aims of the subject

To enable students achieving: (1) knowledge for determination of livestock production systems, (2) understanding of impacts of livestock production systems on the environment, (3) knowledge for management and sustainable utilisation of livestock biodiversity.

Learning outcomes

At the end of the subject student should show: a) knowledge/understanding of characteristics of livestock production systems and their interactions with the environment; b) knowledge/understanding of impact of livestock production systems the environment and natural resources; c) knowledge of methods for protection and utilisation of livestock biodiversity.

At the end of the subject student should be qualified for critical analysis, evaluation, and synthesis of the new ideas in the field of livestock biodiversity, presentation of accomplishment, to be able to give professional knowledge and ideas to the colleagues and broader academic community.

Content

Livestock production, natural resources and the environment; Grazing livestock production systems and the environment; Mixed livestock production systems and the environment; Landless livestock production systems and the environment; Livestock production and livestock biodiversity; Breeding goals and breeding programs for autochthonous livestock breeds; Case studies in protection and utilisation of livestock biodiversity.

Students research work will include individual work on seminar and research papers.

Literature

Bogdanović, V. (2016). Biološke osnove stočarstva. Faculty of Agriculture, Belgrade.

Bogdanović, V. (2010). Environmental protection and biodiversity in livestock production. Austrian Development Cooperation, WUS, Austria, Faculty of Agriculture, Belgrade.

Hall, S. J. G. (2004). Livestock Biodiversity – Genetic Resources for the Farming of the Future. Blackwell Publishing, Oxford, UK.

Jarvis, D. I., Padoch, C., Cooper, H. D. (Eds.) (2007). Managing Biodiversity in Agricultural Ecosystems. Columbia University Press, New York, USA.

Robinson, T.P., Thornton P.K., Franceschini, G., Kruska, R.L., Chiozza, F., Notenbaert, A., Cecchi, G., Herrero, M., Epprecht, M., Fritz, S., You, L., Conchedda, G., See, L. (2011). Global livestock production systems. Rome, Food and Agriculture Organization of the United Nations (FAO) and International Livestock Research Institute (ILRI).

Steinfeld, H., P. Gerber, T. Wassenaar, V. Castel, M. Rosales, C. de Haan (2006). Livestock's long shadow - Environmental issues and options, LEAD FAO, Rome.

Secondary Guidelines for Development of National Farm Animal Genetic Resources Management Plans - Management of small populations at risk. FAO UNEP, Rome.

Selected papers from journals: Agricultural systems, Agriculture, ecosystems and environment, Animal, Livestock Science etc.

Number of contact hours: 60			Other
Lectures: 2	Practical: 1	SIR: 1	

Teaching methodology

Lecture, class discussions, small group work, project work, seminar work.

Evaluation of knowledge (maximum 100)

Pre-exam	**Points: 40**	**Final exam**	**Points: 60**
Seminar and oral discussion on seminar topic	40	Written exam	60

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: ENVIRONMENTAL PROTECTION IN FRUIT GROWING AND VITICULTURE

Teacher: Milica M. Fotirić Akšić, Zorica Z. Ranković-Vasić

Subject status: elective

ECTS: 6

Aims of the subject: To enable the student to acquire:
a) Knowledge / understanding of plants, microorganisms, and animals as bioindicators of soil type and composition, agronomic aspects of fruit and grape production technology according to organic principles and biological characteristics of fruit and grape species and cultivars, the impact of agriculture on environmental pollution, and the impact of pollution on the environment, and human health.
b) Skills in selection of species/cultivars and systems of cultivation, control and biological circulation of pests and antagonists, ecological basis of application of protection measures and bioindicators, impact of the pollution on the environment and mankind, as a key moment in preserving sustainable ecosystem in orchards and vineyards.

Learning outcomes: The student should show knowledge and understanding of the importance of increased numbers of plant and animal species in organic agriculture (bioindicators), knowledge of the most favorable location and terrain exposure, skill in using different methods in soil maintenance and balanced nutrition of fruits and vines; learn agro-technical measures in optimizing agricultural conditions in certain habitats under the conditions of organic production, get to know resistant and tolerant species and cultivars, pruning and fruit and grape growing system, the impact of pollution on the environment and human health, and apply methods of effective learning, teamwork, critical thinking and evaluation of teaching and learning outcomes.

Content

Lectures:Perception of orchards and vineyards as monocultures, knowledge of the causes of dysfunction of agroecosystems, realization of regulated ecosystems in orchards and vineyards, ecosystem diversity, measures for natural improvement of species to reduce pest density, bioindicators, agrotechnical measures in fruit growing and viticulture as pest protection measures and preservation of plantation ecosystems and areas around plantations, division into primary and secondary products in fruit and wine production and ways of their use, fruit quality in organic production, impact of pollution on the environment and human health.

Practical training, seminars: The exercises in Environmental Protection in fruit growing and viticulture will study the traceability of production, labeling; comparison of nutritional composition of organically and conventionally produced fruit, organic production pro and contra. The process of establishing organic production and keeping records of vineyards will be done according to the principles of HACCAP. At the end of the semester, a seminar paper is planned. Seminar work is mandatory and is part of the exam; it can be a team, if there are several participants, or individual.

Literature:

Kevan P.G. (1999) Pollinators as bioindicators of the state of the environment: species, activity and diversity. Agriculture, Ecosystems and Environment, 74:373-393.

Chehregani A., Malayeri B.E. (2007): Removal of Heavy Metals by Native Accumulator Plants. International journal of agriculture & biology, 9(3): 462-465.

Pankhurst C., Doube B.M., Gupta V.V.S.R. (eds.). (1997): Biological indicators of Soil Health. CABI Publishing, Wallingford, UK.

Cubison S. (2009): Organic fruit prduction and viticulture, a complete guide. The Crowood Press Ltd, Ramsbury, Marlborough, UK.

Lind K., Lafer G., Schloffer K., Innerhofer G., Meister H. (2003): Organic fruit growing. CABI Publishing, Wallingford, Oxon, UK..

Number of contact hours 60			Other
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

Lectures combined with interactive teaching, seminars, consultations and mentoring with students

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 50	**Final exam**	Points: 50
Activity during lectures	**5**	Written	**50**
Practical work		Oral	
Coloquia			
Tests			
Seminars	**45**		
Other			

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: BIODIVERSITY AND NATURAL PLANT RESOURCES IN AGRICULTURE

Teacher (s): Zora Dajić Stevanović

Subject status: obligatory

ECTS: 5

Aims of the subject. To enable students acheiving:
а) Knowledge/understanding in (of): the biodiversity – genetic, species and ecosystem biodiversity, plant and vegetation biodiversity of Serbia, sustainable use of natural plant resources in agriculture, biodiversity management and needs for conservation,
б) Skills in (of): species and plant communities determination, sampling for analysis, biodiversity monitoring, data analysis, biodiversity management: in situ and ex situ conservation, collecting of plant genetic resources, characterization and evaluation, use of natural plant resources in agriculture
Generic skills high-level spoken and written communication; capability and skill for teamwork; skill for the independent acquisition of knowledge; capability for lifelong learning in an information-based society; capability for developing critical thought, problem solving, decision making, evaluation of LO and of the teaching process.

Learning outcomes: Understanding of the importance of the maintenance of the biological diversity, knowledge of types of vegetation and its distribution and potetntial use of plant natural resources in agriculture as well as their protection. Student will be able to do individually research with the case study, to use literature and IT technologies.

Content: Biodiversity – introduction : genetic, species and ecosystem biodiversity
Review of the plant biodiversity of the Balkans and Serbia: general floristic and vegetation biodiversity, vegetation zonation, endemic and relic plants and plant communities, causes of biodiversity
Protected areas in Serbia: National parks and related plant and vegetation diversity and specific features, Nature parks, Landscapes of outstanding qualities, Special nature reserves
Major plant natural resources in Serbia and use in agriculture: Grasslands: diversity, management and impacts on biodiversity, sustainable use of grasslands in agriculture (forage plants, medicinal and mellifoerous plants), Other ecosystems, including marginal: saline habitats, swamps and wet habitats, high-mountain shrub and herbaceous vegetation – sustainable use in agriculture and impacts on biodiversity
Biodiversity management and conservation (in agreement with the guest lecturer) : International and national legislative for biodiversity conservation, in situ, ex situ conservation, conservation of plant genetic resources, CITES list of species
Practical, field work: introduction with taxonomy and ecology of species interesting for biodiversity. Introduction in methodology of collecting and determination of target plants, Field work: estimation of floristic and vegetation biodiversity of selected area, Case study: presentation and discussion of the student work (biodiversity monitoring, current use of plant natural resources and impacts on biodiversity of the target area/site.

Literature
Group of authors (1995). Biodiverzitet Jugoslavije sa pregledom vrsta od međunarodnog značaja (ur. V. Stevanović i V. Vasić). Ekolibri i Biološki fakultet, Beograd.
Flora Evrope na CD
Kojić, M., Mrfat-Vukelić, S., Dajić, Z., Đorđević-Milošević, S. (2004): Livade i pašnjaci Srbije. Institut za istraživanja u poljoprivredi "Srbija" Beograd. Monografija.
Stevanović, B., Janković, M. (2001): Ekologija biljaka. NNK Internacional, Beograd
Selected papers in the area of biodiversity and vegetation

Number of contact hours **60**			Other -
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methods

lecture, class discussions, laboratory and field work, small group work, project creation, and electronic discussion (email and website chat room).

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 60	**Final exam**	Points:40
Activity during lectures	10	Written	
Practical work	10	Oral	40
Coloquia			
Tests			
Case study analysis	30		
Workshops, discussions	10		

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: SOIL POLLUTION AND REMEDIATION

Teacher (s): Antić-Mladenović B. Svetlana

Subject status: obligatory

ECTS: 5

Aims of the subject

Introducing a modern concept of soil contamination and pollution, sources and types of pollution, behavior and fate of pollutants depending on their characteristics and chemical, physical and biological soil properties, effects of pollutants on soil, living organisms and the environment, measures / solutions / strategies to reduce the risk of transfer of pollutants from soil to other components of the environment, remediation techniques.

Learning outcomes

At the end of the course student should: show an understanding of the problems that may arise in the environment as a result of soil pollution from agricultural as a source, receiver and / or transmitter of pollutants; interprets the results of chemical analysis of soil and plant material and defines a degree of soil pollution and performs risk assessment; knows, understands, choose and plan appropriate soil management and remediation order to achieve sustainable environmental conditions; be trained for teamwork, critical analysis and presentation of acquired knowledge.

Content

Lectures: Soil as a natural resource - the composition and basic properties; Soil pollution - definition, types and sources of pollution; Inorganic and organic pollutants - behavior in a soil, transfer to other parts of the environment, the effects on soil, living organisms and the environment; Measures for reducing/preventing environmental pollution from agricultural sources; Assessment of soil pollution and risk level; Legislation; Techniques for remediation of polluted soils - physical, chemical, biological, advantages and disadvantages.

Practical work: Group workshops/platforms - solving of specific tasks/study cases. Group presentations. Individual research work.

Literature

Antić-Mladenović, S. (2010): Soil pollution and remediation – script (in Serbian). Austrian Development Cooperation, WUS Austria. Poljoprivredni fakultet Beograd.

Mirsal, I.A. (2008): Soil Pollution: Origin, Monitoring and Remediation, 2nd edition, Springer.

Livingston, J.V. (2006): Agriculture and soil pollution: New Research. Nova Science Pub Inc.

Jayanta K. Saha, J.L., Selladurai, R., Coumar, M.V., Dotaniya, M.L., Kundu, S., Patra, A.K. (2017): Soil Pollution - An Emerging Threat to Agriculture. Springer Singapore

Duarte, A.C., Cachada, A., Rocha-Santos, T.A.P. (2017): Soil Pollution: From Monitoring to Remediation. Academic Press.

Number of contact hours **60**			Other
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

Lectures, presentations, seminars/workshops, work in small groups and mentoring.

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 40	**Final exam**	Points: 60
Seminar	20	Written	60
Workshop	20	Oral	

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: AQUATIC ECOLOGY AND MONITORING

Teacher (s): Dulić P. Zorka

Subject status: obligatory

ECTS: 5

Aims of the subject.

To enable students achieving:

Knowledge/understanding basic water properties and standard water quality parameters. Aquatic organisms and their interaction with the environment. Sources of water pollution and effects of pollutants on aquatic organisms. Bioindicators and biomonitoring. Methods for wastewater treatment.

Learning outcomes

After completion of the subject student should:

1. Recognize different groups of aquatic organisms
2. Analyze the level of water pollution in a water body
3. Apply knowledge in ecology of aquatic organisms
4. Use different methods in water quality assessment using chemical parameters
5. Use bioindicators and biomonitoring in water quality assessment
6. Apply biotic indexes in water quality assessment
7. Show readiness and capability for team work, critical thinking, presentation of acquired knowledge, evaluation of learning outcomes, evaluation of the teaching process
8. Show ability for professional development and progress in spoken and written communication

Content

Lectures: Introduction to aquatic ecology: basic water characteristics, aquatic organisms, structure and functioning of aquatic ecosystems. Standard water quality parameters. Causes and problems of water pollution: Sources and effects of water pollutants on aquatic organisms. Types of pollution in agriculture. Legislation. Introduction to monitoring systems. Indicator organisms. Pollution indices (Saprobien system). Data analysis and interpretation. Methods of wastewater treatment, focusing on biological treatments.

Practicals, field work: Introduction to water sampling equipment. Water sampling and analysis of physical, chemical and biological parameters. Laboratory techniques for biological analysis of water quality and data analysis. Students research work includes individual work on seminar and research papers.

Literature

Dulić, Z., Rašković, B. (2018): Protection and biomonitoring of aquatic ecosystems. Faculty of Agriculture, Belgrade, p.168.

Mirko Cvijan (2000): Ekologija zagađenih sredina, bioindikatori i monitoring sistem. Biološki fakultet, Beograd. 122 str.

Spellerberg Ian F. (2005): Monitoring Ecological Change. Cambridge University Press. Cambridge, p. 391.

Chapman, D. (1997): Water Quality Assessment: A guide to the use od biota, sediments and water in environmental monitoring. Taylor and Fransis, p. 626.

Dulić, Z., Poleksić, V., Rašković, B., Lakić, N., Marković, Z., Živić, Stanković, M. (2009): Assessment of the water quality of aquatic resources using biological methods. Water Treatment and Desalination 11, 264-274.

Poleksić, Vesna, Dulić Zorka, Živić Ivana, Rašković, B. (2007): Zoološki priručnik. Poljoprivredni fakultet. Beograd.149 str.

Selected papers from scientific journals on water quality, bioindicators, biomonitoring and wastewater treatment.

Number of contact hours **60**			Other -
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

Lectures, class discussions, interactive teaching, laboratory and field work, project creation and e-learning on the faculty's moodle platform

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 50	**Final exam**	Points: 50
Activity during lectures	20	Written	50
Practical work		Oral	
Coloquia			
Tests			
Seminars	30		
Other			

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: ECOLOGICAL FARMING OF INVERTEBRATES

Teacher (s): Zorka P. Dulić, Bojan S. Stojnić, Božidar S. Rašković

Subject status: elective

ECTS: 4

Aims of the subject: To enable students to acquire knowledge and understanding of: the biology and ecology of edible snails, earthworms and aquatic invertebrates (Cladocera, Copepoda, Rotatoria, and freshwater crayfish); basis of heliculture, lumbiculture, and culture of aquatic invertebrates, regulation related to exploitation and/or technology of ecological farming of selected species of invertebrates by the use of modern methods of teaching and modern teaching resources (literature, internet, e-learning).

Learning outcomes: At the end of the module student should be able to: 1. Analyze biology of selected species of invertebrates suitable for farming; 2. Apply knowledge on ecology, feeding, enemies, and diseases of invertebrates suitable for farming; 3. Perform visual examination, species and age determination, dissection and/or microscopic examination, as well as sampling for analysis of invertebrates suitable for farming; 4. Classify and explain different systems of sustainable farming and processing of invertebrates that are safe for the environment; 5. Prepare a feeding plan for cultured/farmed invertebrates suitable for farming; 6. Analyze existence and combat enemies of invertebrates suitable for farming; 7. Adapt farming to the requirement of legislation concerning production, processing and trade of invertebrates suitable for farming. Shows readiness and capability for teamwork, critical thinking, presentation of acquired knowledge, estimation of the learning outcomes, and estimation of the teaching process.

Content: *Lectures*: **Biology** and taxonomy of invertebrates suitable for farming. Body organization. Reproduction. Ecology. Feeding and behavior. Natural enemies, farming diseases and protection. **Farming** of invertebrates suitable for farming: farming systems. Selection of the area and sites, facilities organization and equipment on the farm. Broodstock (initial population) and standard litter establishment. Legislation and regulation. Production, processing and placement. *Practical*: Species and age category classification of of invertebrates suitable for farming. Visual examination, dissection and sampling. Establishment and management of the farm. Exploitation and usage of invertebrates suitable for farming.

Literature:

1. Poleksić, Vesna, Stojnić Bojan, Dulić Zorka, Rašković, Božidar (2010): Ekološko gajenje beskičmenjaka. Skripta. Austrian Development Cooperation, WUS Austrija, Poljoprivredni fakultet. Beograd.180 str.
2. Vesna Poleksic (2000): Gajenje puzeva. Nolit. Beograd. 86 p.
3. Poleksić, Vesna, Dulić Zorka, Živić Ivana, Rašković, B. (2012): Zoološki priručnik. Drugo dopunjeno izdanje. Poljoprivredni fakultet. Beograd.155 str.
4. M. Mitrović (1995): Gajenje glista Lumbrikultura. KIZ „Centar“ Beograd.82 str.
5. N. Rajković i B. Minić (1986): Gliste – humus. Biblioteka Unosna zanimanja. „Ekonomski biro“ Beograd. 111str.
6. Poleksić, Vesna. i Dulić Stojanović, Z. (2003): Integralno gajenje beskičmenjaka: rečnog raka, dafnija, glista i drugih beskičmenjaka sa ribama – oblik ekološke i ekonomične proizvodnje. Seminar “Pastrmsko i šaransko ribarstvo”, zbornik predavanja 91-98. Poljoprivredni fakultet.
7. Poleksić, V., Stojnić, B., Topisirović, G. (2004): Gajenje puževa u Srbiji – koncepti i prva iskustva Biotechnology in Animal Husbandry 20 (5-6). 333-340, 2004.Marković, Z., Poleksić, Vesna, Dulić-Stojanović, Zorka, Ljubić, Biljana. 2001. Possibilities of alternative aquaculture in Serbia, Ichthyologia, Vol. 33, No. 1, 1-10, 2001.
8. Poleksic, V., Stojnic, B., Dajic-Stevanovic, Z., Topisirovic, G., and Zaric, V. (2005): Edible snail farming in Serbia: present and future. Savremena Poljoprivreda. 54, 1-2, 42-46.
9. Internet sites concerning research and farming of aquatic plants, invertebrates and fish

Number of contact hours **60**			Other -
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

Lectures and practical teaching/learning in the laboratories of the Faculty of Agriculture and on the experimental farm at the school estate Radmilovac. interactive classes, seminars, e/learning and communication with students on the learning platform of the Faculty (http://moodle.agrif.bg.ac.rs/).

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 60	**Final exam**	Points: 40
Activity during lectures		Written	40
Practical work		Oral	
Coloquia			
Tests			
Seminars	30		
Other	30		

Study program/study programs: Environmental Protection in Agriculture

Type and level of studies: Master academic studies

Course name: ECOLOGICAL AQUACULTURE

Teacher: Zoran, Z., Marković

Course status: elective

ECTS: 4

Requirement: No

Course aim

After successful completion of the course the student is expected to be able to use different systems of ecological aquaculture.

Subject outcomes*:*

Knowledge/understanding in (of): biology and ecology of cultured aquatic organisms, principles of planning and designing aquaculture facilities, principles of aquaculture, sources of pollution in aquaculture, types of pollutants in aquaculture, application of adequate technical and agrotechnical measures for pollution reduction in aquaculture, purifying of water used in aquaculture, effects of pollution from aquaculture on recipient, legislative and regulation concerning aquatic environment protection from aquaculture.

Skills in (of): sampling water and aquatic organisms, dissection of aquatic organisms, preparation, tagging and transport to the laboratory of samples for analysis, measurement of physical and chemical parameters in aquatic environment, determination of critical points – sources of pollution in aquaculture, suggestion of appropriate protection measures from pollutants from aquaculture.

Generic outcomes:

Innovation of knowledge and integration of new acquired knowledge in the existing knowledge; reaction and problem solving on time; ability to further professional development; ability to anticipate and strategic planning; acquiring and using new skills together with high professional written and oral communication; ability and skills for team work, LLL based upon modern teaching methodologies, ability for critical thinking.

Course content*:*

Lectures: Biology and ecology of cultured aquatic organisms; Principles of planning and designing aquaculture facilities; Fundamentals of aquaculture; Sources of pollution (afferent water current, stocking, nutrition, disinfection, treatment, effluent water); Types of pollutants (physical, chemical, and biological pollutants); Application of appropriate technological and agrotechnical measures in aquaculture for pollution reduction (controlled addition of water, water purification, prevention of diseases, proper nutrition, cleaning and disinfection of facilities, water release); Purification of the water used (mechanical, chemical, biological); effects of pollutants on recipients (effects of physical, chemical and biological pollution).

Practicals: Sampling water and aquatic organisms; Dissection of aquatic organisms; Preparation, tagging and transport of samples to the laboratory for analysis. Measurement of physical and chemical parameters in the aquatic environment ; Determination of critical points – sources of pollution in aquaculture.

Literature

Parker, R. (2002): Aquaculture science, DELMAR, 619 p.
Marković, Z,Mitrović Tutundžić, Vera (2003): Fish rearing. Zadužbina Andrejević, 138 p.
Spellerberg, I. (2005): Monitoring Ecological Change. 2nd Edition. Cambridge University Press. 409p
Marković Z. (2010). Carp, Rearing in fish ponds and cages, Prof. Dr Zoran Marković,152.

Number of classes of active teaching 60			Other -
Lectures: **2**	Practice: **1**	SIR: 1	

Teaching methods

Lectures and practicals (in laboratories, faculty's experimental fish farm) combined with interactive teaching/learning, and seminars.

Assessment of knowledge (maximum of 100 points)

Pre-exam obligations	**40 Points**	Final exam	**60 Points**
activity during lecture classes	**10**	written exam	60
practical teaching	**10**		
Seminars	**20**		

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: WASTEWATER TREATMENT

Teacher(s): Vera B. Raicevic

Subject status: elective

ECTS: 4

Aims of the subject.

To provide students with:

a) knowledge/understanding about treatment of wastewater from agriculture and food industry based on biotechnological processes, understanding of wastewater influence on recipient as well as understanding of complex interacions of microorganisms in the activated sludge
b) Skills related to monitoring and quality assessment of wastewater treatment facility and acquiring scientific knowledge in the area of agroindustrial wastewater management.

Learning outcomes

At the end of the subject, student should be able to define agroindustrial wastewater types and to predict their influenc on recipients, to evaluate the quality of activated sludge, to analyze posibilities of microorganisms aplications in wastewater treatment using examples of good practice, to independently decide about the need and level of wastewater treatment, to present acquired knowledge individually or in group, to develop the ability of critical thinking, evaluation of learning process and learning outcomes.

Content

Lectures: The nature and composition of wastewaters from agriculture and food industry, autopurification of surface water, eutrofication–causes and consequences, modes of wastewater treatments, microbial communities in activated sludge, aerobic and anaerobic agroindustrial wastewater treatments, anaerobic digestion, legislation in water protection.

Practicals: sampling of wastewater and activated sludge, analysis of activated sludge, examples of good practice in the wastewater treatments.

Literature:

Bojana Vujović, Smilja Teodorović, Blažo Lalević, Vera Raičević (2016): Praktikum Tehnologija Otpadnih voda, Poljoprivredni fakultet Beograd-Zemun ISBN-86-7834-258-5

Raičević, V., Lalević, B., Kljujev, I., Petrović, Jelena (2010): Ekološka mikrobiologija. Poljoprivredni fakultet Beograd-Zemun ISBN 978-86-7834-091-8

M.Jakovljević., S.Blagojević, Vera Raičević (2004)**:** Hemija i Mikrobiologija voda-uđžbenik, Poljoprivredni fakultet Beograd-Zemun. ISBN 86-80733-61-X,

Tchobanoglous, G., Burton, F.L., Stensel, H.D (2004) Wastewater engineering. Treatment and reuse. McGraw Hill

Number of contact hours 60			Other: -
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

Lectures, case study, interactive classes, practicals, case study, e-learning

Evaluation of knowledge (maximum 100)

Activity during lectures	Points 60	Final exam	Points 40
Tests	20	written	40
Practicals	20	oral	
Poster/presentaion	20		

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: ENVIRONMENTAL EPIZOOTIOLOGY

Teacher (s): Slavča V. Hristov, Branislav M. Stanković

Subject status: elective

ECTS: 4

Aims of the subject: The subject enables students to acquire knowledge and skills in relation to sources of biological agents (pathogens), transmission routes, and modes of infection of animals within the same and different species, ways of transmission of zoonotic agents, biosecurity on farms and preventing and combating infectious and parasitic diseases.

Learning outcomes: Upon completion of this course, the student should be able to: 1. define the terms about the sources and routes of transmission of biological agents; 2. describe the basic methodology of epidemiology and environmental protection, particularly those relating to the investigation of the influence of air, water and land pollution; 3. critically evaluate and interpret scientific results related to the impact of potential hazards to health; 4. review the role of the environment in the emerging and spreading of pathogens in populations of the same and different species of animals, as well as in the emerging and spreading of zoonoses; 5. depending on the environmental conditions and other factors, suggest measures for monitoring and control of the spread of biological agents, and to evaluate the effectiveness of the proposed measures; 6. plan, implement and interpret initial research in solving complex problems related epidemiology and environmental protection including animal health hazards of concern during natural disasters.

Content: *Theoretical study:* 1. a primary, secondary and the intermediate sources of the biological agents; 2. routes of transmission of the biological agents; 3. survival of the biological agents in the environment and infection of the animals within the same and different species; 4. mechanisms of action of biological agents; 5. factors of outbreaks, surveillance and control of emergence and the re-emergence of bacterial, viral, parasitic diseases of animals and zoonoses; 6. biosecurity on farms, monitoring and measures to prevent the occurrence and control of infectious and parasitic diseases including animal health hazards of concern during natural disasters. *Practical training:* For each chapter of the theoretical studies will be organized appropriate practical workshop. Preparation of seminar papers and articles related to the subject will be organized in the form of mentoring.

Literature

1.Hristov S. 2002: Zoohigijena. Poljoprivredni fakultet, Univerzitet u Beogradu. Beograd. [*Hristov S. 2002: Animal hygiene. Faculty of Agriculture, University of Belgrade, Belgrade*].

2.Seimenis A., 2010. Capacity building for zoonotic and foodborne diseases in the Mediterranean and Middle East regions (an intersectoral WHO/MZCP proposed strategy). International Journal of Antimicrobial Agents 36S, S75–S79.

3.WHO., 2006. The control of neglected zoonotic diseases. A route for poverty alleviation. Report of a joint WHO/DFID-AHP meeting with the participation of FAO and OIE. Geneva: World Health Organization; 2006. WHO/SDE/FOS/2006.

4.FAO/WHO., 2003. Hazard characterization for pathogens in food and water. In: Microbiological Risk Assessment Series No. 3. Rome: Food and Agriculture Organization of the United Nations and Geneva: World Health Organization; 2003.

5.King LJ. 2004. Emerging and re-emerging zoonotic diseases: challenges and opportunities. In: OIE 72nd General Session. 2004.

6.Blancou J., Chomel B., Belotto A., Meslin F., 2005. Emerging or re-emerging bacterial zoonoses: factors of emergence, surveillance and control. Veterinary Research, BioMed Central, 36 (3), pp.507-522.

7.Noordhuizen J., Frankena K. 1999. Epidemiology and quality assurance: applications at farm level. Preventive Veterinary Medicine 39 93-110.

8.Blaha Th., 1999. Epidemiology and quality assurance application to food safety. Preventive Veterinary Medicine 39, 81-92.

9.Armour, J., 1980. The epidemiology of helminth disease in farm animals. *Vet. Parasitol.*, 6: 7-46.

10. Noordhuizen J., Metz J., 2005. Quality control on dairy farms with emphasis on public health, food safety, animal health and welfare. Livestock Production Science 94 51–59.

11. Pearce N., Douw J., 2013. Research at the interface between human and veterinary health. Preventive Veterinary Medicine 111, 187– 193.

12.*Alemayehu* A., 2012. Review on Emerging and Re-Emerging Bacterial Zoonotic Diseases American-Eurasian Journal of Scientific Research 7 (4): 176-186.

13.Kahn, L. H., 2006. Confronting zoonoses, linking human and veterinary medicine. Emerging Infectious Diseases 12 (4), 556-561.

14.EFSA/ECDC (European Food Safety Authority/European Centre for Disease Prevention and Control), 2012. The European Union summary report on trends and sources of zoonoses, zoonotic agents and food - borne outbreaks in 2010. EFSA Journal, 10(3):2597, 442 pp.

15. Valčić M. 1998. Opšta epizootiologija, Univerzitet u Beogradu, Fakultet Veterinarske Medicine. [*Valčić M. 1998. General epizootiology, University of Belgrade, Faculty of Veterinary Medicine*]

16. Valčić M. 2004. Specijalna epizootiologija, Veterinarska Komora Srbije, Beograd [*Valčić M. 2004. Special epizootiology, Veterinary Chamber of Serbia, Belgrade*].

Chosen papers from journals that consider relationship between epizootiology, epidemiology and ecology.

Number of contact hours 60	Other:

Lectures: 2	Practicals: 1	Study research work: 1	0
Teaching methodology			
Evaluation of knowledge (maximum 100)			
Pre-exam	Points:	Final exam	Points:
Activity during lectures		Written	
Practical work		Oral	30
Coloquia			
Tests	30		
Seminars	40		
Other			

Study programme: Environmental protection in agriculture
Type of studies: Master studies
Subject: PRACTICAL WORK
ECTS: 3
Aims Subject has to enable student achieving creativity and specific practical skills necessary for the profession. Acquitance with the function, organisation and technology of the work at the company, institution, governmental and non-governmental organisations working with envirronmental protection in agriculture.
Outcomes Student will be able to recognise the sources of pollution in agiricultural production and to protect and improve natural resources.
Content Practical work will be realised in the adequate institutions dealing with environmental protection in agriculture: local comunities, ministries, companies, consultative buros etc. Students will take part in expert analysis of the measures for monitoring and prevention pollution deriving from agriculture.
Methods Practical work will be done in an interactive way by direct communication with experts on the site. Students will be obliged to participate in the activities, run diaries, do seminars.
Evaluation of the practical work (max 100 points) Presentation of the seminar 50 points Diary 50 points

Study programme: Environmental protection in agriculture

Type and level of studies: Master studies, second level

Subject: MASTER THESIS

ECTS: 8

Preconditions: All exams from the study programme passed

Goals of the master thesis:
The major goal of the master thesis is to provide student with competences to individully run research in any aspect of environmental pollution from agriculture, apply relevant methods of case stydy, literature and formulates conclusions with recomendations for solving the problem. Student also has to learn how to present data both in writing and oraly.

Outcomes:
After comleting master thesis student should demonstrate skills in methodologies of research, analysing and sythetising data obtained, oral and written communication with mentor and other teachers and collegues, use of IT- communication technologies and data presentation.
After defending master thesis student gets diploma degree of engeneer - master of environmental protection.

General content:
Master thesis is a research work in which student gets acquainted with the research methodology in the particular area of environmental protection in agriculture. Master thesis has the following chapters: Introduction, Literature review, methods, Results and discussion, Conclusions, Literature.

Methods:
Students will be given guidance by mentor on how to use relevant experimental methods according to the topic of the master work, as well as how to analyse and present data. Defence is organised as a public event in front of members of the commision.

Mark (max. 100 points)			
Pre-examination activities	50	Defence	50
Collecting and analysing data	10	Presentation	30
Research	20	Answer to questions of the members of commision	20
Writing	20		