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RETHINKe

Project Number 544178-TEMPUS-1-2013-1-PT-TEMPUS-JPCR

DOUBLE DEGREE MASTER'S PROGRAMME IN AGRICULTURAL ECOLOGY AND ENVIRONMENTAL SCIENCES, TECHNOLOGY AND MANAGEMENT

TEMPUS PROJECT ,,Reform of Education THru INternational Knowledge exchange" (RETHINKe)

Balti

2017

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TEMPUS PROJECT "Reform of Education THru INternational Knowledge exchange" (RETHINKe)

AGRICULTURAL ECOLOGY AND ENVIRONMENTAL SCIENCES, TECHNOLOGY AND MANAGEMENT

Double Degree Master's Programme Syllabi

Balti

2017

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CZU 631.147

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Double Degree Master's Programme Syllabi: Agricultural Ecology and Environmental Sciences, Technology and Management / S. Stadnic et al.; «Double Degree Master's Programme in Agricultural Ecology and Environmental Sciences, Technology and Management». – Balti, 2017. 100 p.

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2017

ISBN 978-995-50-2014-6

This project has been funded with support from the European Commission. This publication reflects the views only of the authors and the Commission cannot be held responsible for any use which may be made of the information contained therein.

CONTENT

PREFACE

Within the framework of the European Union's TEMPUS Program promoting the modernization of higher education in the EU's surrounding area and supporting implementation of Bologna Process, partners in the multinational project **"**Reform of Education THru INternational Knowledge exchange" (RETHINKe) have entered into international agreements providing for the development of Double Degree Master Programmes in Architecture/Urban Planning and Environmental Sciences/Climate Engineering.

The double degree set up by the agreement is intended to be a relevant academic tool to achieve the following basic objectives of the RETHINKe project in the field of Environmental Sciences:

- to contribute to Reform of Higher Education in the PCs;
- to modernize the Curricula of the PC HEIs and to overcome the outdated knowledge base of the PC HEIs, the EU HEIs are chosen to develop new Double (Master's and PhD) Degrees with "CO2THINK+transdisciplinarity" approach on the areas of Environmental Sciences/Climate Engineering;
- to establish connections between Higher Education Institutions and the Society, addressing the knowledge triangle "Education – Research - Innovation", the Centre for Rapid and Sustainable Product Development and Business Association of Entrepreneurs providing special trainings and students' placement for Innovation/Business network creation;
- to contribute to Global warming mitigation with multiple effect, all the partner countries are included to the RETHINK partnership in order to respond to the regional priority "Environment".

In co-operation with the Faculty of Sciences, University of A Coruña, Spain, the Department of Natural Sciences and Agroecology of Alecu Russo Balti State University,

Moldova, developed the Double Degree Master's Programme in Agricultural Ecology and Environmental Sciences, Technology and Management, which offers twenty courses, taught by the academics of the two educational institutions. The courses offered by the study programme have been carefully selected and designed to provide sound knowledge and develop relevant competences in the students enrolled in Double Degree Master's Programme in Environmental Sciences. It is intended for students and professionals with different scientific backgrounds. The curriculum is intended for biology, chemistry and ecology students, as well for improving the background in environmental matters of building, civil, chemical and industrial engineers. The basic prerequisite is to hold an undergraduate Degree from a European Higher Education Area (EHEA) university or equivalent from a non-EHEA university with access to Master's Degrees in their own academic systems.

The newly developed study programme offers the following courses, taught by the Department of Natural Sciences and Agroecology of Alecu Russo Balti State University:

Soil fertility and crop productivity;

Scientific basis for the development of sustainable agriculture;

Comparative analysis of natural ecosystems and agro-ecosystems;

Sociology of management;

Applied Informatics;

Ecological weed management in agro-ecosystems;

Fertilization system in sustainable agriculture;

Soil ecosystem;

Landscape-based territorial planning;

Research methodology and ethics;

Certification and management of ecological production;

The importance of gene pool in maintaining the biodiversity and targeted improvement of the field crops;

Innovative systems of agriculture and increasing their importance in sustainability,

on the one hand, and the following course units, developed and taught by the academics of University of A Coruña, Spain:

Legislation, regulation and environmental management;

Analytical Strategies Applied to Environmental Studies;

Statistical methods applied to environmental data;

Ecology and biomonitoring;

Air Quality;

Soil Quality;

Water Quality.

Additionally, each student, taking part in the Double Degree programme will be offered an on-line course on entrepreneurship. This course will be considered as a compulsory part of the Double Degree programme. It is intended to strengthen the students' skills and competences to plan, design, develop and manage business activities related to environmental sciences.

Finally, in order to complete the MSc. programme, the students need to develop a compulsory MSc. thesis equivalent to 30 ECTS. At the end of the study programme, the students obtain two MSc. diplomas:

-MSc. in Agricultural Ecology, issued by Alecco Russo University.

-MSc. in Environmental Sciences, Technology and Management, issued by the University of A Coruña.

Learners interested in the above mentioned programme and further training can address also all involved university partners to get further information or training about the listed courses and modules.

The curriculum is designed so that learners will benefit from each course without overlaps. It reflects the paradigm shift in the study programme of environmental sciences, declared by UN and implies a change in the way professionals in environmental sciences, decision makers, academics, students, and general public at large should see, think, do or act in relation to the environment and natural resources. Its objective is to instil changes not only in policies, programs and approaches but also

in the capabilities of an institution and individuals involved in environmental sciences. Any environmental institution, in order to be effective, must rethink its programmes and processes, change its structure and develop competencies consistent with the demands and challenges of the modern society.

The team of authors expresses sincere appreciation to all the partners of the RETHINKe project, especially to Prof. Oksana Turchanina, RETHINKe project Coordinator, for the opportunity to participate and implement the project, for the scientific and methodological assistance. We also thank the working group of academics, representing the University of A Coruña, Spain and Alecu Russo Balti State University, Moldova for the effort and devotion to the implementation of the project and development of this Double Degree Master's Programme.

Co-funded by the Tempus Programme of the European Union

RETHINKe

Project Number 544178-TEMPUS-1-2013-1-PT-TEMPUS-JPCR

Course unit

SOIL FERTILITY AND CROP PRODUCTIVITY

GENERAL INFORMATION

ECTS credits: 5

Total hours: 150

Lectures: 24 hours

Seminars: 16 hours

Individual work: 110 hours

Assessment form: written exam

Target group:

Students enrolled in Master in Environmental Sciences Programme.

Modality:

Traditional (face-to-face) combined with activities presented on the Moodle platform.

Language: Romanian, English

Address: Alecu Russo Balti State University, Republic of Moldova

Teaching staff/coordinator:

Dr. Stanislav Stadnic, Associate Professor, vice head of the Department of Natural Sciences and Agroecology, e-mail: stadnicst@gmail.com

COURSE INTEGRATION IN THE STUDY PROGRAMME

Soil fertility and crop productivity is one of the fundamental disciplines of the programme. This discipline is based on the knowledge obtained from the study of such subjects as the science of soil, agro-chemistry, agricultural technology, agro-ecology. The knowledge gained within the course unit will be used in other specialized subjects.

Soil fertility is fundamental in ensuring sustainable development of the agricultural sector. Soil fertility is often confused with its fertilization, which is inadmissible, as soil fertility is influenced not only by fertilizers, but also by a number of other agro-technical processes (soil irrigation, crop rotation and diversification, etc.). The basic indicator of soil fertility is soil organic matter. Transformation processes of soil organic matter largely determine plant nutrition. Master students will be familiarized with the optimal methods of

soil fertility management in modern agriculture.

COURSE OUTCOMES

By the end of the course unit, learners will:

Know:

- factors affecting soil fertility;
- causes of soil fertility decline;
- optimal methods of soil fertility management in modern agriculture;

Demonstrate skills in:

- determining the optimal methods of soil fertility management in modern agriculture;
- analyzing and synthesizing specialized literature;
- using specialized terminology;
- using conventional symbols and intonation in their activity.
- **Students will be able to:**
- Manifest initiative in establishing interpersonal relationships;
- integrate in working groups and collaborate to perform practical tasks;
- cooperate constructively in solving problems;
- adequately perceive the social situation and develop behavioral flexible tactics;
- highlight the main contents of the messages.

COURSE CONTENT

Unit 1. Soil formation, structure and properties.

The notion of soil. The general scheme of soil formation process.

The main properties that characterize soil fertility.

Unit 2. Soil fertility.

General laws of increasing or maintaining soil fertility.

Soil retention processes.

Fertility as the main and fundamental feature of soil.

Unit 3. Soil organic matter.

Soil organic matter. Transformation processes in soil organic matter and plant nutrition. Biodynamics soil nutrients and fertility status.

Unit 4. Crop productivity dependence on soil fertility.

Crop productivity in long-term stationaries modeling different levels of fertility.

Unit 5. Causes of soil fertility decline.

Agricultural activities. Physical degradation. Chemical degradation. Pollution. Movements of earth masses. Landslides. Soil erosion. Anthropogenic soil scrapping and stripping. Control of soil fertility status**.**

Unit 6. Optimal methods of soil fertility management in modern agriculture.

Agro-technical methods (soil irrigation, crop rotation and diversification, etc.) that ensure management of soil fertility in modern agriculture.

Practical classes:

1. The main soil properties that characterize its fertility.
2. General laws of increasing or maintaining fertility.
3. Soil retention processes.
4. Soil organic matter.
5. Biodynamics of soil nutrients and fertility status.
6. Crops productivity in soil fertility.
7. Causes of soil fertility decline.
8. Control of soil fertility status.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of test-papers/ quizzes/ commentaries /portfolios. To determine the average semester grade, the sum of grades obtained during the semester shall be divided by the minimum number of grades - 3, including absences without valid reasons during seminars and test papers. To be admitted to the exam, the average semester grade should not be less than 5.

The final exam will take place in written form (test-paper). The final grade is determined in accordance with the Regulations on the organization of higher education studies under the National Education Credit System, approved by order of the Ministry of Education no.

726 of 20.09.2010.

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Course unit

SCIENTIFIC BASIS FOR THE DEVELOPMENT OF SUSTAINABLE AGRICULTURE

GENERAL INFORMATION

ECTS credits: 5

Total hours: 150

Lectures: 24 hours

Seminars: 16 hours

Individual work: 110 hours

Assessment form: written exam

Target group:

Students enrolled in Master in Environmental Sciences Programme.

Modality:

Traditional (face-to-face) combined with activities presented on the Moodle platform.

Language: Romanian, English

Address: Alecu Russo Balti State University, Republic of Moldova

Teaching staff/coordinator:

Dr. hab. Boris Boincean, Professor, Head of the Department of Natural Sciences and Agro-ecology, e-mail: bboincean@gmail.com

COURSE INTEGRATION IN THE STUDY PROGRAMME

Master students have attended course related to soil ecosystem, which determines its vitality and functionality. The course of environmental certification and management of organic contributed to the formation of the concept of friendly attitude towards the environment.

Previously, during the licenta cycle, students studied various disciplines such as pedology, agrochemistry, phitotechny, economy etc.

Master students possess knowledge that allows them to analyze the existing contradictions, when practicing the conventional farming system and have the skills

necessary to find solutions to the existing problems in conventional agriculture.

Sustainable agriculture requires a harmonious combination of economic, ecological and social aspects in agricultural production. The dominant agricultural system is oriented mainly to increase production and achieve a maximum level of profit, neglecting the negative impact on the environment and human health. Within this course, master students will be involved in analyzing the existing system of production in agriculture, highlighting the problems, created for the environment and society, seeking solutions to overcome the issues.

COURSE OUTCOMES

By the end of the course unit, learners will:

Know:

- The barriers in promoting sustainable agriculture;
- Alternative methods of preventing the development of diseases, plant pests and weeds;
- Ways to restore soil fertility and prevent soil degradation and pollution;
- Economic, social and environmental benefits due to the extension of the sustainable agricultural system;

Demonstrate skills in:

- Highlighting the problems in agriculture, caused by human activity;
- Development of complex measures of management of agricultural system able to prevent the occurrence of negative consequences for the environment and human health;
- Systematic approach to the economic, social and environmental components of sustainable development at different levels of administrative-territorial organization;
- Making decisions on sustainable development of agriculture and rural communities simultaneously;

Form / reform:

- Capacity to synthesize the information obtained from previous disciplines through

the optimization of economic, environmental and social conditions;

- Team collaboration skills to address problematic situations;
- Critical thinking skills to ensure the integrity of sustainable development of the agricultural sector and rural communities.

COURSE CONTENT

The given discipline is oriented towards a systematic (holistic) approach to the agricultural problems that appeared with the expansion of intensive (industrial) agriculture.

The overarching goal of the given course is to find a compromise in balancing the production level and the increase of profits with environmental and social consequences in the dominant model of agricultural intensification.

Unit 1. Historical background of the discipline

The history of agricultural development in the 20th century. Structural changes in agriculture.

The development of agriculture and the emergence signals unease of soil degradation and environmental pollution.

Eco-systemic vision. Promotion of biodiversity and natural habitat (integration of natural and agricultural ecosystems). Ensuring profit for agriculture and the vitality of rural communities through diversification.

Unit 2. Sustainable systems in plant and animal culture

Transition to a system of sustainable agriculture. Analysis of inner and external factors in promoting this concept. Domestic resource assessment.

Maintaining soil productivity issues (erosion, compaction, loss of soil organic matter, nitrate leaching; maintaining nutritional regime etc.).

Alternative management and maintenance of soil fertility (crop rotation, nservative system of soil cultivation, natural barriers, cultures interlacing; leguminous crops, manure management).

Alternative Management of diseases, plant pests and weeds.

Consequences of pesticides within and outside the household.

Strategies to combat diseases, plant pests and weeds (crop rotation, intercropping and mixed crops, cultivation of crops in strips, mechanical, biological and chemical action).

Animals in sustainable agricultural system.

Disease prevention; waste management in stockbreeding

Grassland management.

Unit 3. Economic aspects of sustainable development

Basic contradictions between short-term economic interests and long-term ecological and social consequences.

Three concepts in economic aspects of sustainable development: systemic vision; diversity and ensuring closed circuit of nutrients and energy within each household.

Measures necessary measures to be taken during the transition from conventional to sustainable agriculture to ensure economic efficiency.

Unit 4. Alternative occupations in agriculture - new ways of ensuring sustainability

Ways to ensure biodiversity in farms and rural communities. Reducing the role of intermediary companies in providing their services, especially options for direct marketing of agricultural products.

Sustainable agricultural practices and economic benefits to the rural community. The vitality of rural communities. Employment opportunities in rural communities.

Unit 5. Policies in the promotion of sustainable agriculture. European Community policy in Agriculture.

State policies for reducing the negative impact of agriculture on the environment.

Socio-economic state policies.

Developing policies to promote sustainable agriculture at regional and local level.

Unit 6. Ethics and agriculture

What is the connection between the ethics and agriculture?

Ethical principles in agriculture.

The application of ethical principles in agriculture.

Practical classes:

1. The causes and the need for sustainable development of agriculture and promotion in reality of industrial intensification.
2. Globalization and liberalization of prices. Ways to solve the dilemma.
3. Alternative ways to ensure soil fertility maintenance and management.
4. Alternative ways to ensure management of diseases, pests and weeds.
5. Stockbreeding system needs to be integrated in agriculture.
6. Alternative occupations in agriculture as measures to increase the sustainability of rural communities.
7. Ethics and agriculture.
8. Revision seminar.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of test-papers/ quizzes/ commentaries /portfolios. To determine the average semester grade, the sum of grades obtained during the semester shall be divided by the minimum number of grades - 3, including absences without valid reasons during seminars and test papers. To be admitted to the exam, the average semester grade should not be less than 5.

The final exam will take place in written form (test-paper). The final grade is determined in accordance with the Regulations on the organization of higher education studies under the National Education Credit System, approved by order of the Ministry of Education no. 726 of 20.09.2010.

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Co-funded by the Tempus Programme of the European Union

Project Number 544178-TEMPUS-1-2013-1-PT-TEMPUS-JPCR

Course unit

COMPARATIVE ANALYSIS OF NATURAL ECOSYSTEMS AND AGRO-ECOSYSTEMS

GENERAL INFORMATION

ECTS credits: 5

Total hours: 150

Lectures: 24 hours

Seminars: 16 hours

Individual work: 110 hours

Assessment form: written exam

Target group:

Students enrolled in Master in Environmental Sciences Programme.

Modality:

Traditional (face-to-face) combined with activities presented on the Moodle platform.

Language: Romanian, English

Address: Alecu Russo Balti State University, Republic of Moldova

Teaching staff/coordinator:

Dr. Hab. Boris Boincean, Professor, Head of the Department of Natural Sciences and Agroecology, e-mail: bboincean@gmail.com

COURSE INTEGRATION IN THE STUDY PROGRAMME

The discipline Comparative analysis of natural ecosystems and agro-ecosystems is based on the knowledge gained from such disciplines as agrotechnology, agrochemistry, agroecology, pedology, plant physiology, etc. In its turn, the knowledge obtained within this discipline will contribute to more thorough assimilation of such disciplines as soil ecology, environmental protection etc.

By studying this subject, master students will better understand the origins of the ecological crisis in agriculture and will become familiar with the ways to overcome it. Natural

ecosystems should serve as a model for sustainable agro-ecosystems. The problem is broader than the production system, it involves the entire chain - from the manufacturer to the consumer, or from the rake up to the consumer's fork. Based on knowledge of laws of natural ecosystem, it is possible to model a sustainable agricultural ecosystem - economically viable, socially acceptable and ecologically balanced.

COURSE OUTCOMES

By the end of the course unit, learners will:

Know:

- The concept of ecosystem and its structure;
- Transformation of energy and matter in ecosystems, ecosystem stability, food chains and trophic levels;
- Biochemical cycles, ways of returning nutrients and energy in the circuit;
- Limiting and physical factors of the environment;
- Factors that contributed to the ecological crisis in agriculture and measures to ensure sustainable development of the agricultural sector;

Demonstrate skills in:

- Determining different ecosystems;
- Commenting on the energy movement within the ecosystem and concepts of productivity;
- Making comparative studies of the structure and functioning of natural ecosystems and agro-ecosystems;
- Analyzing the factors that have caused the ecological crisis in agriculture;

Master student will form / reform:

- Ability to carry out interdisciplinary synthesis;
- Ability to compare different ecological systems based on their structure and functionality;
- Ability to discuss the advantages and disadvantages of different ecosystems.
- Ability to find solutions to overcome typical problems for agro-ecosystems.

COURSE CONTENT

Unit 1. The concept of ecosystem.

Structure of an ecosystem.

Ecosystem stability.

Classification of ecosystems.

Unit 2. Energy in ecological systems

Fundamental concepts.

Entropy.

The concept of productivity.

Food chains and trophic levels. Ecological pyramids.

Unit 3. Biochemical Cycles

Principles and concepts.

The structure and main types of biogeochemical cycles.

Global cycle of carbon and water.

Ways of returning nutrients into the circuit.

Limiting and physical factors of the environment.

Unit 4. Properties of agro-ecosystems

Ecological bases of comparative studies of primary production in natural ecosystems and agro-ecosystems.

Comparative analysis of nutrients circuit in natural ecosystems and agricultural ecosystems. Search of general principles.

Unit 5. Sustainable agriculture

Ecological crises in modern agriculture.

Models for sustainable agriculture.

Ways to stimulate and promote sustainable agriculture.

Practical classes:

1. The concept of ecosystem. The structure and classification of ecosystems. Examples of ecosystems.

2. Energy in ecological systems. Fundamental concepts.
3. Concept of productivity. Food chains and trophic levels.
4. Biogeochemical cycles. The structure and main types of biogeochemical cycles
5. Global circuit of carbon and water. Ways of returning nutrients into the circuit.
6. Ecological bases of comparative studies of primary production in natural ecosystems and agro-ecosystems.
7. Ecological crisis in modern agriculture. Using natural ecosystems as a model for sustainable agriculture.
8. Promoting changes in agriculture, including agricultural research.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of test-papers/ quizzes/ commentaries /portfolios. To determine the average semester grade, the sum of grades obtained during the semester shall be divided by the minimum number of grades - 3, including absences without valid reasons during seminars and test papers. To be admitted to the exam, the average semester grade should not be less than 5.

The final exam will take place in written form (test-paper). The final grade is determined in accordance with the Regulations on the organization of higher education studies under the National Education Credit System, approved by order of the Ministry of Education no. 726 of 20.09.2010.

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Basic readings:

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Further readings:

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Co-funded by the Tempus Programme of the European Union

Project Number 544178-TEMPUS-1-2013-1-PT-TEMPUS-JPCR

Course unit

SOCIOLOGY OF MANAGEMENT

GENERAL INFORMATION

ECTS credits: 5

Total hours: 150

Lectures: 24 hours

Seminars: 16 hours

Individual work: 110 hours

Assessment form: written exam

Target group:

Students enrolled in Master in Environmental Sciences Programme.

Modality:

Traditional (face-to-face) lectures and seminars.

Language: Romanian

Address: Alecu Russo Balti State University, Republic of Moldova

Teaching staff/coordinator:

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COURSE INTEGRATION IN THE STUDY PROGRAMME

To excel in business, one needs more than a solid grasp of math and economics. Any enterprise requires an understanding of people -- large populations in particular. Sociology provides the educational background needed for managers in the field of agro-ecology to understand their employees and customers. Business leaders that understand sociology are able to anticipate customer needs and respond to employee problems in ways others cannot.

Studying sociology helps to develop students' analytical thinking and capabilities. Sociologists analyze qualitative and quantitative data to determine the effects of phenomena on a population. For instance, a sociologist may discover that a country has an age gap due to an uncontrolled epidemic that affects the country's ability to compete globally. This analytical method of thinking helps those in business with the ability to research market data and

eventually draw conclusions from that data.

A background in sociology gives business leaders and human resource managers an advantage when dealing with employees in the workplace. Sociologists study (and are often aware of) the cultural and social aspects that shape an individual. With this background, those in business can avoid alienating employees or hurting company loyalty.

Sociologists understand that certain phenomena create conditions that influence groups of people. Those in business with sociology backgrounds can identify such factors and the opportunities created within a population.

COURSE OUTCOMES

By the end of the course unit, learners will be able to:

- to perceive the management system as a functional one, in which all the components interact and adjust to each other;
- to identify the place and role of leadership in the societal system, as well as the multiple relationship of inter-conditioning between management and other components of social life;
- to demonstrate the importance of management sociology in the context of integration of the Republic of Moldova into the European Community;
- to use the scientific research methods and techniques of the management system;
- to demonstrate the efficiency of learning through a research project on the management of a social process;
- to demonstrate thorough knowledge of social reality and the ability to carry out a critical analysis of the relationship between the management subsystem and the societal system;
- Be aware of the need to constantly take into account the social context when it comes to understanding the leadership efficiency.

COURSE CONTENT

1. Sociology of leadership in the structure of sociological knowledge.
2. Theories and paradigms of leadership sociology.
3. Particularities of management sociology and its methodology.
4. Macro-sociological dimension of management.

5. Social institutions and social management.
6. Actor in the management system: micro-sociological dimension.
7. The role of leadership in the operation of an organization.
8. Organizational culture.
9. Sociological aspects of conflict.
10. Motivation of participation in the organizational context.
11. Information technologies in the management systems. Applied sociology.

Practical classes:

1. Sociology of leadership.
2. Organizational structure of the society.
3. Organizational culture. Organizational development.
4. Organizational conflict.
5. Management of the workforce.
6. Enterprise as a social system.
7. Particularities of management sociology and its methodology.
8. Sociological diagnosis in the leadership management.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of test-papers/ quizzes/ commentaries /portfolios. To determine the average semester grade, the sum of grades obtained during the semester shall be divided by the minimum number of grades - 3, including absences without valid reasons during seminars and test papers. To be admitted to the exam, the average semester grade should not be less than 5.

The final exam will take place in written form (test-paper). The final grade is determined in accordance with the Regulations on the organization of higher education studies under the National Education Credit System, approved by order of the Ministry of Education no. 726 of 20.09.2010.

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2. Buzărnescu, Ștefan. *Introducere în sociologia organizațională și a conducerii*. București: Ed. Didactică și Pedagogică, 1995;

3. Hoffman, O. *Sociologia organizațiilor*. București: Editura Economică, 2004;

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12. Burazeri G. et al. Survey of attitudes and knowledge about science in medical students in southeast Europe //Bmj. – 2005. – Т. 331. – №. 7510. – С. 195-196.

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14. Gavrilita P. Environmental Systems Analysis of Municipal Solid Waste Management in Chisinau, Moldova. – 2006.

Course unit

APPLIED INFORMATICS

GENERAL INFORMATION

ECTS credits: 5

Total hours: 40

Lectures: 8 hours

Seminars: 32 hours

Individual work: 110 hours

Assessment form: practical task

Target group:

Students enrolled in Master in Environmental Sciences Programme, Didactics of Chemistry, and Didactics of Biology.

Modality:

Traditional (face-to-face) lectures and practical classes carried out in computer classes.

Language: Romanian

Address: Alecu Russo Balti State University, Republic of Moldova

Teaching staff/coordinator:

Dr. Valeriu Gutan, Associate Professor, e-mail: vgutan@gmail.com

Dr. Ion Olaru, Associate Professor, e-mail: ionolaru@mail.ru

COURSE INTEGRATION IN THE STUDY PROGRAMME

The Curriculum for the course of Applied Informatics takes into account the latest requirements of the society, the evolution and performance of information and communication technologies, the current developments in the field of computer sciences, as well as the specifics of masters programs.

The didactic activities of the course are carried out in the Multimedia Training Laboratory,

endowed with a local computer network connected to the Internet, a projection device, TV and audiovisual technologies, and are oriented towards the formation of competences for the use of information and communication technologies in the future professional activity.

The course aims at the development of some key competences, required for the students' efficient operation in their future professional activity, based on the key competences, developed by the European Commission's Working Group B in November 2004. They represent a multifunctional and transferable package of knowledge, abilities and attitudes able to function as active support for learning as part of the education that takes place throughout life and is the basis for the students' education to ensure their competitiveness on the labor market.

Competences in the field of information and communication technologies are fundamental taken into account the conditions of the current society, as well as the European openness towards collaboration and communication.

COURSE OUTCOMES

By the end of the course unit, learners will be able to:

Know:

- the notion of information society, its features and characteristics;
- the specific technologies of e-learning.
- the physical resources of the computer, the principles of architecture, structure, physical units, computer evolution and new developments in ICT;
- the resources of the computer and determine their destination,
- different types, versions and editions of operating systems and application programs;
- the interface layout of the current versions of the Windows operating system (XP, Vista, 7) and Office programs (XP, 2007, 2010).
- the types of computer networks, classify them,
- the technologies of network cooperation and physical components that ensure the functioning of networks.
- the concept of Internet and the types of services offered.
- the basics of laws regulating the information security, the notion of freeware programs, open source, types of programs for the protection of data antivirus;

Operating systems

- the hardware requirements for installing current versions of the Windows operating system;
- the technology of configuring a user account with administrator rights and limited rights,

Be able to

- to cancel user accounts;
- to configure the graphical interface of the Windows environment and to modify / customize the properties of windows, folders, and files;
- to install / uninstall physical components and program components;
- to manage data and discs in the Windows operating system;
- be able to use the application programs in the Accessories folder;
- to use standard multimedia applications.

Application programs

- to install a freeware browser and enable the Internet Explorer, Mozilla FireFox, Opera, and Google Crome browser interfaces to know the setup interfaces of these applications.
- to use search engines and configure their interfaces.
- to copy information of different types placed on the Web page.
- to download free software from the Internet.
- to apply free software for network audio / video communication.
- to apply character, paragraph and page formatting technologies to MS Word 2007.
- to have competencies to use the Equation Editor gadget.
- to create and process tables and charts in MS Word and MS Excel.
- to produce a presentation in the Power Point 2007 program.
- to install and apply PDF and DjVu file creation and reading programs.

COURSE CONTENT

Lectures:

1. Computerization of the society. The features and characteristics of the information society. Building an information-based society in the Republic of Moldova. Computerization of the educational system. Electronic services, e-learning.
2. The main fields of informatics. Office supplies, Multimedia, Virtual Reality, Artificial Intelligence.
3. Evolution of computers. Hardware components, current status, technical features. Modern ICT developments.
4. Computer networks. Network types. Classification by coverage and topology. Network protocols. The concepts of Hub, switch, server, client. Internet network. URL, domain, site, host. User services.
5. Evolution of operating systems and application programs. Office XP \ 2007 \ 2010 Packages. Free and open source software (Free / open source software).

Practical classes:

1. **Configuration Graphical Interface of Windows (XP, Vista, 7).**

Configuring users accounts, setting access levels.

Modifying the properties of the graphical interface (windows, folders, worksheet, etc.).

Installing / Removing Physical Components. Installing printers.

Install / Uninstall Programs.

Configuring parameters of geographic region and installing keyboard languages.

2. **Managing data and disks in the operating system.**

Scanning and defragmenting disks.

Back up.

Archiving. WinZip archiving programs, WinRar.

Programs for system maintenance. CCleaner. AusLogics BoostSpeed.

Antivirus protection. Antivirus and antispyware programs.

3. **Standard Multimedia Programs.**

Setting parameters for recording and playback of sound. Volume Control. Sounds and

Audio Devices Properties.

Sound Recorder. Open and play .wav and .mid files.

Voice recording via microphone. Saving sound files. Processing of sound fragments, application of effects.

The Media Player program. Structure and modification of the graphics interface. Open and play .wav, .mid, mp3, .wma, .avi files. Recording data on CD, Nero program.

4. Internet browsing programs.

Internet Explorer browsers, Mozilla FireFox, Opera. Installation and configuration particularities. Navigating governmental and educational webpages.

5.Searching for information on the Internet, search engines.

Google search engine, interface language configuration. Advanced search tools. Copying the information placed on the web page. Downloading freeware and their installation.

6. **Educational sites.**

Electronic dictionaries and encyclopedias. On-line educational programs. Interactive resources. Free software for audio and video communication on the Internet. The ooVoo program. Downloading, installation, and configuration.

7. **Electronic mail services**.

E-mail servers. Setting up an e-mail account. Electronic mail. Format your e-mail. Making attachments, creating e-mail lists.

8. **Advanced word processing.**

Structure and configuration of Word 2007 interface.

Advanced character and paragraph formatting: applying effects, setting space between characters, kerning effect. Indenting paragraphs. Numbered and highlighted lists.

9. **Advanced page formatting.**

Applying the page jump, header and footer processing, creating newspaper columns, inserting references, applying styles, creating your own styles, automatically generated content.

10. **Inserting and Processing Items.**

    Inserting and processing text boxes, images, tables, charts, and graphs. Checking grammatical and spelling mistakes.

    Create files in PDF and DjVu formats.

    PrimoPDF and Acrobat Reader. Downloading from the Internet, installing and configuring the interface.

11. **Programs for chemistry and biology.**

    PL Table program, Downloading and installation process. Configuring the interface. Acquiring application features.

12. **Creating electronic presentations.**

    Structure and configuration of PowerPoint 2007 interface. Principles and stages of the presentation. Setting the slide layout. Inserting text boxes, default properties.

13. **Creating and processing tables and charts, inserting sound files.**

    Creating tables, formatting table items. Creating and processing of various types of diagrams. Inserting audio and video files, setting playback parameters.

14. **Final processing and public presentation**.

    Applying background templates, transition effects, and animation effects. Public presentation of individual projects, navigation during presentation, use of links.

METHODOLOGY OF ASSESSMENT

The current evaluation technology was discussed and approved by the Department of Applied Informatics and Informational Technologies.

Student assessment includes an initial assessment, a current evaluation and a final evaluation.

The initial evaluation (pretesting) is done in the form of an electronic test with practical assignments in order to determine the level of students' knowledge and abilities.

The current evaluation includes 4 tests: 1 test on general knowledge, a practical assignment performed at the computer, 2 independent assignments.

Students can receive assignments for independent work (elaboration of a report, according to the approved topic and a Power Point presentation).

REFERENCES

1. *Curriculum naţional la informatică*, cl.X-XII, Ştiinţa, 2010.
2. V.Guţan, E.Harconiţă, I.Olaru, şi al. *Curriculum la disciplina Tehnologii informaţionale şi comunicaţionale*, Universitatea de Stat “Alecu Russo”, Presa universitară bălţeană, 2008, 30 p.
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Co-funded by the Tempus Programme of the European Union

RETHINKe

Project Number 544178-TEMPUS-1-2013-1-PT-TEMPUS-JPCR

Course unit

ECOLOGICAL WEED MANAGEMENT IN AGRICULTURAL ECOSYSTEMS

GENERAL INFORMATION

ECTS credits: 5

Total hours: 150

Lectures: 24 hours

Seminars: 16 hours

Individual work: 110 hours

Assessment form: written exam

Target group:

Students enrolled in Master in Environmental Sciences Programme.

Modality:

Traditional (face-to-face) combined with activities presented on the Moodle platform.

Language: Romanian, English

Address: Alecu Russo Balti State University, Republic of Moldova

Teaching staff/coordinator:

Dr. Stanislav Stadnic, Associate Professor, vice head of the Department of Natural Sciences and Agroecology, e-mail: stadnicst@gmail.com

COURSE INTEGRATION IN THE STUDY PROGRAMME

The discipline of Ecological management of weeds in agricultural ecosystems is included in the area of specialized disciplines. The study of ecological management of weeds in agricultural ecosystems is based on the knowledge gained from such disciplines as agro-technology and agro-ecology. The knowledge gained by studying the course unit will be used to study other specialized subjects.

The domination of chemical method of weed control in agriculture in Moldova disregards ecological peculiarities of weeds. At the same time, it does not take into account the biological peculiarities of weeds. Agricultural researches disregard problems of crop and weed interaction

(allelopathy). Recent research has established that weeds have a very beneficial ecological role within the economic damage threshold.

Master students will learn how to use ecological peculiarities of weeds in their rational management.

COURSE OUTCOMES

By the end of the course unit, learners will

Learn:

- main types of weeds in Moldova;
- damage threshold and the critical period of weed damage;
- weed management methods;

Demonstrate skills in:

- identifying and determining the specific composition of weeds in agricultural ecosystems;
- formulation of weed type and degree;
- weed mapping;
- developing complex weed management system;
- proper use of specialized terminology;
- the use of conventional symbols and intonation in activity.

Students will form/reform:

- manifestation of initiative in establishing interpersonal relationships;
- integration of group work at practical tasks;
- constructive cooperation in resolving problems;
- adequate perception of the social situation and development of behavioral flexible tactics;
- highlighting the main contents of messages.

COURSE CONTENT

Unit 1. Weed biology and classification.

Biological peculiarities of weeds.

Weed sources and ways of their spreading.

Classification of weeds. Weed type and degree.

Unit 2. Main types of weeds in Moldova.

Ephemeral weeds.

Spring annual weeds.

Autumn annual weeds and hibernating.

Biennial weeds. Perennial weeds with suction cups.

Perennial weeds with rhizomes.

Parasitic weeds.

Quarantine weeds.

Unit 3. Weed mapping.

Methods of keeping weed evidence. Weed mapping.

Unit 4. Damage threshold and critical period of weed damage.

Methods for assessing the damage threshold and the critical period of weed damage.

Allelopathy and competition.

Unit 5. Weed management methods.

Preventive measures.

Crop rotation as a factor of weed management.

Soil cultivation.

Biological methods of weed management.

Physical methods of weed management.

Chemical methods of weed management.

Unit 6. Integrated weed management.

Practical classes:

1. The study of the basic representatives of the ephemeral weeds.
2. The study of the basic representatives of the spring annual weeds.

3. The study of the basic representatives of the autumn annual weeds and hibernating.
4. The study of the basic representatives of the biennial weeds.
5. The study of the basic representatives of the perennial weeds with suction cups.
6. The study of the basic representatives of the perennial weeds with rhizomes.
7. The study of the basic representatives of the parasitic weeds.
8. The study of the basic representatives of the quarantine weeds.
9. The evidence of crops weeding.
10. Weed mapping.
11. Calculation of the intake norms, concentration of the solution and liquid consumption. Description of herbicides. Rotation of herbicides.
12. Development of an integrated system of weeds management.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of test-papers/ quizzes/ commentaries /portfolios. To determine the average semester grade, the sum of grades obtained during the semester shall be divided by the minimum number of grades - 3, including absences without valid reasons during seminars and test papers. To be admitted to the exam, the average semester grade should not be less than 5.

The final exam will take place in written form (test-paper). The final grade is determined in accordance with the Regulations on the organization of higher education studies under the National Education Credit System, approved by order of the Ministry of Education no. 726 of 20.09.2010.

REFERENCES

Basic readings:

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8. Bàrberi, P. A. O. L. O. "Weed management in organic agriculture: are we addressing the right issues?." *Weed research* 42.3 (2002): 177-193.
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Co-funded by the Tempus Programme of the European Union

RETHINKe

Project Number 544178-TEMPUS-1-2013-1-PT-TEMPUS-JPCR

Course unit

FERTILIZATION SYSTEM IN SUSTAINABLE AGRICULTURE

GENERAL INFORMATION

ECTS credits: 5

Total hours: 150

Lectures: 16 hours

Practical classes: 24 hours

Individual work: 110 hours

Assessment form: exam

Target group:

Students enrolled in Master in Environmental Sciences Programme.

Modality:

Traditional (face-to-face) lectures combined with Moodle tasks.

Language: Romanian, English

Address: Alecu Russo Balti State University, Republic of Moldova

Teaching staff/coordinator:

Dr. Stanislav Stadnic, Associate Professor, vice head of the Department of Natural Sciences and Agroecology, e-mail: stadnicst@gmail.com

COURSE INTEGRATION IN THE STUDY PROGRAMME

The fertilization system in conventional agriculture is based on the application of synthetic chemical fertilizers. With the increase of the cost of non-renewable energy resources, the synthesis of nitrogen fertilizers is becoming more and more expensive.

Apart from the economic aspect, the application of mineral nitrogen fertilizers increases the danger of volatilization in the atmosphere (greenhouse effect) and leaching to groundwater (nitrate pollution). Mankind is looking for alternative ways of providing plants with nutrients. Students will acquire new alternative methods of plant physiology with mineral nutrition avoiding the danger of environmental pollution and global warming.

The study of the course unit is based on the knowledge and skills acquired in studying such course units as Soil fertility and crop productivity, Comparative analysis of natural ecosystems and agro-ecosystems. The knowledge gained within this course will contribute to the study of other specialized disciplines. The student must have at least the minimal knowledge of plant physiology.

COURSE OUTCOMES

By the end of the course unit, learners will be able to:

- identify and establish the agrochemical bases of fertilization in relation to plant requirements, the dosages of fertilizers;
- investigate and evaluate the forms of soil nutrients and their accessibility to plants;
- plan and implement environmentally balanced fertilization systems;
- adapt scientific achievements in other areas to ecological investigations.

COURSE CONTENT

Unit 1. Object and purpose of the course unit. Structure and integration of the course unit in the environmental agriculture program.

Unit 2. Basics of agrimony. Agrochemical bases of fertilization in relation to plant breeding requirements. Assimilation of nutrients. Photosynthesis and breathing. The chemical composition of plants in relation to their nutritional requirements. Classification of nutrients. Forms of nutrients assimilated by the plant. The role of nutrients in the life of the plant. Nutrient plant supply. Radical absorption of nutrients. Interaction of nutrient ions.

Unit 3. Forms of soil nutrients and their accessibility to plants. Forms of nitrogen supply for plants. Phosphorus forms accessible to plants. The forms of potassium accessible to plants. N, P, K bio-dynamics in soil. Soil retention processes.

Unit 4. Fertilizers as a means of enhancing soil fertility and agricultural production.

Definition and classification of fertilizers. Production and consumption of fertilizers in the world and in our country. The physical and chemical properties that condition the quality of fertilizers. Classification of fertilizers. Factors that condition the application of fertilizers. Natural organic fertilizers.

Unit 5. Establishing the optimal fertilizer doses. Direct, intermediate, and indirect dose computation methods.

Unit 6. Fundamentals of fertilization systems.

Systems theory and application of fertilizers. Principles of setting up the fertilization system. The physiological, pedoclimatic and technological basis of the fertilization system. Types and methods of fertilization. Factors that influence the fertilization necessity. Peculiarities of applying fertilizers to irrigated crops.

Application of fertilizers to agricultural crops. Peculiarities of crop rotation and fertilization system. The distribution of fertilizers in several types of rotation and crop rotation. Distribution of fertilizers in crops.

Application of fertilizers to crops outside crop rotation. Fertilization of pastures and meadows. Vegetable fertilization from protected areas. Basic principles of fertilization of tree plantations, fruit shrubs and vineyards.

Agrochemical bases for estimating and correcting the fertilization system. Efficiency of fertilizers.

Unit 7. Ecological aspects of the fertilization system.

Fertilizers - sources of water and soil pollution. General principles of rational fertilization. Techniques for application of mineral and organic fertilizers. Specific restrictions on application of fertilizers.

Practical classes:

1. Nitrogen based chemical fertilizers.
2. Phosphorus based chemical fertilizers.
3. Potassium-based chemical fertilizers.
4. Chemical fertilizers with secondary elements as microelements. Mixed chemical fertilizers.
5. Organic fertilizers.
6. Dosing of fertilizers.
7. Determining fertilizer recovery with production increase.
8. Fertilization system in crop rotation.

Individual work:

Course activities are based on interactive collaboration of students. Based on synthetically presented material, the students will get ready for interactive debates, preparing various individual projects.

Depending on the specificity of each topic, the students will carry out individual activities based on instructional worksheets.

The teacher-guided individual work will include additional study of course materials and consultations.

The students will be required to develop a project on one of the following topics:

1. Systems theory and application of fertilizers.
2. Principles of setting up a fertilization system.
3. The physiological, pedoclimatic and technological basics of fertilization system.
4. Types and methods of fertilization.
5. Factors influencing the application and use of fertilizers.
6. Peculiarities of application of fertilizers to irrigated crops.
7. Application of fertilizers in agricultural crops.
8. Features of crop rotation and the fertilization system.
9. Distribution of fertilizers in several types of crop rotation.
10. Distribution of fertilizers in crops.
11. Application of fertilizers to crops outside the crop rotation.
12. Fertilization of pastures and meadows.
13. Vegetable fertilization in protected areas.
14. Basic principles of fertilization of tree plantations, fruit bushes and vineyards.
15. Agrochemical bases for estimating and correcting the fertilization system.
16. Efficiency of fertilizers.

Other topics related to the given field may also be accepted.

Requirements for the development and formatting of the report, are established in the publication “ABC”-ul elaborării şi susţinerii unei teze ştiinţifice: de an, de licenţă, de masterat, Bălţi: Presa univ. bălţeană, 2011. – 60 p. ISBN 978-9975-50.047-0 BUZDUGAN,

V., NICORICI M., STADNIC S, [et al]
http://tinread.usb.md:8888/tinread/fulltext/buzdugan/ghid_teze.pdf):

1. Title page shall contain: Ministry, University, Faculty, Chair, Topic, elaborated by, the scientific advisor, locality and year;
2. Contents;
3. Introduction: about 1 page, highlighting the relevance and importance of the problem researched, its connection with the specialty;
4. Content: structured in chapters, paragraphs, and sections;
5. References: allowed in text after quote, e. g: [9. p.199];
6. General conclusions and recommendations (about 1 page);
7. Bibliographic references: no less than 10 sources, presented according to the requirements established here http://tinread.usb.md:8888/tinread/fulltext/bsu/reguli_referinte.pdf

The volume of the report shall not be less than 12 typed pages.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of test-papers/ quizzes/ commentaries /portfolios. To determine the average semester grade, the sum of grades obtained during the semester shall be divided by the minimum number of grades - 5, including absences without valid reasons during seminars and test papers. To be admitted to the exam, the average semester grade should not be less than 5.

The final exam will take place in written form (test-paper). The final grade is determined in accordance with the Regulations on the organization of higher education studies under the National Education Credit System, approved by order of the Ministry of Education no. 726 of 20.09.2010.

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Basic readings:

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11. Leshchenko V. I., Solonenko N. M. Effect of top dressing application dates of nitrogen fertilizers on the productivity of hay meadows //Agrokhimiia. – 1987.
12. Rusek P. et al. Studies on manufacturing suspension fertilizers on the basis of waste phosphates from polyether production //Przemysl Chemiczny. – 2009. – Vol. 88. – №. 5. – Pp. 563-564.

Course unit

SOIL ECOSYSTEM

GENERAL INFORMATION

ECTS credits: 5

Total hours: 150

Lectures: 20 hours

Seminars: 20 hours

Individual work: 110 hours

Assessment form: exam

Target group:

Students enrolled in Master in Environmental Sciences Programme, Didactics of Chemistry, and Didactics of Biology.

Modality:

Traditional (face-to-face) lectures and combined with Moodle tasks.

Language: Romanian, English

Address: Alecu Russo Balti State University, Republic of Moldova

Teaching staff/coordinator:

Dr. Hab, Boris Boincean, Professor, head of the Department of Natural Sciences and Agroecology, e-mail: bboincean@gmail.com

COURSE INTEGRATION IN THE STUDY PROGRAMME

Sustainable agriculture, including the organic one, is based on the fundamental that the soil is a living organism. Soil vitality is determined by the complexity of soil organisms, which essentially provides for the vital process of transformation of soil organic matter. The soil formation process largely depends on the intensity and the relationship between the processes of synthesis and decomposition of soil organic

matter. They set in motion the "Wheel of Life" which ensures life on the earth. Reducers in the soil ensure the work of producers and consumers. That is why knowing the miraculous activity of soil organisms, the conditions for their activity and the measures for optimizing their activity is a mandatory prerequisite for the training of specialists in the field of natural sciences and agroecology.

Soil functionality largely depends on the diversity of soil organisms and the environment that favours their activity. Therefore, soil ecology is one of the basic disciplines in ensuring the sustainable development of the agrarian and forestry sector. The knowledge gained in studying soil ecology will be used to synthesize the knowledge gained from other previously studied disciples: agrochemistry, pedology, plant physiology, agroecology, agrotechnics, environmental protection, etc.

COURSE OUTCOMES

By the end of the course unit, learners will:

- know the soil organisms, their diversity and their ecological functions, the interaction of the plant root system with soil organisms, the processes of soil organic matter synthesis and decomposition, the basic nutrients in the soil, the processes of creating and destroying the soil structure, the possibilities of biological control of diseases and pests to meet the requirements of the food chain;
- determine different groups of organisms in the soil with an understanding of their role in ensuring soil functionality;
- identify the role of organic soil transformation processes in the determination of soil basic nutrients;
- take the necessary measures to ensure favorable conditions for the life of soil organisms;
- assess the phytosanitary potential of the soil in reducing the negative impact of diseases and pests on plants.

COURSE CONTENT

Unit 1. Fundamental properties of the soil ecosystem.

Soil formation factors. Favourable environment for the development of soil organisms.

Unit 2. Soil organisms and the food chain in the soil.

Soil microorganisms.

Soil micro-fauna.

Soil macro-fauna.

Soil mesofauna.

Unit 3. Soil food chain.

Diversity of organisms and their ecological functions in the soil.

Importance of biodiversity in the soil food chain.

Unit 4. Primary production. Roots in the soil. Interaction of roots with soil organisms (symbiotic and non-symbiotic bonds).

Unit 5. Synthesis and decomposition of organic soil.

Chemical composition of plant remnants in the soil.

Hypothesis about the formation of organic matter in the soil.

The global carbon circuit in the soil.

Unit 6. Nitrogen circuit in the soil.

Soil - plant connection

Soil - plant - microorganisms.

Phosphorus and sulphur circuit in the soil.

Unit 7. Soil structure. Factors contributing to the formation and deterioration of structural aggregates.

Unit 8. Fundamental principles of the biological methods to control diseases and pests.

Unit 9. Interaction of plants-microorganisms in the biological control of diseases and pests.

Unit 10. Management of the ecosystem and soil food chain.

Sustainable management of the food chain in the soil in conditions of environmental change, including the climate.

Practical classes:

1. Fundamental properties of soil ecosystem.
2. Microorganisms, micro-fauna, macro-fauna, mesofauna. Soil food chain.
3. Diversity of organisms and their ecological functions in the soil.
4. Synthesis and decomposition of organic substance in the soil.
5. The circuit of carbon, nitrogen, phosphorus and sulfur in the soil.
6. Soil structure. Factors contributing to the formation and degradation of soil structure.
7. Diversity of soil organisms in the food chain that ensure biological control.

Individual work:

Course activities are based on interactive collaboration of students. Based on synthetically presented material, the students will prepare for interactive debates, drafting various individual projects.

Depending on the specificity of each topic, the students will carry out individual activities based on instructional worksheets.

The teacher-guided individual work will include additional study of course materials and consultations.

The students will be required to develop a project on one of the following topics:

- Soil organisms, their diversity and ecological functions.
- Interaction of the plant root system with soil organisms.
- Processes ensuring the synthesis and decomposition of organic soil.
- Basic nutrients in the soil (nitrogen, phosphorus, carbon, sulphur).
- Processes of creation and destruction of soil structure.
- Possibilities of biological control of diseases and pests to meet the requirements of the food chain.

Other topics related to the given field may also be accepted.

Requirements for the development and formatting of the report, are established in the publication “ABC”-ul elaborării şi susţinerii unei teze ştiinţifice: de an, de licenţă, de masterat, Bălţi: Presa univ. bălţeană, 2011. – 60 p. ISBN 978-9975-50.047-0

BUZDUGAN, V., NICORICI M., STADNIC S, [et al] http://tinread.usb.md:8888/tinread/fulltext/buzdugan/ghid_teze.pdf):

1. Title page shall contain: Ministry, University, Faculty, Chair, Topic, elaborated by, the scientific advisor, locality and year;
2. Contents;
3. Introduction: about 1 page, highlighting the relevance and importance of the problem researched, its connection with the specialty;
4. Content: structured in chapters, paragraphs, and sections;
5. References: allowed in text after quote, e. g: [9. p.199];
6. General conclusions and recommendations (about 1 page);
7. Bibliographic references: no less than 10 sources, presented according to the requirements established here http://tinread.usb.md:8888/tinread/fulltext/bsu/reguli_referinte.pdf

The volume of the report shall not be less than 12 typed pages.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of test-papers/ quizzes/ commentaries /portfolios. To determine the average semester grade, the sum of grades obtained during the semester shall be divided by the minimum number of grades - 5, including absences without valid reasons during seminars and test papers. To be admitted to the exam, the average semester grade should not be less than 5.

The final exam will take place in written form (test-paper). The final grade is determined in accordance with the Regulations on the organization of higher education studies under the National Education Credit System, approved by order of the Ministry of Education no. 726 of 20.09.2010.

REFERENCES

Basic readings:

1. Grace Gershuny and Ioseph Smillie. The Soul of Soil. A Guide to Ecological Soil Management. Third Edition, ag Access, Davis, California, 1995, 174 p.
2. Joann K.Whalen, Luis Sampedro. Soil Ecology and Management, CABI, UK, 2010, 29 p.
3. Michigan Field Crop Ecology. Michigan State University Extension, Dec. 2000, 87 p.
4. Биология почвы: пособие для начинающих. Soil and Water Conservation Society, USA, 2000, 48 p.
5. Жизнь в почве. Связь между сельским хозяйством и почвенными микроорганизмами, 11 с.

Further readings:

1. Fred Magdof and Ray R. Weil. Soil Organic Matter in Sustainable Agriculture, CRC Press, London, New York, 2004, 398 p.
2. Robert Pernes. Fertile Soil. Grower Guide to Organic and Inorganic Fertilizers, ag Access, Davis, California, 1990, 191 p.
3. Richards B. N. et al. Introduction to the soil ecosystem. – Longman Group Ltd, 1978.
4. Kardol P. et al. Soil ecosystem functioning under climate change: plant species and community effects //Ecology. – 2010. – Vol. 91. – №. 3. – Pp. 767-781.
5. Tate III R. L. et al. Soil Microbiology. – John Wiley and Sons, 1995.
6. Hooper D. U. et al. Effects of biodiversity on ecosystem functioning: a consensus of current knowledge //Ecological monographs. – 2005. – Vol. 75. – №. 1. – Pp. 3-35.
7. Loreau M. et al. Biodiversity and ecosystem functioning: current knowledge and future challenges //Science. – 2001. – Vol. 294. – №. 5543. – Pp. 804-808.

Co-funded by the Tempus Programme of the European Union

RETHINKe

Project Number 544178-TEMPUS-1-2013-1-PT-TEMPUS-JPCR

Course unit

LANDSCAPE-BASED TERRITORIAL PLANNING

GENERAL INFORMATION

ECTS credits: 5

Total hours: 150

Lectures: 20 hours

Seminars: 20 hours

Individual work: 110 hours

Assessment form: exam

Target group:

Students enrolled in Master in Environmental Sciences Programme, Didactics of Chemistry, and Didactics of Biology.

Modality:

Traditional (face-to-face) lectures combined with Moodle tasks.

Language: Romanian, English

Address: Alecu Russo Balti State University, Republic of Moldova

Teaching staff/coordinator:

Dr. Hab. Boris Boincean, Professor, head of the Department of Natural Sciences and Agroecology, e-mail: bboincean@gmail.com

COURSE INTEGRATION IN THE STUDY PROGRAMME

Sustainable agriculture implies a rational use of natural resources, avoiding the risk of soil pollution and degradation, reducing biodiversity on soil surface and in soil structure, waste of water resources and pollution, etc. Historically, the development of agriculture has been achieved by reducing the area of forests and meadows and expanding the areas of arable land. In its turn, the industrial model of agriculture made

large use of agricultural techniques on large fields, without taking into account the peculiarities of the terrain, which led to soil degradation, pollution of surface and underground waters, reduction of the carbon sequestration potential, etc.

The main purpose of this course is to revitalize farmland, including arable land, to adapt to climate change and provide services taking into account the requirements of the ecosystem.

By studying the course unit, students will become aware of the role of an optimal ratio of forests, meadows, water reservoirs and arable land at landfill level in reducing the negative impact of soil erosion and droughts in steppe. At the same time, they will learn how to reduce the negative influence of erosion using the differential positioning of crops on the slopes, the ratio between the different crops, the soil cultivation methods and so on. Correspondingly, the crop structure will be differentiated for different landfill elements.

COURSE OUTCOMES

By the end of the course the student will:

- know specific requirements of crops taking into account the peculiarities of the soil;
apply them to their differentiated location of landfill elements and carry out an agro-ecological assessment of the land;
- design soil crops rotation, soil cultivation and soil fertilization systems;
- differentiate the structure of the sowing areas according to the slope location;
- develop an anti-erosion design of arable land located on the slopes;
- assess the need for technological adaptation of field crop cultivation to the peculiarities of the land in the Republic of Moldova.

COURSE CONTENT

Lectures:

1. The concept of adaptive agriculture system based on land planning.
1. Agro-ecological assessment of land.
2. Crop requirements to soil. Territory analysis based on environment and land

planning.

3. Mapping methodology.
4. Design of agricultural systems taking into account the ecological and land planning peculiarities.
5. Soil rotation planning based on different categories of land.
6. The anti-erosion organization of arable lands located on slopes.
7. Soil cultivation and soil fertilization.
8. Design of forest strips.
9. Crop cultivation technologies.
10. The design of agricultural systems based on ecological and landscape features within the modern system of territorial organization.

Practical classes:

1. Agro-ecological assessment of land. Crop requirements to soil. Territory analysis based on environment and land planning.
2. Design of agricultural systems taking into account the ecological and land planning peculiarities.
3. Soil rotation planning based on different categories of land.
4. Anti-erosion organization of arable lands located on slopes.
5. Soil cultivation and soil fertilization. Crop cultivation technologies.

Individual work:

Course activities are based on interactive collaboration of students. Based on synthetically presented material, the students will prepare for interactive debates, developing various individual projects.

Depending on the specificity of each topic, the students will carry out individual activities based on instructional worksheets.

The teacher-guided individual work will include additional study of course materials and consultations.

The students will be required to develop a project on one of the following topics:

1. Scholars of agronomic science about the need to study the complexity of soil

formation factors at land planning level;

2. The role of forest strips in reducing soil erosion and droughts and their organization;

3. Differential placement of crops on various land cover elements;

4. The use of natural ecosystems as a model of sustainable agriculture. Processes that occur in replacing perennial vegetation by annual vegetation;

5. What we need to learn from nature to avoid serious problems the contemporary agriculture faces.

Other topics related to the given field may also be accepted.

Requirements for the development and formatting of the report, are established in the publication "ABC"-ul elaborării şi susţinerii unei teze ştiinţifice: de an, de licenţă, de masterat, Bălţi: Presa univ. bălţeană, 2011. – 60 p. ISBN 978-9975-50.047-0 BUZDUGAN, V., NICORICI M., STADNIC S, [et al] http://tinread.usb.md:8888/tinread/fulltext/buzdugan/ghid_teze.pdf):

1. Title page shall contain: Ministry, University, Faculty, Chair, Topic, elaborated by, the scientific advisor, locality and year;

2. Contents;

3. Introduction: about 1 page, highlighting the relevance and importance of the problem researched, its connection with the specialty;

4. Content: structured in chapters, paragraphs, and sections;

5. References: allowed in text after quote, e. g: [9. p.199];

6. General conclusions and recommendations (about 1 page);

7. Bibliographic references: no less than 10 sources, presented according to the requirements established here http://tinread.usb.md:8888/tinread/fulltext/bsu/reguli_referinte.pdf

The volume of the report shall not be less than 12 typed pages.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of test-papers/ quizzes/ commentaries /portfolios. To determine the average semester grade, the sum of grades obtained during the semester shall be divided by the minimum number of grades - 5,

including absences without valid reasons during seminars and test papers. To be admitted to the exam, the average semester grade should not be less than 5.

The final exam will take place in written form (test-paper). The final grade is determined in accordance with the Regulations on the organization of higher education studies under the National Education Credit System, approved by order of the Ministry of Education no. 726 of 20.09.2010.

REFERENCES

Basic readings:

1. Агроэкологическая оценка земель. Проектирование адаптивно-ландшафтных систем земледелья и агротехнологий. Москва, 2005, ФГНУ «Росинформагротех», Методическое руководство под ред. Академика Кирюшина В.И. и Иванова А.Л., 783 с.
2. Gus P., Rusu T., Bogdan I.. Asolamentele, rotaţia culturilor şi organizarea teritoriului. Editura Risoprint, Cluj-Napoca, 2004, 219 p.
3. De Groot R. S. et al. Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making //Ecological complexity. – 2010. – Vol. 7. – №. 3. – Pp. 260-272.
4. Sanderson E. W. et al. A conceptual model for conservation planning based on landscape species requirements //Landscape and urban planning. – 2002. – Vol. 58. – №. 1. – Pp. 41-56.
5. Opdam P., Foppen R., Vos C. Bridging the gap between ecology and spatial planning in landscape ecology //Landscape ecology. – 2001. – Vol. 16. – №. 8. – Pp. 767-779.

Further readings:

6. Moilanen A. Landscape zonation, benefit functions and target-based planning: unifying reserve selection strategies //Biological Conservation. – 2007. – Vol. 134. – №. 4. – Pp. 571-579.

7. Saura S., Pascual-Hortal L. A new habitat availability index to integrate connectivity in landscape conservation planning: comparison with existing indices and application to a case study //Landscape and Urban Planning. – 2007. – Vol. 83. – №. 2. – Pp. 91-103.

Course unit

RESEARCH METHODOLOGY AND ETHICS

GENERAL INFORMATION

ECTS credits: 5

Total hours: 150

Lectures: 24 hours

Seminars: 16 hours

Individual work: 110 hours

Assessment form: / oral exam

Target group:

Students enrolled in Master in Environmental Sciences Programme.

Modality:

Traditional (face-to-face).

Language: Romanian, English

Address: Alecu Russo Balti State University, Republic of Moldova

Teaching staff/coordinator:

Dr. Hab., Vasilii Sharagov, Professor, head of the Chemical Laboratory, Alecu Russo Balti State University, Moldova.

E-mail: sharagov@mail.ru

COURSE INTEGRATION IN THE STUDY PROGRAMME

The course will offer students the knowledge and skills, necessary to carry out research in the field of environmental sciences. It will teach them how to plan and develop a research work based on experiment, how to process and present the data obtained in the experiment. The skills developed in this course will help the learners successfully write their master's thesis.

COURSE OUTCOMES

By the end of the course unit, learners will

Know:

- How to organize the research activities;
- How to rationally plan intellectual work;
- How to process sources of information;

Demonstrate skills in:

- Planning and developing an experiment;
- Carrying out system analysis to study agroecology;
- Using appropriate methods to research real-life issues;
- Mathematical processing of data obtained in the experiment;
- Determine the sources of errors in the experiment;
- Analyzing and generalizing experimental data;
- Presenting experimental data in tables, graphs, schemes, etc.
- Communicating the information obtained in individual research to the public.

COURSE CONTENT

Unit 1. Object, purpose and objectives of the discipline. Importance of scientific research. The notion of culture, hygiene and ethics of scientific research.

Unit 2. Search for information. Reliable sources of information for scientific research. Searching for printed information. Advantages and disadvantages of the Internet sources.

Unit 3. Organization of scientific research. Setting objectives and organizing the experiment. Types of scientific experiments. Principles of choosing the methods and objects of research.

Unit 4. System analysis. Planning and development of experiment methodology based on system analysis.

Unit 5. Measurement errors.

Unit 6. Mathematical processing of experimental data.

Unit 7. Methodology of science. Research models. The notion of “methodology of experiment”.

Unit 8. Drafting a conference report. Conference presentation. Preparation of the scientific article. Protection of intellectual property.

Practical classes:

1. Information processing. Coding of information.
2. Methods used to solve real –life problems (technical, scientific, management).
3. Psychological barriers that prevent problem solving and ways to overcome them.
4. Determining sources of errors in the experiment and arranging them according to the degree of importance based on the system analysis.
5. Calculating the absolute and relative errors in the experiment.
6. Presentation of graphic materials. Designing tables, graphs and charts.
7. Experiment method and methodology.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of test-papers/ quizzes/ commentaries /portfolios. To determine the average semester grade, the sum of grades obtained during the semester shall be divided by the minimum number of grades - 3, including absences without valid reasons during seminars and test papers. To be admitted to the exam, the average semester grade should not be less than 5.

The final exam will take place in written form (test-paper). The final grade is determined in accordance with the Regulations on the organization of higher education studies under the National Education Credit System, approved by order of the Ministry of Education no. 726 of 20.09.2010.

REFERENCES

1. Mihai, N. *Introducere în filosofia şi metodologia ştiinţei*. Chişinău: Editura ARC, 1996. 160 p.
2. Ţapoc, v. T*eoria şi metodologia ştiinţei contemporane: concepte şi orienteri*. Chişinău: Editura CEP USM, 2005. 212 p.
3. Radulescu, M. St. *Metodologia cercetarii stiintifice*. Ed. 2. Bucureşti: Editura Didactică şi Pedagogică. 2011. 224 p.
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6. Denscombe, Martyn. *The Good Research Guide: for small-scale social research*. McGraw Hill, 2010.
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Co-funded by the Tempus Programme of the European Union

RETHINKe

Project Number 544178-TEMPUS-1-2013-1-PT-TEMPUS-JPCR

Course unit

CERTIFICATION AND MANAGEMENT OF ECOLOGICAL PRODUCTION

GENERAL INFORMATION

ECTS credits: 5

Total hours: 150

Lectures: 20 hours

Seminars: 20 hours

Individual work: 100 hours

Assessment form: written/ oral exam

Target group:

Students enrolled in Master in Environmental Sciences Programme.

Modality:

Traditional (face-to-face).

Language: Romanian, English

Address: Alecu Russo Balti State University, Republic of Moldova

Teaching staff/coordinator:

Dr. Hab., Boris Boincean Professor, Head of the Department of Natural Sciences and Agro-ecology, e-mail: bboincean@gmail.com

COURSE INTEGRATION IN THE STUDY PROGRAMME

Human intervention in nature, especially by grubbing up virgin lands, has led to a number of negative consequences (soil erosion, groundwater pollution, biodiversity loss in soil and its surface, etc.). The transition to an organic farming system requires an environmentally friendly attitude.

By complying with the organic farming system, it is possible to solve a multitude of economic, ecological and social problems, meaning it is possible to move to a sustainable farming system.

This course unit involves a harmonious blend of knowledge gained in most agricultural and environmental disciplines.

COURSE OUTCOMES

By the end of the course unit, learners will:

- know the principles of organic farming, problems and requirements to the transition period from conventional agriculture to organic farming, the criteria for choosing crops for crop rotation in order to avoid negative consequences in agroecosystems;
- know the existing standards for production certification at the national and international levels;
- determine the principles of organic farming as compared to conventional agriculture;
- identify the erroneous concepts of organic farming;
- develop a transition plan for organic farming based on previously acquired knowledge in such disciplines as: agrotechnics, plant protection, agrochemistry, microbiology, etc.;
- determine the place and the way of transition to an organic farming system;
- develop a certification program, according to the national and international standards.
- evaluate and apply solutions to overcome weaknesses in order to promote organic agriculture in the Republic of Moldova.

COURSE CONTENT

Unit 1. Object and purpose of the discipline. Certification and management of organic production as a subject of study. Interdependence of this discipline with other disciplines in agronomy and ecology. Definitions.

Unit 2. Aims of producing and processing organic production. Principles of production and processing of organic production.

Unit 3. Genetic engineering: advantages and disadvantages. GMO and organic farming standards.

Unit 4. Advantages of the organic farming system. Adaptation to environmental conditions and limited resources of non-renewable energy. Ways of preventing environmental degradation and pollution. Reducing the effect of global warming.

Unit 5. Transition period and its problems. Nitrogen deficiency. Phytosanitary issues.

Unit 6. Soil fertility management. Organic soil substance. Circulation of nutrients in

agroecosystems. Water balance in soil.

Unit 7. Development of a plan of transition from conventional agriculture to organic farming. Stages of transition to organic farming.

Importance of the field history book**.**

Unit 8. Planning the crop rotation process. Basic principles of crop production. Zoning in agriculture and farming. Advantages and disadvantages of different crops in crop rotation. The ability to accumulate organic matter in the soil. Soil cover during the vegetation period. Use of nutrition and water by different cultures. The ability to fight diseases and pests and complete with weeds. The need for technology and labor force.

Unit 9. Certification of agricultural production. Organic inspection and certification procedure. Legislative framework. Issue of the certificate of conformity.

Unit 10. Marketing of organic production. Consumer education. Ways to promote organic production on the market.

Practical classes:

1. Principles for the production of organic production in compliance with the national and international standards. Misconceptions about organic farming.
2. Attitude towards the GMOs in agroecology.
3. Advantages of organic farming system compared to the conventional farming system.
4. Ways to overcome the possible problems of transition to organic farming.
5. Requirements for a transition plan from conventional agriculture to organic farming.
6. Crop rotation planning and measures to restore soil fertility. Where and how to start the transition to crop rotation.
7. Certification of agricultural production. The role of inspection and certification authorities. Legislative framework.
8. Organic production marketing. New forms of promoting organic production on the market.

Individual work:

Course activities are based on interactive collaboration of students. Based on synthetically presented material, the students will get ready for interactive debates, preparing various individual projects. Depending on the specificity of each topic, the students will carry out individual activities based on instructional worksheets. The teacher-guided individual work will include additional study of course materials and consultations.

The students will be required to develop a project on one of the following topics:

Advantages and disadvantages of different crops in crop rotation:

1. Soil capacity to store organic substance.
2. Soil cover during the vegetation period.
3. Use of nutrition and water by different cultures.
4. Plant's ability to compete with diseases, pests and weeds.
5. The need for technology and labor force.
6. Soil fertility management:
7. Balance of soil organic matter.
8. Circulation of nutrients in agroecosystems.
9. Water balance in soil.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of test-papers/ quizzes/ commentaries /portfolios. To determine the average semester grade, the sum of grades obtained during the semester shall be divided by the minimum number of grades - 3, including absences without valid reasons during seminars and test papers. To be admitted to the exam, the average semester grade should not be less than 5.

The final exam will take place in written form (test-paper). The final grade is determined in accordance with the Regulations on the organization of higher education studies under the National Education Credit System, approved by order of the Ministry of Education no. 726 of 20.09.2010.

REFERENCES

1. Boincean B. P. *Ghidul agriculturii ecologice* (în perioada de tranziţie de la agricultura convenţională la agricultura ecologică), Chişinău, 2010, 34 p.

2. Boincean B. P. *Testamentul bunelor practici agricole favorabile mediului*, Făleşti, 2006
3. Boincean B. P. *Ghidul agriculturii ecologice*, Făleşti, 2005.
4. Senic Iu. *Procedura de inspecţie şi certificare ecologică*. Chişinău, 2010, 28 p.
5. *Basics Standards for Organic Production and Processing*. Decided bz the IFOAM General Assambly in BASEL, Switherland, September, 2000, 68 p.
6. *Ghidul bunelor practici în agricultură*, Athensnetwork of collaborating experts. Dresden, 2010, 67 p.
7. Lampkin Nicolas. *Organic Farming*. Farming Press, 1998, UK, 715 p.
8. *Organic Field Crop Handbook*, Canadian Organic Growers, Ottawa 1992, 192 p.
9. *Report and recommendations on organic farming*. United States Ddepartment of Agriculture, 1980, 94 p.
10. Toncea Ion. *Ghid practic de agricultură ecologică*. Tehnologii ecologice de cultivare a terenurilor. Editura Academicpres, Cluj-Napoca, 2002, 169 p.
11. Борживой Иржи Урбан. *Органическое сельское хозяйство*. 2010, 398 с.

Course unit

THE IMPORTANCE OF GENE POOL IN MAINTAINING THE BIODIVERSITY AND TARGETED IMPROVEMENT OF THE FIELD CROPS

GENERAL INFORMATION

ECTS credits: 5

Total hours: 150

Lectures: 24 hours

Seminars: 16 hours

Individual work: 110 hours

Assessment form: written/ oral exam

Target group:

Students enrolled in Master in Environmental Sciences Programme.

Modality:

Traditional (face-to-face).

Language: Romanian, English

Address: Alecu Russo Balti State University, Republic of Moldova

Teaching staff/coordinator:

Dr. Petru Hropotinschi

COURSE INTEGRATION IN THE STUDY PROGRAMME

The use of gene pool and germplasm in plant breeding is one of the basic disciplines. This course is based on the knowledge gained in such disciplines such as Amelioration, General Genetics, Botany and Plant Physiology. The knowledge gained from the study of this course will be used later for the PhD theses in the field of "Improvement and production of seeds".

The use of gene pool and germplasm in amelioration is applied in order to create, by different contemporary methods, new varieties and hybrids of agricultural plants with adaptive capacity to the climatic and soil conditions. Also, the study of this discipline allows for various methods of amelioration such as: remote hybridization, selection, polyploidy, induced mutagenesis, etc.

COURSE OUTCOMES

By the end of the course unit, learners will:

Know:

- the notions of gene pool and germplasm;
- the general scheme for the use of germplasm in amelioration;
- the composition, characteristics, and structure of the gene pool;
- classification of germplasm test methods.

Demonstrate skills in:

- memorizing the basic notions with their logical reproduction;
- determining the methods of germplasm improvement;
- determining the composition and properties of the gene pool;
- carry out an analysis and synthesis of specialized literature;
- recognizing the basic methods of improving crops;
- correct use of specialized terminology;
- use of conventional signs, intonation in their activity.

The student will form / reform:

- demonstrate initiative in establishing interpersonal relationships;
- integrating into group work when performing practical tasks;
- constructive cooperation in problem solving;
- adequate perception of social situation and development of flexible behavioural tactics.

COURSE CONTENT

Unit 1. Amelioration as science, its structure, and its correlation with other disciplines.

Unit 2. The notions of gene pool and germplasm.

The structure of gene pool.

Unit 3. Genetic erosion. The notion of germplasm.

The importance of germplasm.

Classification of germplasm.

Collection of germplasm. Organization of germplasm.

Study of germplasm.

Storage of germplasm.

Variability within germplasm.

Areas of use of germplasm.

Unit 4. Estimation of genetic variability of gene pool and germplasm.

Classical methods. Genetic-molecular methods.

Unit 5. Use of genetic resources in the improvement of different agricultural crops.

Unit 6. Methods of germplasm testing. Abiotic conditions. Testing for diseases. Quality testing.

Unit 7. Preservation of germplasm. Environmental factors. Forms of conservation. Preservation in situ and ex situ. In vitro culture. Genesis.

Unit 8. Biodiversity - legal framework and its conservation methods.

The notion of biodiversity.

Legal framework on biodiversity.

Biological security and GMO.

Testing of transgenic organisms**.**

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of test-papers/ quizzes/ commentaries /portfolios. To determine the average semester grade, the sum of grades obtained during the semester shall be divided by the minimum number of grades - 3, including absences without valid reasons during seminars and test papers. To be admitted to the exam, the average semester grade should not be less than 5.

The final exam will take place in written form (test-paper). The final grade is determined in accordance with the Regulations on the organization of higher education studies under the National Education Credit System, approved by order of the Ministry of Education no. 726 of 20.09.2010.

REFERENCES

1. Siminel V. D. *Ameliorarea generală a plantelor de câmp*., Chişinău, "Tipografia Centrală", 1998.
2. Ceapoiu N., Potlog A. *Ameliorarea generală a plantelor agricole*, Bucureşti, 1990
3. Potlog A., Suciu Z., Lăzăreanu A., Nedelea G., Moisuc A. *Principii moderne în ameliorarea plantelor*, Timişoara, 1989
4. Siminel V.D. P*roducerea şi studiul seminţelor. Recunoaşterea şi aprobarea culturilor de soi*, Chişinău, 1998
5. Siminel V.D. *Ameliorarea specială a plantelor agricole*, Chişinău, 2003
6. Soran, Viorel, et al. "Conservation of biodiversity in Romania." *Biodiversity and Conservation* 9.8 (2000): 1187-1198.
7. Gheţea, Ligia Gabriela, et al. "Assessment of Diversity in Grapevine Gene Pools from Romania and Republic of Moldova, Based on SSR Markers Analysis." *Horticulture*. InTech, 2012.
8. Rao, V. Ramanatha, A. H. D. Brown, and M. Jackson. *Managing plant genetic diversity*. CABI, 2001.

Co-funded by the Tempus Programme of the European Union

RETHINKe

Project Number 544178-TEMPUS-1-2013-1-PT-TEMPUS-JPCR

Course unit

INNOVATIVE SYSTEMS OF AGRICULTURE AND INCREASING THEIR IMPORTANCE IN SUSTAINABILITY

GENERAL INFORMATION

ECTS credits: 5

Total hours: 150

Lectures: 24 hours

Seminars: 16 hours

Individual work: 110 hours

Assessment form: written exam

Target group:

Students enrolled in Master in Environmental Sciences Programme.

Modality:

Traditional (face-to-face) combined with activities presented on the Moodle platform.

Language: Romanian, English

Address: Alecu Russo Balti State University, Republic of Moldova

Teaching staff/coordinator:

Dr. Hab. Boris Boincean, Professor, Head of the Department of Natural Sciences and Agroecology, e-mail: bboincean@gmail.com

COURSE INTEGRATION IN THE STUDY PROGRAMME

Master students studied during the bachelor cycle and throughout the first year of master studies different disciplines that will be synthesized in the given subject.

Innovative agricultural systems are based on a holistic (systematic) vision and include a harmonious combination of the component parts of agricultural system.

Reducing non-renewable energy inputs requires application of beneficial principles of biodiversity principles both in the air and in the underground part of the plant.

Integrating knowledge from different disciplines is the basis for the application of innovative systems in agriculture.

By studying this discipline, master students will learn to integrate knowledge obtained from various disciplines. A systemic vision involves a creative application of knowledge obtained from previously studied subjects.

Gaining new knowledge is continued by conducting systemic research involving experts from adjacent fields. The skills obtained within this discipline will contribute to the planning and development of the students' master theses.

COURSE OUTCOMES

By the end of the course unit, learners will:

Learn

- Possibilities of optimization of agricultural system by applying the concept of precision agriculture, taking into account the heterogeneity of the landscape;
- the advantages of using crop diversity, crop rotation and integrating plant growing and stockbreeding to ensure sustainable development;
- existing barriers in promoting different soil cultivation systems and ways to overcome them;
- necessity of change in agricultural policies to support services, provided by farmers to society and the environment;
- indicators, used to assess the sustainability of agricultural households, etc.

Demonstrate skills in

- developing innovative crop rotation systems with maximum use of solar radiation, optimizing the use of soil water and nutrients;
- correct selection soil cultivation system to reduce soil erosion hazard and reduce energy expenditures' work;
- adaptation of agricultural system to the heterogeneity of water and nutrients regimes within each field;
- combining ecological and socio-economic factors in the development of agricultural and rural communities;
- assessment of the level of sustainability of agricultural systems, etc.

Form / reform

- the capacity to synthesize the information obtained from previous courses to ensure the transition to an agricultural system with low power consumption obtained from non-renewable energy sources and environment friendly, avoiding the danger to human health;
- the ability to ensure a sustainable development not only of the agricultural sector, but of the rural communities, as well;
- teamwork skills to address problematic situations.

COURSE CONTENT

1. Precision agriculture. Possibilities to adapt the existing system of agriculture to soil fertility heterogeneity for each field individually and each landscape type.
2. Ecological and agronomic peculiarities of innovative system of crop cultivation.
3. Crop rotations with a greater diversity of crops.
4. The role of leguminous crops in crop rotation.
5. Polycultures (mixed cultures).
6. Combining agroforestry and cultivating crops.
7. Allelopathy. Practical aspects.
8. Farming system using direct sowing and minimal soil cultivation.
9. Combining the branches of plant growing and stockbreeding. Innovations in livestock.
10. Alternative strategies to combat diseases, pests and weeds.
11. Creating infrastructure at landscape level.
12. Action and interaction of different agro-technical processes.
13. Management of soil organic matter in sustainable agricultural system. Preparing composts.
14. Changing policies to promote sustainable agricultural system.
15. The role of long-term field experiences in reorienting the dominant intensification of agriculture.

16. Agricultural cooperatives. Principles of activity. The role of cooperatives in revitalizing rural communities.
17. Reassessment of the parameters (indicators) for the reorientation of agriculture towards sustainable development

Practical classes:

1. Precision agriculture. Possibilities for its use in Moldova.
2. Longer crop rotation. The role of perennial leguminous grasses in agriculture.
3. Mixed cultures. Allelopathy. Practical aspects.
4. Barriers in promoting sustainable agricultural system.
5. Adopting policies to promote sustainable agriculture.
6. Agricultural cooperatives. Principles of activity. The role of agricultural cooperatives in revitalization of rural communities.
7. The use of agro-ecological principles in innovative farming systems.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of test-papers/ quizzes/ commentaries /portfolios. To determine the average semester grade, the sum of grades obtained during the semester shall be divided by the minimum number of grades - 3, including absences without valid reasons during seminars and test papers. To be admitted to the exam, the average semester grade should not be less than 5.

The final exam will take place in written form (test-paper). The final grade is determined in accordance with the Regulations on the organization of higher education studies under the National Education Credit System, approved by order of the Ministry of Education no. 726 of 20.09.2010.

REFERENCES

Basic readings:

1. Sustainable Agricultural Systems. Edited by Clive A. Edwards, Rattan Lal, Patrick Madden, Soil and Water Conservation Society, 1990, USA, 695 p.
2. Agricultural Systems. Agroecology and Rural innovation for development. Sieglinde

Snapp and Barry Pound, Elsevier, 2008, 386 p.

3. RA Leigh and Lohnston AE Long-term Experiments in Agricultural and Ecological Sciences, CAB International, UK, 1994, 428 p.
4. Fred Magdoff and Harold Von ES. Building Soils for Better Crops, Second Edition, 2000, 230 p.

Further readings:

1. Sustainable Agriculture. From Common Principles to Practice. Second Edition. Edited by Hani I. Fritz, Hans R. Herren and Laszlo Pinter; 2008 International Institute for Sustainable Development and the Swiss College of Agriculture, Canada, 248 p.
2. Handbook on-farm composting. Northeast Regional Agricultural Engineering Service, Editor Robert 1992, USA, 186 p.
3. Salin, Victoria. "Information technology in agri-food supply chains." *The International Food and Agribusiness Management Review* 1.3 (1998): 329-334.
4. Swanson, Burton E. *Global review of good agricultural extension and advisory service practices*. Food and Agriculture Organization of the United Nations, 2008.
5. Spielman, David J., and Regina Birner. *How innovative is your agriculture?: Using innovation indicators and benchmarks to strengthen national agricultural innovation systems*. World bank, 2008.
6. Stinner, Benjamin R., and John M. Blair. "Ecological and agronomic characteristics of innovative cropping systems." *Sustainable agricultural systems* (1990): 123-139.

Course unit

LEGISLATION, REGULATION AND ENVIRONMENTAL MANAGEMENT

GENERAL INFORMATION

ECTS credits: 6

Assessment form: exam

Target group:

This course is designed for students and professionals with different scientific backgrounds. It is directed to biology and chemistry and ecology students, as well as for improving the formation of building, civil, chemical and industrial engineers.

The basic prerequisite is to hold an undergraduate Degree from a European Higher Education Area (EHEA) university or equivalent from a non-EHEA university with access to Master Degrees in their own academic systems.

Modality:

Traditional (face-to-face) lectures combined with Moodle tasks.

Language: English, Spanish

Address: University of A Coruña, Spain

Teaching staff/coordinator:

Javier Sanz, Department of Public Law, University of A Coruña.

E-mail: javier.sanz.larruga@udc.es

José Manuel Andrade-Garda, Department of Chemistry, University of A Coruña.

E-mail: jose.manuel.andrade@udc.es

COURSE INTEGRATION IN THE STUDY PROGRAMME

Solid knowledge of the legal framework that governs the activities of the environmental sector is an important component in the training of a future expert in Environmental Sciences. The given course unit aims at familiarizing the students with the existing legal

frameworks that enable the environmental management. The students enrolled in the course will become acquainted with the most important legal instruments that govern the activities of public and private enterprises, operating in the EU. They will be introduced to the regulations that govern waste management, soil, air and water pollution.

COURSE OUTCOMES

By the end of the course the student will:

- Know the EU legislative documents governing the environmental aspect of any enterprise;
- be familiar with European Union Laws on Water management, air quality, soil quality;
- be familiar with the Environmental Management System;
- explain the concept of Circular Economy;

COURSE CONTENT

Unit 1. Legislation, regulation and management 1.

Manual of European Environmental Policy.

- An introduction to EU environmental policy.
- Overview of EU policy: Air quality.
- Sectorial policies key to the environment.

Unit 2. Introduction to EC environmental Law and Water Law.

Introduction to Water Policy.

- Prior concepts.
- Main concepts.
- International Water Law.
- European Community law and water
- Water framework directive (wfd)
- A blueprint to safeguard Europe's water resources
- Implementation of (wfd)
- Information sources in the Internet.

Unit 3. Voluntary Environmental Management Systems (Self- regulation).

Principles of management of modern companies.

Environmental Management Systems (ISO).

Modern Quality Management Systems.

Voluntary framework: international guidelines.

Introduction to the guidelines.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of tests, participation in the discussions and fulfillment of practical assignments.

The final exam will take place in written form. The final grade is determined in accordance with the Regulations of the University of A Coruna.

REFERENCES

Farmer, A.M. (2012) (Editor). Manual of European Environmental Policy. 1043pp. Routledge, London.

Barnes, P. M., & Barnes, I. G. (2000). Environmental policy in the European Union.

World Health Organization. (2004). *Guidelines for drinking-water quality* (Vol. 1). World Health Organization.

Boyd, C. E. (1982). *Water quality management for pond fish culture*. Elsevier Scientific Publishing Co.

Course unit

ANALYTICAL STRATEGIES APPLIED TO ENVIRONMENTAL STUDIES

GENERAL INFORMATION

ECTS credits: 6

Assessment form: exam

Target group:

This course is designed for students and professionals with different scientific backgrounds. It is directed to biology and chemistry and ecology students, as well as for improving the formation of building, civil, chemical and industrial engineers.

The basic prerequisite is to hold an undergraduate Degree from a European Higher Education Area (EHEA) university or equivalent from a non-EHEA university with access to Master Degrees in their own academic systems.

Modality:

Traditional (face-to-face) lectures combined with Moodle tasks.

Language: Spanish, English.

Address: University of A Coruña, Spain

Teaching staff/coordinator:

Soledad Muniategui Lorenzo, Analytical Chemistry, University of A Coruña.

COURSE INTEGRATION IN THE STUDY PROGRAMME

The course will familiarize the learners with the analytical strategies, applied to environmental issues. It will teach them to apply the "**ANALYTICAL CRITERION**" to solve problems of different nature, selecting the most appropriate analytical methodology in each case. The course considers the developments and current trends in sampling treatment and instrumental determination; their application to determine the

priority and emerging pollutants in samples of environmental interest (air, water, soil, sediment, biological, food, etc.).

COURSE OUTCOMES

By the end of the course, the learners will:

- Define the concept of analytical chemistry and its principles;
- Be able to classify (bio) chemical information;
- Learn the principles of green chemistry;
- Become familiar with the methodological approaches in green chemistry;
- Identify the major challenges in analytical chemistry;
- Be able to carry out a sampling analysis;

COURSE CONTENT

Unit 1. Analytical Problem. Introduction to Analytical Chemistry. Definition and steps in solving an analytical problem. Types of methods and selection criteria. Development of a method of analysis. Analytical quality parameters. Validation of an analytical method. Green Analytical Chemistry.

Unit 2. Sampling. Sampling, design and strategies of a sampling plan. Passive sampling. Automatic systems.

Unit 3. Sample treatment. Advances in sample preparation techniques. Solvent-free-"green" extraction techniques. Micro-extraction techniques. New extracting materials. Automatic systems. Miniaturization.

Unit 4. Analytical instrument techniques. Current trends in spectro-chemical methods and chromatographic analysis. Hyphenated techniques.

Unit 5. Chemical speciation. Environmental importance. Speciation schemes. Specific speciation. Analytical difficulties. Methods of Analysis and application.

Unit 6. Analytical applications. Environmental pollutants of interest. Air analysis. Water analysis. Analysis of soils and sediments. Analysis of biological samples. Food analysis and food safety.

Practical classes:

Visiting analytical and instrumentation, environmental, food control, agricultural experiment stations, chemical and industrial laboratories.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of tests, participation in the discussions and fulfillment of practical assignments.

The final exam will take place in written form. The final grade is determined in accordance with the Regulations of the University of A Coruna.

REFERENCES

http://rethink.fa.ulisboa.pt/moodle/mod/folder/view.php?id=77

Course unit

STATISTICAL METHODS APPLIED TO ENVIRONMENTAL DATA

GENERAL INFORMATION

ECTS credits: 3

Assessment form: exam

Target group:

This course is designed for students and professionals with different scientific backgrounds. It is directed to biology and chemistry and ecology students, as well as for improving the formation of building, civil, chemical and industrial engineers.

The basic prerequisite is to hold an undergraduate Degree from a European Higher Education Area (EHEA) university or equivalent from a non-EHEA university with access to Master Degrees in their own academic systems.

Modality:

Traditional (face-to-face) lectures combined with Moodle tasks.

Language: Spanish, English.

Address: University of A Coruña, Spain

Teaching staff/ coordinator:

Maria Amalia Jacome Pumar, Department of Mathematics, University of A Coruña, Spain, e-mail: maria.amalia.jacome@udc.es

COURSE INTEGRATION IN THE STUDY PROGRAMME

Environmental studies imply usually large amounts of experimental data, whose analysis should allow extracting the relevant information hidden behind them. This subject introduces some core advanced multivariate statistical techniques. They will

allow a reduction in the dimensionality of the datasets and the discovery/description of sample groups. Commonly-available computing power simplify the treatment of large databases, which are quite frequent nowadays and, therefore, this subject is of general interest for environmentalists.

COURSE OUTCOMES

By the end of the course, the learners will:

- Be able to design experiments, get information and interpret results;
- Apply critical, logical and creative thinking to solve problems as effectively as possible.

COURSE CONTENT

Unit 1.

Introduction. A review of the basic methods to describe a dataset, univariate and multivariate approaches.

Unit 2.

Relationships among variables. Dependence measurements: correlation matrix, simple and multiple linear regression; multicolinearity.

Unit 3.

Multivariate analysis. Description of multivariate datasets. Principal components analysis. Discriminant analysis. Cluster analysis.

Individual work:

Students will be required to develop a study on a particular dataset. They will apply the different techniques learnt in this subject, along with a critical discussion of the results and addressing several predefined questions. They will be monitored by the teachers so that they can solve their doubts with both "face-to-face" and online advice sessions.

Tutorships will take place at the office of the teachers for solving doubts, correcting mistakes, suggesting proper approaches to deal with the proposed problems and

reviewing initial versions of the works. Online advice sessions will be by means of e-mail, virtual platform, and similar.

METHODOLOGY OF ASSESSMENT

Attendance to the theoretical classes and active participation will be scored positively (up to 10% of the final overall score of the subject). Attendance should not be lower than 80% of the total hours of the subject (but for clearly justified reasons). The remaining 90% of the overall score will be obtained by performing a written report on a practical case-study. This task may be assisted by the teachers so that main doubts are solved. Scoring of the reports will consider: formal aspects, clarity in the written explanations, sound defence / basement of the explanations and, when required, the performance on the oral presentation. All activities (problem solving, working team essays) posed by the teachers must be addressed by the students, otherwise the subject will not be passed. The overall final score will be a weighted sum of the scores obtained in the different blocks.

For part-time students 100% of the overall score will be obtained by performing a written report on a practical case-study and they are not required to defend their works in class.

To obtain a NR (No Grade Reported), the student must not participate in the collaborative learning activities.

REFERENCES

1. Jobson, J.D. (1992). Applied Multivariate Analysis. Vol. II: Categorical and Multivariate Methods. Springer Texts in Statistics, Springer-Verlag: NewYork.
2. Miller, J.N. & Miller, J.C. (2002) Estadística y Quimiometría para Quí-mica Analí-tica. Edit. PrenticeHall.
3. Mongay Fernández, C. (2005) Quimiometría. Servicio Publicaciones Universidad de Valencia.
4. Morrison, D.F. (1990) Multivariate statistical method. 3rd Edition. McGraw-Hill Series in Probability and Statistics.

5. Peña, D. (2002). Análisis de Datos Multivariantes. McGraw-Hill.
6. Pérez López, C. (2004) Técnicas de análisis multivariante de datos. Aplicaciones con SPSS. Pearson Prentice Hall, Madrid.
7. Pérez López, C. (2005) Métodos Estadísticos Avanzados con SPSS. Thomson, Madrid.
8. Ramis Ramos, G. (2001) Quimiometría. Síntesis, Madrid.
9. Millard, S.P. & Neerchal, N.J. (2001) Environmental Statistics with S-Plus. Springer. CRC Press LLC.

Course unit

ECOLOGY AND BIOMONITORING

GENERAL INFORMATION

ECTS credits: 3

Assessment form: exam

Target group:

This course is designed for students and professionals with different scientific backgrounds. It is directed to biology and chemistry and ecology students, as well as for improving the formation of building, civil, chemical and industrial engineers.

The basic prerequisite is to hold an undergraduate Degree from a European Higher Education Area (EHEA) university or equivalent from a non-EHEA university with access to Master Degrees in their own academic systems.

Modality:

Traditional (face-to-face) lectures combined with Moodle tasks.

Language: Spanish, English.

Address: University of A Coruña, Spain

Teaching staff/coordinator:

Jose Miguel Ruiz, Department of Biology, University of A Coruna.

E-mail: jose.miguel.ruiz.delarosa@udc.es

Roberto Bao, Department of Physics and Earth Sciences, University of A Coruna.

E-mail: roberto.bao@udc.es

Sergio Roiloa, Department of Biology, University of A Coruna.

E-mail: sergio.roiloa@udc.es

COURSE INTEGRATION IN THE STUDY PROGRAMME

The course introduces the students to the key issues of ecology, focusing on the relationship of ecology and evolution, ecology and population, ecology and community. The content of the course has a significant importance for the formation and professional development of students of environmental sciences. Within the course unit the learners will learn about the importance of long-term ecosystem analysis.

COURSE OUTCOMES

By the end of the course, the learners will:

- Realize the fact that long-term ecosystem analysis allows them to assess the extent, to which the ecosystem is disturbed or recovered;
- Establish the disturbance threshold in ecosystems;
- Determine the future trajectories of change in ecosystem;
- Identify the reasonable restoring measures, depending on the peculiarities of the environment.

COURSE CONTENT

Unit 1. Ecology and evolution. Definition of evolution. Hardy Weinberg principle. Law of genetic equilibrium. Genetic drift. Gene flow. Mutations. Random mating. Natural selection. Evolution by natural selection. Types of selection. Adaptive evolution.

Unit 2. Population ecology. Population ecology. Patterns of dispersion. Population growth. Exponential population growth. Logistic population growth. Exponential and logistic population growth.

Unit 3. Community ecology. Community ecology. Species diversity. Shannon diversity index. Interspecific interactions. Competition. Competition: Lotka-Volterra model. Predation. Mutualism.

Unit 4. Paleoecology and Ecosystem Management. Global warming. Natural variability of ecosystems. Natural vs anthropogenic variability. Rate and magnitude of environmental change. Effective ecosystem management. Case studies.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of tests, participation in the discussions and fulfillment of practical assignments.

The final exam will take place in written form. The final grade is determined in accordance with the Regulations of the University of A Coruna.

REFERENCES

1. Smol, J.P. Pollution of Lakes and Rivers: A Paleoenvironmental Perspective – 2nd Edition. Blackwell Publishing, Oxford, 2008
2. Gillson, L., Biodiversity Conservation and Environmental Change. Oxford University Press, Oxford, 2008
3. Shaun A. Marcott et al. Science 2013;339:1198-1201
4. Weatherhead, P. J. How unusual are unusual events? American Naturalist, 1986,128: 150-154

http://rethink.fa.ulisboa.pt/moodle/course/view.php?id=5

Course unit

AIR QUALITY

GENERAL INFORMATION

ECTS credits: 3

Assessment form: exam

Target group:

This course is designed for students and professionals with different scientific backgrounds. It is directed to biology and chemistry and ecology students, as well as for improving the formation of building, civil, chemical and industrial engineers.

The basic prerequisite is to hold an undergraduate Degree from a European Higher Education Area (EHEA) university or equivalent from a non-EHEA university with access to Master Degrees in their own academic systems.

Modality:

Traditional (face-to-face) lectures combined with Moodle tasks.

Language: English, Spanish

Address: University of A Coruña, Spain

Teaching staff/coordinator:

Professor in charge for units 1-3: Soledad Muniategui Department of Chemistry, University of A Coruña. E-mail: soledad.muniategui@udc.es

Professor in charge for units 4-6: Christian Kennes, Department of Chemistry, University of A Coruña. E–mail: c.kennes@udc.es

COURSE INTEGRATION IN THE STUDY PROGRAMME

The course introduces the students to the notion of air pollution, problems of air pollution and the legal, monitoring and control networks. The course unit focuses on the main air polluting activities and introduces the learners to the PRTR regulations, sampling methodologies and analysis of major pollutants emission.

COURSE OUTCOMES

By the end of the course the student will:

- Know the regulative, monitoring and control mechanisms of air pollution;
- Be acquainted with the main technologies that deal with gas emissions;
- Be familiarized with innovative technologies and troubleshooting in the field of air pollution;
- define and establish objectives for ambient air quality designed to avoid, prevent or reduce harmful effects on human health and the environment as a whole;
- assess the ambient air quality in Member States on the basis of common methods and criteria.

COURSE CONTENT

Unit 1. Introduction to air pollution. Problem of air pollution. Specific regulations. Monitoring and control networks.

Global warming and climate change

- Soil erosion
- Deforestation
- The extinction of animal and plant species
- The destruction of the stratospheric ozone layer
- The disappearance and alteration of natural landscapes
- The transport of air pollutants and acidification of the medium
- Management of water resources
- The degradation of coastal areas
- The quality of the urban environment.

Unit 2. Analytics for assessing air quality methodology. Reference methodology for sampling and analysis of various pollutants in the air. Case studies and interpretation of results. Conclusions of certain studies and current research.

Unit 3. Atmospheric emissions. Main air polluting activities. Introduction to PRTR

regulations. Sampling methodologies and analysis of major pollutants emission.

Unit 4. Dedusting technologies. Fundamentals. Description of equipment. Design equations. Troubleshooting.

Unit 5. Removal Technologies gases /vapors. Fundamentals. Description of equipment. Design equations. Troubleshooting.

Unit 6. Innovative technologies. Fundamentals. Description of equipment. Design equations. Troubleshooting. Case study.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of tests, participation in the discussions and fulfillment of practical assignments.

The final exam will take place in written form. The final grade is determined in accordance with the Regulations of the University of A Coruna.

REFERENCES

1. Farmer, A.M. (2012) (Editor). Manual of European Environmental Policy. 1043pp. Routledge, London.

2. Barnes, P. M., & Barnes, I. G. (2000). Environmental policy in the European Union.

3. EU Reports to be consulted at https://www.eea.europa.eu/publications/latest#c7=en&c11=5&c14=&c12=&b_start=0

Explaining road transport emissions https://www.eea.europa.eu/publications/explaining-road-transport-emission

IARC: Outdoor air pollution a leading environmental cause of cancer deaths. https://www.iarc.fr/en/media-centre/iarcnews/pdf/pr221_E.pdf

Every breath we take. Improving air quality in Europe https://www.eea.europa.eu/media/audiovisuals/every-breath-we-take-air/view

Living in a changing climate.
https://www.eea.europa.eu/highlights/living-in-a-changing-climate
Well-being and the environment. Building a resource-efficient and circular economy in Europe
http://wedocs.unep.org/handle/20.500.11822/19050
Air Quality Standards
http://ec.europa.eu/environment/air/quality/standards.htm

Course unit

SOIL QUALITY

GENERAL INFORMATION
ECTS credits: 3 Assessment form: exam **Target group**: This course is designed for students and professionals with different scientific backgrounds. It is directed to biology and chemistry and ecology students, as well as for improving the formation of building, civil, chemical and industrial engineers. The basic prerequisite is to hold an undergraduate Degree from a European Higher Education Area (EHEA) university or equivalent from a non-EHEA university with access to Master Degrees in their own academic systems. **Modality**: Traditional (face-to-face) lectures combined with Moodle tasks. **Language:** Spanish, English. **Address:** University of A Coruña, Spain **Teaching staff/coordinator**: Dr. Marcos Lado, Department of Physics and Earth Sciences, University of A Coruna. E-mail: marcos.lado@udc.es Dr. Antonio Paz González, Department of Physics and Earth Sciences, University of A Coruna. E-mail: antonio.paz.gonzalez@udc.es
COURSE INTEGRATION IN THE STUDY PROGRAMME
The course introduces the students to the notion of soil pollution, problems of soil pollution and the legal, monitoring and control mechanisms. The course unit focuses on the main soil polluting activities and suggests ways of avoiding this negative phenomenon.

COURSE OUTCOMES

- By the end of the course, the learners will:
- Be familiar with the existing dangers of soil pollution;
- Know the current scientific developments in the field;
- Assess the potential risks of soil pollution;
- Be able to carry out the soil quality assessment;
- Be able to develop a thematic strategy on soil protection;
- Know the EU framework directive;
- Learn the main soil threats in EU.

COURSE CONTENT

Unit 1. Soil quality. Soil functions. Soil quality assessment. Soil quality model.

Unit **2**. Soil structure: degradation and erosion. Soil aggregate. Clay mineralogy. Water content and wetting rate. Wind erosion. Sheet erosion. Landslides. Runoff. Water erosion. Post-fire soil protection measures.

Heavy metals in soil. Redox processes.

Unit. 3. Soil reaction. Liming mechanism. Soil acidification. Soil complex and ionic exchange.

Unit 3. Phytoremediation. Definition, types of phytoremediation. Mechanisms. Phytoextraction of heavy metals. Pros and cons of phytoremediation. Aquatic plant for waste water treatment.

Unit 4. Soil risk assessment. EU strategies against soil pollution. Changes in soil research trends. Risk assessment. Values and thresholds in Soil Science. Soil protection strategy. EU soil framework directive. The DPSIR concept. Contamination. National Remediation Strategy.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of tests, participation in the discussions and fulfillment of practical assignments.

The final exam will take place in written form. The final grade is determined in

accordance with the Regulations of the University of A Coruna.

REFERENCES

1. Ratta, R., & Lal, R. (Eds.). (1998). *Soil quality and soil erosion*. CRC press.
2. Lal, R. (1998). Soil erosion impact on agronomic productivity and environment quality. *Critical reviews in plant sciences*, *17*(4), 319-464.
3. Karlen, D. L., Mausbach, M. J., Doran, J. W., Cline, R. G., Harris, R. F., & Schuman, G. E. (1997). Soil quality: a concept, definition, and framework for evaluation (a guest editorial). *Soil Science Society of America Journal*, *61*(1), 4-10.
4. Doran, J. W. (2002). Soil health and global sustainability: translating science into practice. *Agriculture, ecosystems & environment*, *88*(2), 119-127.
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Course unit

WATER QUALITY

GENERAL INFORMATION

ECTS credits: 6

Assessment form: exam

Target group:

This course is designed for students and professionals with different scientific backgrounds. It is directed to biology and chemistry and ecology students, as well as for improving the formation of building, civil, chemical and industrial engineers.

The basic prerequisite is to hold an undergraduate Degree from a European Higher Education Area (EHEA) university or equivalent from a non-EHEA university with access to Master Degrees in their own academic systems.

Modality:

Traditional (face-to-face) lectures combined with Moodle tasks.

Language: Spanish, English.

Address: University of A Coruña, Spain

Teaching staff/coordinator:

Jordi Delgado Martin, Department of Terrain Engineering, University of A Coruña.

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COURSE INTEGRATION IN THE STUDY PROGRAMME

The course presents the students a detailed study of the concept of water, its properties

and types. It also introduces notions from the adjacent fields, such as chemistry, which are indispensable in the study of water. Students are introduced to the water sampling procedure and the equipment necessary for water assessment and various measurements.

COURSE OUTCOMES

By the end of the course, the learners will:

- Know all the peculiarities, functions and types of water;
- Apply chemical concepts to deal with water related issues;
- Be able to carry out various measurements to determine the quality of water;
- Be able to perform water sampling applying a correct methodology, required by the process.

COURSE CONTENT

Unit 1. Water quality. Structure and properties of water. Types of water. Phase diagram of water. Water density. Water salinity. Ice shelf. Icebergs. Oceanic stratification.

Unit 2. Basic concepts of chemistry. Ponderal laws. Stoichiometry. Units of concentration. Measurements. Conductivity. Hardness. Alkalinity. Acidity.

Unit 3. Water analysis. Graphic representation of water analysis.

Unit 4. Water sampling and preservation. Types of sampling. Factors that compromise the integrity of the samples. Contamination control. Time and frequency of sampling. Sampling equipment. Field summary report.

Unit 5 a. The study of natural waters. Precipitation, water cycle. Rain/ forest interaction. Fog, mist, smog. Meteorology. Chemical composition of rain. Continental effects. Acid rain. Marine traffic effects.

Unit 5 b. Natural waters: streams and rivers. Watersheds. Rosgen classification. Rivers and streams. River processes.

Unit 5 c. Natural waters: lakes and reservoirs. Fresh water environments. Ecological classification of fresh water organisms. Ecological zoning. Great lakes of the world. Water salinity classification. Reservoirs. Morphometry. Bathymetry. Colmatation.

Unit 6. Assessment of quality of water analyses. Experimental measurements. US – EPA Recommendations. Quality assessment. The Redox ladder. Other indicators.

METHODOLOGY OF ASSESSMENT

The current assessment will be performed by means of tests, participation in the discussions and fulfillment of practical assignments.

The final exam will take place in written form. The final grade is determined in accordance with the Regulations of the University of A Coruna.

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