QUALIFICATION CHARACTERIZATION

OF MAJOR FIELD OF STUDY "INFORMATION TECHNOLOGIES IN ECOLOGY"

FOR "MASTER OF SCIENCE" DEGREE
WITH PROFESSIONAL QUALIFICATION "MASTER OF SCIENCE IN INFORMATICS"

Neofit Rilski South-West University prepares qualified experts in Informatics that can apply their knowledge and skills in the area of science, culture, education, and economics in Bulgaria and abroad.

After completion of MSc in Informatics degree in the area of Information Technologies in Ecology, graduates can successfully realize themselves as: computer programmers, system and network administrators and designers, graphic designers, scientists, experts in databases, experts in software technologies, etc.

At completion of MSc in Informatics degree, students obtain:

- profound knowledge in the area of application of information technologies in ecology;
- competences to develop and apply theoretical models, mathematical modeling and computational techniques for simulation of systems processes in the area of ecology;
- skills for applying information technologies in preservation, prognostics and management of natural resources and applications in the area of natural sciences and humanities, as well as development and execution of projects, financed by various programs of the European Union;
- interdisciplinary preparation and opportunity for research in the area of modern ecology, ecological modeling and prognostics of natural components and human society;
- good theoretical preparation in the area of Mathematics and Informatics as well as solid practical skills conforming to modern European standards and requirements;
- formation of affinity and ability for independent research and design;
- basis for continuing education at PhD level;

- good opportunities for realizing as experts in Bulgaria and abroad;
- thinking style and affinity to the quickly changing requirement of the information society.

Students completed MSc in Informatics degree in the area of Information Technologies in Ecology have to possess the following knowledge, skills and competences:

- to conduct independent research, to model real processes and make computer automation systems for information maintenance;
- to use mathematical models and software packages for solving real economic, engineering and management problems in continuous and discrete macrosystems;
- to take part in development of program products and packages;
- to adapt and introduce program products and systems;
- to solve various optimization problems.

CURRICULUM

MASTER PROGRAMME

„INFORMATION TECHNOLOGIES IN ECOLOGY”

First year			
First semester	ECTScredits	Second semester	ECTScredits
Compulsory Courses		***Compulsory Courses***	
Fundamentals of ecology	5	Neural Networks	4
Evironmental protection	5	Mathematical Models in Ecology and Environmental protection	5
EnvironmentalMonitoring	4	Ecotoxicology	3
Functional Biocoenology	4	***Optional Courses*** 3	3
Computer Cartography and Geographic Information Systems		Introduction to the Stochastic Processes	
Optional Courses 1	4	Practice in Measurement Systems	3
Ontologies and applications in ecology	4	Environmental Management	3
Chronoecology with Dendrochronology Analyze		Specializied softuer for statistical analysis Script languages	
Environmental standards and requirements		Preparation and defense of a graduation thesis	15
Conservation of Biological Diversity			
Contemporary technologies and environmental protection			
Operations Research			
Aerospace information technologies in environmental protection			
	Total 30		Total 30

TOTAL FOR 1 ACADEMIC YEAR: 60 CREDITS

COURSES DESCRIPTION

Fundamentals of ecology

ECTS credits: 5 **Hours per week: 3**l+1pe
Form of assessment: on-going control and exam **Examination type:** written
Semester: I
Methodological guidance:
Department: "Geography, Ecology and Environmental Protection"
Faculty of Mathematics and Natural Sciences
Lecturers: Assist. prof. Lidia Sakelarieva, PhD
E-mail:sakelarieva.lidia@swu.bg

Annotation: The course goes into the basic issues of ecology as an interdisciplinary science that links together the biological, physical and social sciences and that is closely tied to the environmental protection. The aim of the course is to presentthe basic characteristics of biological macro-systems – populations, communities, ecosystems.

Discipline content: The discipline content has been structured in two divisions:

Division I. Ecology as a science.Environmental factors. Subject, tasks, and methods of research in ecology.Basic environmental factors – biotic, abiotic, and anthropogenic.The concept of limiting factors.Light, temperature, air, water and soil as physical factors. Ecological groups of organismsdepending on their adaptations to different light, temperature and moisture regimes. Water and soil as mediums for life.Ecological classification of water and soil organisms.

DivisionII.Population ecology, synecology, biosphere. Population characteristics– structure, density, birth rate, death rate, age distribution, dispersion, growth form.The biotic community concept.Community structure – species, morphological (vertical and horizontal) and functional.Types of interactions between two species.Ecological niche.Concept of the ecosystem.Productivity, energy flow and biogeochemical cycles.Ecosystem development.Primary and secondary succession.Concept of the climax.Nature and organization of biosphere.

Literature:

Basic:

1. BogoevV., A. Kenarova. 2009. Fundamentals of ecology.PENSOFT, Sofia-Moskow. (in Bulgarian)
2. Kamenov D., D. Bachvarova, Al. Doichinov. 2006. Ecology.Episkop Konstantin Preslavski, Shumen.(in Bulgarian)
3. Baikov B. 2012. Ecology.NBU, Sofia.(in Bulgarian)
4. Odum E. 1986. Ecology.Mir, Moscow. (in Bulgarian)

Additional:

5. Velcheva I. et al. 2009.Manual of laboratory and field exercises in ecology.Plovdiv. (in Bulgarian)
6. Begon M., J. Harper, K. Townsend. 2000. Ecology. Individuals, Populations and Communities. B.W.S., Thirth Edition.
7. Odum, E.P. 1996. Ecology.A Bridge between Science and Society.Institute of Ecology.The University of Georgia.Sinauer Associates Inc. Publishers, Sanderland, Massachusetts 01375, USA.

Technology of education and grading:

The lectures are elaborated as Powerpointpresentations.The exercisesare conducted in a laboratory or as field trips.

The final grade is formed on the basis of continuous control and written exam. The continuous control takes place during the semester and includes a test, an assignment, and the students' preparation and work during the exercises.The share of the continuous control from the final grade is 40%.The written exam includes 2 questions from the discipline content.The share of the written exam from the final grade is 60%.

ENVIRONMENTAL PROTECTION

ECTS credits: 5 **Hours per week: 3**l+1pe
Form of assessment: on-going control and exam **Examination type:** written
Semester: I
Methodological guidance:
Department: "Geography, Ecology and Environmental Protection"
Faculty of Mathematics and Natural Sciences
Lecturers: Assoc.prof. K. Tyufekchiev PhD, Assist. prof. Lidia Sakelarieva, PhD
E-mail: konstantinat@abv.bg; sakelarieva.lidia@swu.bg

Annotation: The course goes into and gives the necessary knowledge about the anthropogenic impacts on the abiotic environment and on the organisms and biological macro-systems – populations, communities, ecosystems; the global environmental problems (ecological problems); the possibilities for reduction of the negative consequences from the anthropogenic impacts; the environmental, including the biological diversity, protection, cleanness and reproduction. The air, soil, water, flora and vegetation, fauna and animal life protection are considered in close connection with ecology as an interdisciplinary science.

Discipline content: The discipline content has been structured in two divisions. The basic environmental problems are considered in the first division– air, water and soil pollution; methods for their purification; strategies for their protection; methods for control of air and water cleanness. The second division includes the aims, tasks, significance and the methods in biodiversity protection; the problems in biological diversity protection at species, population and community levels; practical applications and conformity of human actions with the biological diversity protection at global and regional scale.

Literature:

1. Акимова, Т.А., Кузьмин А.П., Хаскин В.В. 2007. Экология: Природа, Человек, Техника. ЗАО Издательства Экономика, Москва, 510.
2. БАН & МОСВ. 2011. Червена книга на Република България. Том 1, 2 и 3. Интернет издание.http://e-ecodb.bas.bg/rdb/bg/.
3. Влахов С. 2004. Биоиндикации. Акад. изд „Марин Дринов", София.
4. Георгиев, Г. 2004. Националните и природните паркове и резерватите в България. Гея – Либрис, С. 293 е.
5. Георгиев, Г., К. Тюфекчиев. 1989. Риломанастирски гори. Земиздат, С.
6. Стоилов, Д., К. Тюфекчиев. 2001. Консервационна природозащита. Унив. и-во "Н. Рилски", Благоевград.
7. Стоянов С., Д. Тодоров, И. Ботев. 2008. Замърсяване на атмосферата и околната среда – здравен и екологичен проблем. „ПъблишСайСет – Еко", София.
8. Шуберт Р. (ред). 1988. Биоиндикация загрязнений наземных экосистем. Москва „Мир" (перевод с немецкого).
9. Groom, Martha J., Gary K. Meffe, and C. Ronald Carroll. 2006. Principles of Conservation Biology. Third Edition, 699 p., 369 ill.
10. Primack, Richard B., 2006. Essentials of Conservation Biology, Fourth Edition. 535 p., 287 ill.
11. Strangeways, I. 2003. Measuring the Natural Environment. CambridgeUniversity Press. UK, p. 527.

Technology of education and grading:

The teaching process is performed by lectures, practical training and controlled self-dependent work. The lectures are elaborated as Powerpointpresentations.The exercisesare conducted in a laboratory or as field trips– visiting of drinking water or waste water treatment plants, or various protected natural areas and their administrative managing bodies.

The final grade is formed on the basis of continuous control and written exam. The continuous control takes place during the semester and includes a test, and an assignment.The share of the continuous control from the final grade is 40%.The written exam includes one question from the two divisions of the discipline content. The share of the written exam from the final grade is 60%.

Environmental Monitoring

ECTS credits: 4 **Hours per week:** 2l+0se+0le+1pe+p
Form of knowledge evaluation: Examination **Examination type:** written
Semester: I
Methodological guidance:
Chair: "Geography, Ecology and Environment Protection"
Faculty: Mathematics and Natural Sciences
Lecturers:
Ass. Prof. Dr. Eng. StefkaCekova
phone: +359 (0)2/ 828 74 60, +359 (0)888 47 12 49, +359 (0)878 47 12 49
E-mail: teshe@abv.bg ,teshe@swu.bg

Abstract:
As a result of anthropogenic activities of human society, the environment is being polluted at a pace and scale that the problem of preserving it gains a critical and globally.Consequently, there was a strong need for objective and comprehensive assessment of her condition to be achieved through a unified methodical system, such as monitoring system.
Environmental monitoring is information system for surveillance, registration and control of the condition, quality and changes in key components of the natural environment due to the impact of anthropogenic factors.
Course content:
Course covers two groups of theoretical questions:
- Basic concepts, structure and competent authorities insystem environmental monitoring, environmental problems in the region for economic development in Bulgaria, a European scheme for trading greenhouse gas emissions and national allocation of quotas;
- Monitoring of environmental components, factors, noise and waste, the conditions for deployment of the monitoring stations, instrumental analyses and actual results.
Teaching and assessment:
In the training process of students - Masters lectures and practical exercisesare provided.In lectures, students are introduced to the theoretical basis of the course, divided intotwo groups. Lectures are conducted ina traditional way, it is illustratedwithgraphic material, and emission limit valuesfor variouspollutantsofthe environment components.Bestpracticesglobally worldwide will be commented
The workshops are conducted in the laboratory, students inguidance of the teacherwill mark on the maps on Bulgaria placesforecological monitoring based ondifferent environmentcomponents outline the most polluted areas, take samples from the river Bistritza analyzethem in the chemical laboratory(if possible), visit the laboratories of the Regional Environmental Inspectorate - Blagoevgrad and get acquainted withmethods of analysis of samples taken from monitoring pointsenvironment.
Extramural training of students is mainly related to working in a library, the individual and group consultations with the teacher.
During the course of study is an ongoing review of the evaluation of knowledge - the development and protection of paper, solving test and a test that corresponds to the contents of the lectures
Criterion for assessing the degree of implementation of tasks (essay, test) taking into account: the level of competence and analytical skills:Excellent 6 - more than 89%, Very Good 5 - 70% - 89%, Good 4 - 45% - 69%, Satisfactory 3 - 30% - 44%, Off 2 - below 30%.

The developed abstracts are defended in front of students who will evaluate themselves the thesis.

To the exam will be admitted only thesestudents who have fulfilled the requirements of the Rules of the educational activities of the SWU, have met the requirements for mastering the content of the course set out in their audience, and individual employment and overall assessment of the current control is not lower Average of 3.

The share of current control weighting is 40% and its relative weight in theabstract or presentation, 60% and 40% test under developed and adopted in the Department «GEOOS» system for monitoring and evaluation of students' knowledge.

Functional Biocoenology

ECTS credits: 4 **Hours per week:** 2l+1pe
Form of assessment: on-going control and exam **Examination type:** written
Semester: I
Methodological guidance:
Department: Informatics
Faculty of Mathematics and Natural Sciences
Lecturer: Assoc. Prof. DrMariyanaLyubenova, Depatrment „Ecology and EP", SU
E-mail: ryann@abv.bgryana_l@yahoo.com

Annotation:

The course "Functional Biocoenology" to master course "Information Technology in ecology" is a thorough review of functioning of the biocoenosis and their role in the functional specificity of ecosystems. In considers also the importance of other ecosystem components for plant associations themselves, which links underlie the creation of empirical and formal models for simulating "behavior" of these macro biological systems under climate environmental factors.

Functional specificity of ecosystems occurs in different directions: energy flow, circulation of substances space-time structure, development, evolution and self-organization. Attention is paid to the role of biodiversity for ecosystem resilience and the various contemporary indicators and models for assessing ecosystem health and environmental risks that underlie environmental resource management and sustainable being recognized. Students are introduced to various ecosystem models with their advantages and drawbacksp and the priorities in the modeling of ecosystems. All these aspects are considered consecutively in lectures and practical sessions.

Discipline content:

- Geochemical background environment. Clark and migration of chemical elements. Major biogeochemical factors. Zonal particularities in the chemical composition of the biomass. Biological cycle - and capacity characteristics in different groups depending on the ecosystem structure and functioning of biocoenosis. "Bottlenecks" in the cycle of nutrients.
- The biological productivity as an indicator of the intensity of functioning of biocoenosis and ecosystems. Features in the quantity, structure and dynamics of primary production in various types of terrestrial and aquatic ecosystems. Use of primary production and operation of the biocoenosis. Modeling.
- Biomass as a geochemical and functional indicator. Biological activity of the biomass. Particularities of the distribution of biomass in different types of ecosystems - an indicator of the functioning of the biocoenosis. Balance of productive and destructive processes in nature. Biocoenotical importance and role in shaping the environment. Relevance.
- Energy characteristics of the environment. Energy flow and functioning of the biocoenosis. Trophic structure and ecological pyramids reflecting the functional characteristics of the biocenosis and ecosystems. Models. Main conclusions for energy flow in ecosystems on earth - practical significance. Energy field of anthropology sphere.
- Biodiversity and ecosystem functioning. Importance of ecosystemmodeling.

- Classification of ecosystem types. Problems and concepts. Application of PFTs and ETs classification of ecosystem type.
- Dynamics of biocoenosis and stability of ecosystems. Basic models self-organization.
- Practical problems of ecosystem modeling. Plant and ecosystem functional types (PFTs and ETs) and ecosystem modeling - definitions and concepts. Characteristics and shortcomings of the current Dynamic Global Vegetation Models (DGVMs). Application of PFTs and ETs development models. Ecosystem approach for the development of DGVMs.
- Basic approaches to ecosystem diagnosis (ED) and ecosystem management. Role of bioindications and biomonitoring of biocoenotical and ecosystem level for ED. Ecological and adaptive management of ecosystem functions. Importance of different types of models. Concept of sustainable development and ecosystem management as an attempt to regulate the human impact on the biosphere. Socio-political and economic problems of its implementation.

Literature:

A) BAISIC READING

1. Begon M., J.L. Harper, C. Towsend. 2000. Ecology.Blackwell Science, 1068.
2. Canadell, J.G., D.E. Pataki, L.F. Pitelka(ed.).2007. Terrestrial Ecosystems in a Changing World.Springer, Berlin-Heidelberg-New York, 336 p.
3. Lyubenova, M. 2004. Plant Ecology.S., Publisher. BAS „M. Drinov"574.
4. Lyubenova, M. 2009. Functional Biocoenology.S., Publisher «An-Di», 370.
5.13. Lyubenova, M. 2009. Guide to functional biocoenology. S., Publisher «Ан-Ди», 190.
6.23. Smith, T., H. Shugart, F. Woodward (Eds). 1997. Plant Functional Types. : Their Relevance to Ecosystem Properties and Global Change (International Geosphere-Biosphere Programme Book Series) (Hardcover).Cambridge University Press, UK, 361.
7.24. Strangeways, I. 2003. Measuring the Natural Environment.Cambridge University Press.UK, 527.

B) FURTHER READING

8. Akimova, T.A., Kusmin A.P., HaskinV.B. 2007.Ecology: Nature, Human, Technics. ZAO Publisher Economy, Moscow, 510.
9. Basilevitch at all.. 1978. Methods for biology urnover study in different nature zones. M., Mir.
10. . Begon M., J.L. Harper, C. Towsend. 2000. Ecology. M., Mir, v.I, II.
11. Brux, R. 1986. Biology methods for minerals search. M., Nedra, 310.
12.Chikalanov, A., V. Sergey, M. Lyubenova. 2012.Application of Neural Network and SOM for Oak Ecosystems Classification by Structural and Functional Parameters. 2012. –In: Abstract Book "Modelling the terrestrial biosphere: From Ecological Processes to Remote Sensing Observations", 2nd TERRABITES Symposium ESA/ESRIN, Frascati, Italy 6-8 February, 39 p.
13. Cowie, J. 2008. Climate Change: Biological and Human Aspects.Cambridge University Press.UK, 487.
14. Duvinyo, P., Tang. 1986. Bio sphere and human's place in it. Leningrad. Progres.
15. Lyubenova, M. 2004.Basic approaches for ecosystem diagnostics.Ecology engineering and environmental protection. N 3, 16 - 23.
16.Chikalanov, A., **M. Lyubenova**, St. Stoyanov. 2010. Classification Oriented Databases for Facilitating Plant and Terrestrial Modelling.*Comptesrendus de l'Academiebulgare des Sciences*,Biologie, ecologie, t.63, № 9, 1327-1334.
17.Lyubenova, M. 2011.About Ecological Fundaments of New Generation Global Models.*ComptesrendusdelʼAcademieBulgaredesSciences*. Biologie, ecologie, t. 64 , № 11, 1589-1601.
18. Lyubenova, M., R. Nedkov, I. Ivanova, A. Chikalanov, N. Georgieva, E. Ivanova, V. Lyubenova. 2012. Ecological Space Modeling as a Pattern for Forest Vegetation Investigations (Example with Belasitsa Mt., BG*). ComptesrendusdelʼAcademieBulgaredesSciences.* Biologie, ecologie, t. 65 , № 4, 483-491.*IF=0.204*

19.Chikalanov, A., **M. Lyubenova**, S. Stoyanov, V. Lyubenova. 2012. Application of Onthologies and Semantic Web for Facilitation of Ecology. *ComptesrendusdelʼAcademieBulgaredesSciences*. Mathematique, informatique, t. 65, № 5, 599-609
20.Mirchev, C.,M. Lyubenova. 2000. Dendrochronology. Pensoft, S.
21. Odum, U. 1986. Ecology. M., Mir, v.I, II.
22. Prelman, A. 1975.Landscape geochemistry. M., Naouka.
23. Shulze,E. D., H. Mooney (Eds.). 1994. Methods of assessing terrestrial productivity.-Ecol.Studies, 14, 55-114.
24. Shulze,E. D., H. Mooney (Eds.). 1994.Biodiversity and Ecosystem Function. Springer-Verlag, 525 p.
25.Stepanovskih, A.S. 2009. Ecology theory and practice..Unity, Moscow, p. 791.

Technology of education and grading:

Lecturesare developed on Power point and will be presented with video - projector. Practical classes are conducted in subgroups in a laboratory where students study the general characteristics of the indicators, their importance for the functioning of the ecosystem and biocenosis, opportunities for their empirical and formal models.Attention is drawn to the values of the parameters on which you can evaluate the steady state of ecosystems and those who speak for destabilization and onset of degradation. . At the end of each session the next topic is introduced students for their preparation.

Extracurricular training of students is related to work in a library, Internet, individual and group consultations to prepare for the exercises, writing of essays and courseworks, preparations for ongoing control and final exam.

During the semester students carry out periodical checks of knowledge by solving test, which corresponds to part of the contents of the lectures. Evaluated the preparation and performance of the students during the activity through the development of coursework.

Examination procedure includes a written examination on two questions or computer test. The relative weight of the total test score is 60%, and the current rating - 40%.

Computer Cartography and Geographic Information Systems

ECTS credits: 4
Hours per week: 2l+1pe
Form of assessment: on-going control and exam
Examination type: written
Semester: I
Methodological guidance:
Department of Informatics
Faculty of Mathematics and Natural Sciences
Lecturers:
Assoc prof. PenkaKastreva,PhD, Assist. Eng. Galina Bezinska
E-mail: penkakastreva@swu.bg, galinabezinska@swu.bg

Annotation:

The subject "Cartography and GIS" is mandatory anddesigned for students whohave notstudiedin bachelor's degree the basic subjects"Cartography" and “Geographic Information Systems."

The lecture courseaimsto familiarize studentswith the basic principlesfor thecreation and useof maps. With the practical exercises the students receive undersanding for themapping, a system ofcartographicconcepts, knowledge and skillsto work with differentcartographic products.

Discipline content:

The lecture courseis divided intwo parts.The first part isentirely devoted tocartographyand aimsto familiarize the students with the basic theoreticaltopicsregardless ofthe medium in whicharedesignedand are created themaps, they remain constant-as datum, local and globalreferencesystems, coordinate systems, map projections,cartographicsymbolsand methods formappinggeographic objectsand phenomena.Moreattention is paidto theprocessestaking place in thedigital environment.Someissuesabout the nature oftopographic andthematic maps andestablish themin the digital environmentare included.

The second partintroduces the students to thegeneralconcepts for thedevelopment and implementationof GIS.The topicsare grouped intomodulescoveringfundamentaltheoretical directionswhichaim toprovide practicalknowledge aboutkey aspectsof GIS-hardware,custom software, types and data structures, database andmodernmethods of storageand data management, spatial andnetwork analysis.

Literature:

1. Андреев А., Марков (2009) М. Географски информационни системи. НВУ Шумен;
2. Андреев А., Марков М. (2009) Географски информационни системи. Ръководство за упражнения. НВУ Шумен;
3. Бандрова Т. (2008) Картография I. Картни проекции. УАСГ София,
4. Делийска Б. Географски информационни системи. Учебник. Лотус ИС. София 2003;
5. Кастрева П. (2011) Географски информационни системи и компютърна картография. Университетскоиздателство „НеофитРилски”, Благоевград,
6. Кастрева П. (2008)Географска информационна система ArcView. Университетско издателство „Неофит Рилски”, Благоевград,
7. Кастрева П. Упражнения по ГИС в цифров вид. (достъпни в мрежата на катедра „ГЕООС”
8. Кастрева П. Лекции в цифров вид за магистри.
9. Тепелиев Ю. Димитров В. Рашков С. Географски информационни системи. София, 2008
10. Anson R.W, F.J. Ormeling. Basic cartography. Vol.3., 1996. Butteworth-Heinemnn, pp 128.
11. Demers S.Fundamentals of Geographic Information Systems. (2nd ed.). John Willey&Sons, New York , 2000;
12. Jones C.Geographic Information Systems and Computer Cartography. (1997). Pearson Education Limited, Edinburgh Gate, Harlow, England ;
13. Longley P., Goodchild M., Maguire D.Geographic Information Systems and Science. John Willey&Sons, New York, 2001;
14. Robinson A., J. Morrison, P. Muehrcke, Kimerling A., Gupttile S. Elements of cartography (6th ed.), pp 674. John Willey&Sons, New York, 1995
15. Slocum T., R. McMaster, F. Kessler, H. Howard. Thematic Cartography and Geographic Visualization. (2nd ed) pp518. Pearson Education, 2005.

Technology of education and grading:

The lectures and exercises are conducted solely on the equipment basis of the Department „Geography Ecology and Environmental Protection”. To illustrate the lecture material are used: computer with video –projector, study videos, specialized software (ArcGIS), additional materials (tables, diagrams and maps), some of which have been developed as students’ course and diploma works. For the practical exercises is used a multimedia computer lab. For the normal conduct of the exercises the students are divided into groups and each student has a separate computer.

During the semester periodically the students are assigned individualtasks.or testing. The tasks are fullyrelated todigitalworkenvironmentwith specialized software formappingand using ofmaps. The students are admitted to the exam with a minimal note of 3, which is formed as the average of all notes received during the semester. The final note is 40% of the periodic evaluation and 60% of the semester exam according to the department’s developed and adopted system for control of the students’ knowledge and skills.

Neural networks

ECTS credits: 5 **Hours per week:** 2l+2pe
Form of assessment: on-going control and exam **Examination type:** written
Semester: II
Methodological guidance:
Department: "Geography, Ecology and Environmental Protection"
Faculty of Mathematics and Natural Sciences
Lecturers: Prof. Peter Milanov, PhD
E-mail: peter_milanov77@yahoo.com

Annotation:
Neural networks use learning algorithms that are inspired by our understanding of how the brain learns, but they are evaluated by how well they work for practical applications such as speech recognition, object recognition, image retrieval and the ability to recommend products that a user will like. As computers become more powerful, Neural Networks are gradually taking over from simpler Machine Learning methods. They are already at the heart of a new generation of speech recognition devices and they are beginning to outperform earlier systems for recognizing objects in images.

Discipline content:

The course will explain the new learning procedures that are responsible for these advances, including effective new proceduresr for learning multiple layers of non-linear features, and give you the skills and understanding required to apply these procedures in many other domains.

Literature:

1. КироваТ.,Невронимрежи. София, изд."Софтех", 1995 г.
2. Gurney K., Introduction to Neural Networksл . London, UCL Press, 1997
3. V. Alluru B. Rao ., C++ Neural Networks and Fuzzy Logic, London IDG Books Worldwide, Inc. 1998.
4. R.B. Macy. Pattern recognition with Neural networks in C++, CRC Press, 1994
5. Лекциипотеориянаигрите 2012, www.gametheory.net
6. Rob Kaas, Marc Goovaerts, Modern Actuarial Risk Theory Using R, 2009, Springer,

Technology of education and grading:
Written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).

MATHEMATICAL MODELS IN ECOLOGY AND ENVIRONMENT PROTECTION

Semester: **2 semester**

Type of the course:lectures/laboratory seminars

Hours (per week) /SS/: 2lectures / 3 laboratory seminars

Credits: 5

Teacher: Assoc. prof. MihailKolev

Department: Mathematics, FMNS, "IvanMihajlov" 66, Blagoevgrad

Course Description:

Theeducationalprocessinthiscourseincludesteachingof ecology in order to apply the methods of mathematical modeling for investigation of ecological problems, ecosystems and problems of the environment, in particular the air and water pollution, climatic changes etc. Basic mathematical models in ecology will be considered and analyzed with special attention to the application of the population theory.

Aim of the course:

Thestudents must acquire knowledge about the basic mathematical concepts and approaches used for investigation and modeling of ecological processes and phenomena. They must become able to use this mathematical methods for solving case studies and particular problems from ecology practice.

Assessment:written exam

Bibliography:

1. Mathematical modeling. K. Markov, Sofia, Sofia University Press, 2002 (inBulgarian).
2. Purification of wastewater. C. Cachev, Sofia, „Martilen", 1991 (inBulgarian).
3. Mathematical Modeling and Computer Simulation. D. Maki, M. Thompson, Thompson Brooks/Cole, 2005.
4. Sustainable Management of Natural Resources, M. DeLara, L. Doyen, Springer-Verlag, Berlin, Heidelberg, 2008
5. MathematicalModelsinPopulationBiologyandEpidemiology. F. Brauer, C. Castillo-Chavez, Springer, New York, 2012.

Ecotoxicology

ECTS credits: 3 **Hours per week:** 2l+1pe
Form of assessment: on-going control and exam **Examination type:** written
Semester: 2
Methodological guidance:
Department: Informatics
Faculty of Mathematics and Natural Sciences

Lecturer: Assoc. Prof. DrMariyanaLyubenova, Depatrment „Ecology and EP", SU

E-mail: ryann@abv.bgryana_l@yahoo.com

Annotation:

The Ecotoxicology course comprises studying of effects of the toxic components impact in the environment on biological systems of different ranks - organisms, individuals, populations, communities and ecosystems.For the expression of these effects knowledge about the properties and effects of the toxicant on biosystemsare needed, as well asknowledge about the structure and function of all components of the environment. In this connection, ecotoxicology is the complex, upbuilding discipline for all professionals involved in the environmental protection. The course examines the use of various tests and biomarkers for toxic effects of various pollutants on bio systems which is related to the conducting of bio indication and biomonitoring studies priorred the identification of conservation actions.It is also considered the impact of the ecotope on the toxicantbehavior. The knowledge of the course in ecotoxicology are part of the required basic and applied basis for the preparation of MA students in ecology, modeling possibly effective behavior of the affected ecosystems, menidzhamant and protection of the natural environment and all environmental sciences.

Discipline content:

In the course in ecotoxicology are considered main parts of this interdisciplinary applied science, short history of the legislation related with ecotoxicology and ecotoxicological monitoring in Bulgaria. Students will study the basic types of biotoxins and toxicants and their existing classifications.They will be familiarized with "the black and gray lists" of toxicants and factors modifying their activities in different environments. Additionally students will study toxicants spatial and temporal scales oftoxicity variation and the relationship between their quantity, structure and activity. There are considered also ecological principles underlying the ecotoxicological tests, the types of ecotoxicological parameters, and methods for their determination. Attention is given to the types of ecotoxicological tests - acute and chronic mono-and multi-species; the types of test - organisms and their requirements, also the types of expose systems - watercourse, static and are updated in the aquatic toxicology.

The ways of toxicological exposure to bio-systems and patterns of influence are considered in detail – bioaccumulation, biomagnification,bioconcentration as processes. Affected is also the essence of biotransformation and bio elimination. Students will study the toxicological effects on individuals, populations, communities and ecosystems: resource competition as a means of direct and indirect effects of contaminants; ecosystem effects, and the combined effects of exposure to more than one toxicant, etc. Specialattentionis paid to the ecosystem diagnosis; ecotoxicological risk assessment for human health and the environment, the use of early warning systems and risk assessment for new xenobiotics.

Literature:

A) MAIN REFERENCES

1. Lyubenova, M. 2004. Ecotoxicology - methodical approach to optimizing the man - environment relationship. Biology, ecology and biotechnology № 5,10-24.
2. Lyubenova, M., R. Kaltchev. 2009. Ecotoxicology - small practicum. Sofia, AnDy Press, 380 p.
3. Moriarty, F. 1999. Ecotoxicology: The Stidy of Pollutants in Ecosystems. Academic Press, ISBN, 384 p.
4. Newman, M. C., W.H.Clements. 2008. Ecotoxicology. A Comprehensive Treatment.CRC Press,Taylor &FrancisGroup, 852.

B) FURTHER READING

5.Vassilev, K. 2001. Chemistry and environmental protection.Sofia, Univ. Publishing House "St. KlimentOhridski ", 251.
6. Cockerham, L., B. Shane. 1994. Basic Environmental Toxicology. CRC press, Inc., 627p.
7. Hayes, A. Wallace. 2000. Principles and Methods of Toxicology. Taylor&Francis ISBN, 1250.
8. Lands, W. G., Ming-Ho Yu. 1998. Introduction to Environmental Toxicology : Impacts of Chemicals upon Ecological Systems. Lewis Publishers, Inc., ISBN, 416.
9. Lyubenova, M. 2004. Basic approaches to ecosystem diagnostics.Ecological engineering and environment protection, N 3, 16 - 23.
10. Lyubenova, M. 2006. Bioassays in ecotoxicology - existing practices and problems.Ecological engineering and environment protection, 1, 23-30.
11. Lyubenova, M., Ts. Valtcheva, K. Pachedjieva. 2005. Assessment of the risk for the beech vegetation in the biosphere reserve "Chuprene", connected with climatic, orographic and soil factors. Annuire de l'Universite de Sofia "St. KlimentOhridski",Part II, v.96, l. 4 – 10eme Session Scientifique, Sofia' 03, 27-35.
12. Roumenina, E., M. Lyubenova, V. Dimitrov. 2003. Ecological risk assessment of the spruce vegetation in "Chuprene" biosphere reserve by spatial modeling in GIS. - In: Proceedings "Scientific reports of "International Conference - 75 years Forest Research Institute, BAS», 1-5 October 2003, Volume I, 61 -64.

13. Heinz, A., G. Reinhardt. 2000. Chemistry and environment. Sofia, "St. Kl. Ohridski "Univ. Publishing House, 339.
14. Horizontal legislation of the Republic of Bulgaria. 2005. Ministry of environment and waters.
15. Scow, K., C. Peterman. 1999. Integrated Assessment of Ecosystem Health. Lewis Publishers, Inc., ISBN, 384.
16. Stine, K., T. Brown. 1996. Principles of Toxicology. Lewis Publishers, Inc., ISBN, 272.

Technology of education and grading:

Lecturesare developed on Power point and will be presented with video - projector.Practical classes are conducted in subgroups in a laboratory where students consistently learn about the general characteristics of the test objects of the tested toxicant, methodologies, training and setting of ecotoxicological test.Attention is drawn to the way of construction of the dose-response curve, reporting the LD_{50} and $LC_{50}$and interpretation of results. At the end of each session the next topic is introduced students for their preparation.Extracurricular training of students is related to work in a library, Internet, individual consultations to prepare for the exercises, writing of essays and courseworks,preparation for ongoing control and final exam.

The examination procedure involves solving computer test or develop two questions from a pre-defined conspectus. The relative weight of the final assessment in the overall assessment is 60%.The relative weight of current control is 40%, and includes an assessment of test presentation and performance during exercise.

Ontologies and applications in ecology

ECTS credits: 4
Hours per week: 2l+1pe
Form of assessment: on-going control and exam
Examination type: written
Semester: I
Methodological guidance:
Department: “Geography, Ecology and Environmental Protection”
Faculty of Mathematics and Natural Sciences
Lecturers: Senior assistant Irena Atanasova PhD
E-mail: irenatm@swu.bg

Annotation:

The main goal of course "Ontologies and applications in ecology" is to introduce the current state of research and practical developments in the field of Semantic Web technologies and their applications in the area of Ecology to the students. The course program includes issues relating to methods for the creation, integration and usage of the ontologies. The course is a theoretical and a practical introduction in methodologies for ontological engineering. Students should study the principles for modeling and design of ontological systems for representing and working with knowledge. The typical problems, tasks and their applications in the area of ecology are discussed as well. The course is an extension of the courses, related to ecology, giving students a real opportunity to represent and model knowledge in a given area.

The extramural activities in this course involve working in the library and developing the course project. The ratio between the auditorium activities and the additional activities is 1:2.

Discipline content:

Lectures

Topic	Lecture	Independent work in library	Independent work with computer	Project work
1. Semantic annotation.	2			
2. Ontologies and ontology systems.	4			
3. Systems and tools for representation of ontology knowledge.	2		1	
4. Methodology for design and development of ontologies.	4	1	2	
5. Features of the ontology Cyc. Features of inference in Cyc.	2	1	2	
6. Tools for describing of information resources in RDF/RDFS.	4	1	2	
7. General characteristics of the language OWL. Basic structures for describing ontologies in OWL.	4	1	3	
8. Tools and environments for developing of ontologies. Protégé.	4	1	4	
9. Ontologies for knowledge management. Usage of the ontologies in ecology domain.	4	1	2	8
Total	30	6	16	8

Lab Exercises

Topic	Lecture	Independent work in library	Independent work with computer	Project work
1. Semantic annotation.	1			
2. Ontologies and ontology systems.	1			
3. Systems and tools for representation of ontology knowledge.	1		1	
4. Methodology for design and development of ontologies.	2	1	2	
5. Features of the ontology Cyc. Features of inference in Cyc.	1	1	4	
6. Tools for describing of information resources in RDF/RDFS.	2	1	4	
7. General characteristics of the language OWL. Basic structures for describing ontologies in OWL.	3	1	5	
8. Tools and environments for developing of ontologies. Protégé.	2	1	4	
9. Ontologies for knowledge management. Usage of the ontologies in ecology domain.	2	1	7	12
Total	15	6	27	12

Literature:

1. Davies, J., R. Studer, P. Warren (Eds.). Semantic Web Technologies: Trends and Research in Ontology-based Systems. Wiley, 2006.
2. Russell, S., P. Norvig. Artificial Intelligence: A Modern Approach (3rd ed.). Pearson Education Ltd., 2010.
3. OWL 2 Web Ontology Language Document Overview. W3C Recommendation, 27 October 2009. Available at http://www.w3.org/TR/owl2-overview/

4. What is Cyc? Available at http://www.cyc.com/cyc/technology/whatiscyc
5. Matthew Horridge, Sebastian Brandt. A Practical Guide to Building OWL Ontologies Using Protégé 4 and CO-ODE Tools, Edition 1.3. University of Manchester, 2011. Available at http://owl.cs.manchester.ac.uk/tutorials/protegeowltutorial/resources/ProtegeOWLTutorialP4_v1_3.pdf
6. Thomas R. Gruber. Toward Principles for the Design of Ontologies Used for Knowledge Sharing. International Journal of Human-Computer Studies, Vol. 43 (1995), pp. 907-928. Available at http://tomgruber.org/writing/onto-design.pdf

Technology of education and grading:

А. Lectures: Lectures with the whole group, which chooses the course.

Б. Lab exercises: Exercises in the small groups.

В. Current control and final evaluation of the knowledge: The current control (К) is carried through during the lab exercises. The final assessment (Оок) is calculated using the current control during the term and the assessment for class project (П) according the formula:Оок = (К + П)/2

Chronoecology with Dendrochronology Analyze

ECTS credits: 4
Hours per week: 2l+1pe
Form of assessment: on-going control and exam
Examination type: written
Semester: I
Methodological guidance:
Department: Informatics
Faculty of Mathematics and Natural Sciences
Lecturer:
Assoc. prof. drMariyanaLyubenova, Department „Ecology and EP“, SofiaUniversity
E-mail: ryann@abv.bgryana_l@yahoo.com

Annotation:

The dynamics of biological systems of different rank / individuals, populations, communities, ecosystems and biosphere/ in connection with various continuous changes and dynamics of environmental factors are considered in the course "Chronoecology with Dendrochronology Analyze". Particular attention is paid to the biological rhythm as synthesized adaptation with exo-endogenous nature in various biological systems and its modification –the expression of ecological plasticity and also the basis for the systems evolution. The impact of anthropogenic factors on the natural history of biological phenomena at different levels is also considerred.Students are introduced to the modeling capabilities of the change and the dynamics of biological phenomena and with the development of the dynamic global models.

The lecture course gives an information on the nature and possibilities of dendrochronology as one of the most advanced and perspective methods for chronoecological analysis.

Knowledge and understanding of the natural history of natural phenomena andbiological rhythms is important for the environmental assessment and to assess the extent of its modification, also for forecasting and environmental management of natural resources.

Discipline content:

- Periodicity and time lack of regularity of the environmental factors. Time measurement and determination of periodicals through mathematical - physical methods.
- Cronology and periodicals of biological time –its endo-and exogenous nature and as a result of self-regulation systems and adaptation to environmental factors.

- Types of biorhythmsof biological systems: daily rhythms,monthly and "tidal" / lunar / rhythms,annual rhythms, multi-annual and ancient rhythms and changes in environmental factors. Characteristics of biological rhythms and theirendo - exogenous conditioning. Importance of cosmicfactors, geophysical factors and environmental regimes. Phylogeny and ontogeny of changes in biological rhythms. Ecological significance. Modeling capabilities and assessment of changes and rhythms in the environmental factors. Influence of human factors on perennial and ancient changes. Evolution of the systems. Link between ancient and perennial changes in populations and communities and states, functioning and evolution of ecosystems and the biosphere.
- Ecological and biological bases of dendrochronology. Periodicity in the growth of the stems of woody plants. Factors influencing the characteristics of the annual rings. Dendrochronology and global monitoring and rhythmic changes in the environment. Basic models.

Literature:

A) BAISIC READING

1. Lyubenova, M. 2006. Chronoecology. Sofia, Publisher „An-Di».
2. Mirtchev, St., M.Lyubenova, A.Chikalanov, N.Simeonova. 2000. Dendrochronology. A short course. S., Pensoft, 198.
3. Stoynev, A., O.Ikonomov, N.Vrabchev, A.Kurtev. 1991. Biorithms. MedicinaiFiskoultura, C.: 135.
4. Rensing, L. 1973. BiologischeRhythmen und Regulation. Gustav FicherVerlag, Stuttgart : 265 p.
5. Saunders, D. 1977. An Introduction to Biological Rhythms. Thomson Litho Ltd., East Kilbride, Scotland: 167.
6. Schweingruber F. H. 1996. Tree Rings and Environment Dendroecology. P.H.P.B., Stuttgart-Vienna. 603.

B) FURTHER READING

7. Asenova, A., M. Lyubenova, S. Mirchev. 2001. Dendrochronological investigation on red oak in Sofia district. – In:Third Balkan Scientific Conference, 2-6.10.2001 "Study, Conservation and Utilization of Forest Resources", vol. 1, 125-134.
8. Asenova,A., M. Lyubenova, A. Bratoeva. 2005. Dendroecological investigations in reserve "Sokolata", MalashevskaMountain. – In: Proceeding " First National Scientific Conference of Ecology - biodiversity, ecosystems, global changes", Sofia, 145-155.
9. Bratanova-Dontcheva, Sv., St. Mirtchev, M. Lubenova. 2005. Dendrochronological investigation of Mistletoe Growth Impact (*Loranthuseuropeus* L.) on European chestnut (*Castanea sativa* Mill.). ActaHorticulturae, special issue, Chaves, Portugal, 367-373.
10. Lyubenova, M., S. Mirchev, R. Nedelchev. 2001. Dendrochronological investigation of *Taxusbaccata* L. from the common yew-beech forests in "Central Balkan" National Park. – In:Third Balkan Scientific Conference, 2-6.10.2001 "Study, Conservation and Utilization of Forest Resources", vol. 1, 108-115.
11. Lyubenova, M., A.Asenova. 2003. Indicatory significance of the early and late wood of *Quercusrubra* L. in dendroecological research in Sofia region. PhytologiaBalcanica 9(1), Sofia: 53-58.
12. Lyubenova, M., A. Asenova. 2005. Indicatory Significance of Early and Late Wood of Pinus*sylvestris* L. and *Pinusnigra*Arn. Located in Sofia Region, Bulgaria. Journal of Balkan Ecology, vol. 8, N 1, 47-55.
13. Lyubenova, M., A. Asenova, E. Mihov. 2005. Dendroecological investigation of Balkan's pines in National park "Pirin". Annuire de l'Universite de Sofia "St. KlimentOhridski", Part II, v.96, l. 4, 343-351.
14. Mirtchev, S., M. Lyubenova, A. Shikalanov. 2008. Climate reconstruction from oak tree-ring records in Southwestern Bulgaria for the last 200 years. Journal ofBalkan Ecology, Vol. 11, No 4, 419-427.

15. MirchevSt., M. Lyubenova, V. Dimitrova, Sv. Bratanova – Doncheva. 2009.Dendrochronological investigation on *Castaneasativa*Mill. inBelasitza mountain andWestern Balkans (Berkovitza). Biotechnol. &Biotechnol. EQ 23/SE. p.377-380.

Technology of education and grading:

Lectures are developed on Power point and presented with video - Projector. Practical classes are conducted in subgroups in a laboratory where students are introduced to measurement, stages of statistical data processing and modeling of stemgrowths, depending on environmental factors. At the end of each students are familiarized with topics of the next exercise.

Extracurricular training of students is related to work in a library, Internet, individual consultations to prepare for the exercises, preparation of essays coursework, and exam preparation.

During the semester students carry out periodical checks of knowledge by presenting a PowerPoint presentation on given topic and its discussion in front of the group.They also will solve tests, which correspond to parts of lectures content. The students will be assessed according to their performance in class and prepared course work.The relative weight of the current control is 40% of the total score.

The examination procedure involves solving computer test or detailed answer two questions from a pre-defined conspectus. The relative weight of the final assessment in the overall assessment is 60%.

ENVIRONMENTAL STANDARDS AND REQUIREMENTS

ECTS credits: 4 **Hours per week:** 2l+0se+0le+1pe+p
Form of knowledge evaluation: Examination **Examination type:** written
Semester: I
Methodological guidance:
Chair: "Geography, Ecology and Environment Protection"
Faculty: Mathematics and Natural Sciences
Lecturers:
Ass. Prof. Dr. Eng. StefkaCekova
E-mail:teshe@swu.bg

Abstract:

Environmental Law is a system of principles, requirements and standards aimed to regulate relations arising from the management of the main components of the environment, in order to maintain the balance between them, protect life and health and ensure sustainable development.Essential forenvironmental managementis the consistentapplication of the principleof 'integrationpolicy' and the inclusion ofenvironmental concernsin branch policies.Overall, environmental requirements and standards are intended to introduce a better law rules in the field of environmental protection and human health, regulate and adjust social and economic behavior of individuals, legal entities and businesses within the approved national and international norms and standards so as to ensure and guarantee the constitutional rights of Bulgarian citizens for living in a healthy and propitious environment.

Course "Environmental regulations and requirements" is studied by master students "Information technologies in ecology" in order to prepare staff to implement control activities and to participate in the development of information technology, expertise, plans and programs related to the protection of components of the environment, and reducing the adverse factors.

Emphasis in training is placed on sustainable development implies a deliberate policy of environmentally friendly technologies to reduceanthropogenic impact on the components of environment .At the learning process are examined directives, regulations and decisions of the European Union andharmonization of the Bulgarian legal structure relating to the management of the environment and harmful factors such as noise and waste.

Course content:

Course covers two groups of theoretical questions:
- General theoretical - National priorities and strategic documents;
-Environmental requirementsand standardsfor the management ofenvironmental components, widespread wasteand noise.

The course "Environmental Regulations and Requirements" provides students - MSc necessary knowledge and skills to apply them in practice in compliance with the environmental requirements for permissible emissions or impacts of different production activities.

Teaching and assessment:

In the process of teaching students - Masters lectures and practical classes are provided Lectures are conducted in a traditional way. They are illustrated with visual material, showing the limit concentrations of various pollutants in the environmental media and commenting good practice globally.

. The workshops are conducted in the laboratory. Students will get acquainted with structure of EU environmental policy, basic principles of the strategy "Environment 2020" and industries polluting the environment components. Tolerances and requirements as well as the best European practices will be commented.

Extramuraltraining of studentsismainly related toworkingin a library, individual and group consultation with the teacher.

During the course of study is an ongoing review of the evaluation of knowledge - preparing and defending of abstract analysis of certain legal document, selected by students, solving test and a testpaper that corresponds to the contents of the lectures.

Criterion for assessing the degree of implementation of tasks (essay, test) taking into account: the level of competence and analytical skills:Excellent 6 - more than 89%, Very Good 5 - 70% - 89%, Good 4 - 45% - 69%, Satisfactory 3 - 30% - 44%, Off 2 - below 30%.
The developed abstracts are defended in front of students who will evaluate themselves the thesis.

To the exam will be admitted only these students who have fulfilled the requirements of the Rules of the educational activities of the SWU, have met the requirements for mastering the content of the course set out in their audience, and individual employment and overall assessment of the current control is not lower Average of 3.

The share of current control weighting is 40% and its relative weight in the abstract or presentation, 60% and 40% test under developed and adopted in the Department «GEOOS» system for monitoring and evaluation of students' knowledge.

CONTEMPORARY TECHNOLOGIES AND ENVIRONMENTAL PROTECTION

ECTS credits: 4 **Hours per week:** 2l+1pe
Form of assessment: on-going control and exam **Examination type:** written
Semester: I
Methodological guidance:
Department: “Geography, Ecology and Environmental Protection”
Faculty of Mathematics and Natural Sciences
Lecturers:

Associated profesor Dimitrina Kerina, PhD – d_kerina@swu.bg
Assistant professor Vladimir Gaberov- vgaberov@swu.bg

Annotation:

The general loading of the course is 45 hours (it includes 30 lecture hours and 15 hours laboratory exercises) and 75 out auditorium hours. It is an elective course for subject Information Technologies in Ecology, M.S. Curriculum (2 educational semesters). The aim of the course is to introduce the students to the contemporary technologies for environmental protection from liquid and solid steady organic pollutions. Within out auditorium hours the students study the Best Available Techniques (BAT) for environmental protection.

Discipline content:

In this course are considered the following main topics: components of the surroundings; a basic characterization of the steady organic pollutions; theoretical knowledge for obviating the steady organic pollutions; prevention methods for prevention of the steady organic pollutions.

Literature:

1. Baiko B., Ecology, NBU, 2012. (in bulgarian)
2. Sokolovski E., Metrov P., etc., Obviating technologies for steady organic pollutions, BNOCOOC, 2007. (in bulgarian)
3. BAT Guidance Note for Ferrous Metal Processing and the Pressing, Drawing and Stamping of Large Castings where the Production Area exceeds 500 sq m , EPA, Aug 2012.
4. BAT Guidance Note for Ferrous Metal Foundries, EPA, 2012.
5. BAT Guidance Note - Waste Sector (Transfer & Materials Recovery), EPA, 2011.

And the following addresses: http://www.epa.ie/pubs/advice/bat; http://europa.eu/abouteuropa/index_en.htm; http://europa.eu/rapid/press-release_IP-11-1544_bg.htm

Technology of education and grading:

The lecture hours are organized according to the subject Information technologies in Ecology, M.S. Curriculum (2 educational semesters). Lectures are prepared on Power point. The contemporary technical equipment as multimedia, software, models, etc. is used for these lectures. Thestudents' extra-curriculumactivityrepresents the preparation and presentation of a scientific experimental research; conducting physical studies; testing.

The assessment of the students' results is done accordingly to the ECTS. The final rating is formed at the end of the course on the basis of the rating of a written test on all topics mentioned above, on the basis of the rating of the student's routine control and on the basis of the rating of the student's extra-curriculum activity in the following ratio.

Final grade calculation is done by using a 6-point rating scale: the rating 6 equals level A on ECTS; the rating 5 equals level B on ECTS; the rating 4 equals level C on ECTS; the rating 3 equals level D on ECTS; the rating 2 equals level E on ECTS.

OPERATIONS RESEARCH

Semester: 1 semester
Course Type: lectures
Hours per Week/FS/SS: 3 lecture hours per week/FS
ECTS Credits: 4 credits

Lecturer: Assoc. Prof. Stefan M. Stefanov, PhD
Department: Informatics, telephone: 073 / 588 532, e-mail: stefm@swu.bg

Course Status: OptionalCourse in the Information Technologies in Ecology M.S. Curriculum

Course Description: The course in Operations Research includes the following main topics: basic concepts in Operations Research; deterministic models, models with uncertainty and stochastic models, especially the facility location (production planning) problem in deterministic and stochastic version; stochastic programming and stochastic quasigradient methods; dynamic programming and Bellman's principle of optimality; the concept of algorithm, algorithmic (computational) complexity and NP-hard problems; discrete (including integer) optimization problems and network optimization; scheduling theory; queueing theory; game models, matrix game theory and the relationship between matrix game theory and linear programming; decision making theory; fuzzy sets and their application to decision making and management; multi-objective (vector) optimization and Pareto optimality; Marcov processes (discrete and continuous); the concept of Monte-Carlo methods and their applications. Software for solving some of the problems under consideration will also be demonstrated.

Course Objectives: Students should obtain knowledge about basic results and methods for studying various real objects, events, phenomena, etc. by using mathematical methods and computes.

Teaching Methods: lectures and tutorials
Requirements/Prerequisites: Numerical Analysis, Mathematical Optimization

Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).

Registration for the Course: by request at the end of the previous academic year
Registration for the Exam: coordinated with lecturer and Student Service Department

References:
Basic Titles:

1. E. S. Vencel – „Operations Research: Problems, Principles, Methodology“, 2-nd ed., Nauka, Moscow, 1988 (in Russian).
2. Yu. P. Zaichenko – "Operations Research", VisshtaShkola, Kiev, 1988 (in Russian).
3. S. M. Stefanov – "Quantitative Methods of Management", 2003 (in Bulgarian).

Additional Titles:

4. Hamdy A. Taha – „Operations Research. An Introduction", 9-th ed., Prentice Hall, USA, 2010.
5. S. M. Stefanov – "Separable Programming. Theory and Methods", Kluwer Academic Publishers, Dordrecht–Boston–London, 2001.

Abbreviation:
FS: Fall Semester
SS: Spring Semester

AEROSPACE INFORMATION TECHNOLOGIES IN ENVIRONMENTAL PROTECTION

ECTS credits: 4 **Hours per week:** 2l+1pe
Form of assessment: on-going control and exam
Examination type: written and oral
Semester: I
Methodological guidance:
Department: "Geography, Ecology and Environmental Protection"
Faculty of Mathematics and Natural Sciences

Lecturers: Prof. Dr. RoumenNedkov, Dipl. Eng.
E-mail: rnedkov@space.bas.bg

Annotation:
Aerospace Information Technologies in Environmental Protection is a comparatively new discipline with a focus on the theoretical and practical aspects of the cotemporary high technologies in investigation and protection of the environment. It discusses theoretical and practical problems of the application of the geo-information technologies and of the remote sensing in the protection of environment.

Students become familiar with the contemporary aerospace information technologies, the integrated geo-information model systems, and the systems of global positioning (GPS) which are widely applied both in monitoring and protecting the ecosystems.

As a result, in the end of the course students have gained not only theoretical knowledge about the remote sensing but also some practical skills in its applying in an integrated geo-information model system.

Discipline content:
The course discusses the problems of the contemporary integrated geo-information model systems and the general principles of the remote sensing for the Earth observation and the environmental protection. It treats the electromagnetic specter and the atmosphere impact as well as the spectral reflection characteristics of the Earth surface in the process of remote sensing.Another important subject of the syllabus is the GIS and IGMOS application in environmental protection. Different aerospace platforms are described and their functions explained. Special attention is paid to the processing of the received data and the interpretation and analysis of the images of the investigated ecosystems.

Literature:

1. Владов, М., Д. Добров, Р. Недков, М. Колпакович, Г. Сотиров. СканердистанционногозондированияЗемли. SES 2011, Seventh Scientific Conference with International Participation, SPACE, ECOLOGY, SAFETY, 29 November–1 December 2011, Sofia, Bulgaria, 101–105.
2. Иванова, И., Р. Недков, Т. Мичев, Н. Камбурова. Изследване динамиката на плаващите острови на територията на поддържан резерват „Сребърна“ на базата на аерокосмическа, GPS и наземна информация. Екологично инженерство и опазване на околната среда 2007, № 3–4, 19–28.
3. Иванова, И., Р. Недков, Н. Станкова, М. Захаринова, М. Димитрова, С. Николова, К. Радева. Анализ на наводнението от месец февруари 2012 г. на територията на с. Бисер на базата на спътникови и GPS данни в ГИС среда. SES 2012, Eighth Scientific Conference with International Participation, SPACE, ECOLOGY, SAFETY, 4–6 December 2012, Sofia, Bulgaria.

INTRODUCTION TO THE STOCHASTIC PROCESSES

Semester: 2 semester

Type of Course: lectures, and tutorials in computer lab

Hours per week – 2 hours lectures, and 1 hours tutorials in computer lab/winter semester

Credits Numbers:3credits

Lecturers:**Associate Prof. PhD. Elena Karashtranova**
Department:**Informatics, Tel.: +359 73 8889 132**

Course Status:OptionalCourse in the Information Technologies in Ecology M.S. Curriculum

Course description:
The course Introduction to Stochastic Processes should introduce students to apply the methods of stochastic processes in practice with the tools of IT. The course provides basic knowledge of stochastic processes and their application in the field of Ekology. The students should obtain basic knowledge about:

- Stochastic Processes
- The Application of Stochastic Processes in the Field of Ekologics

The main goal is to prepare students for their future researches.
After successfully completing the course the students should know and be able to apply stochastic processes in real processes.
Methods of teaching:seminars, tutorials, discussions, projectbasedmethod, simulations
Pre-requirements:Probability and Statistics, Information Technology

Assessment and Evaluation

Project- 30%
Final Test- 30%

Individual students works-40%

The course is successful completed with at least 50% of all scores.

Registration for the Course: required

Registration for the Exam: coordinated with the lecturer and the Student Service Office

Practice in Measurement Systems

Semester: 2 / 4semester
Course Type: laboratory practice
Hours per Week/FS/SS: 3 lab hours per week hours per week/SS
ECTS Credits: 3 credits
Lecturer: Ass. Prof. Anton Stoilov, PhD
Department: Physics
Course Status: Optional Course in the M.S. Curriculum

Course Description: The proposed course will address some basic methods for designing and solving scientific problems. The main objectives of the course is to equip students with practical skills and knowledge to work with specialized software programs and search for information in academic libraries. The course will demonstrate the approach to the mathematical modeling of real problems and ways of solving them. The models will be tested in practice.
Course Objectives:
Upon completing the course, the student should be able to:

- Describe the basic theoretical aspects of molecular modeling techniques
- Evaluate the successes and limitations of molecular modeling
- Analyze the results of molecular modeling calculations
- Evaluate and discuss current literature related to molecular modeling

Teaching Methods: lectures
Requirements/Prerequisites: Computer skills, Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).

Registration for the Course: by request at the end of the previous academic year
Registration for the Exam: coordinated with lecturer and Student Service Department

References:
1. Basak S., Grunwald G., Niemi G., Use of Graph-Theoretic and Geometric Molecular Descriptors in Structure-Activity Relationships, in From Chemical Topology toThree-Dimensional Geometry, edited by Balaban A., Plenum Press N.Y., 1997
2. Baxter M.J., Beardah C.C.,Beyond the histogram − improved approaches to simple
data display in archaeology using kernel density estimates, Department of Mathematics, Statistics and Operationa lResearch, The Nottingham Trent University, http://science.ntu.ac.uk/msor/ccb/romenew.ps
3. Baxter M.J., Beardah C.C.,MATLAB Routines for Kernel Density Estimation and the Graphical Representation of Archaeological Data Department of Mathematics,
Statistics and Operational Research, The Nottingham Trent University, 2010, http://science.ntu.ac.uk/msor/ccb/caarev.ps
4. Boething R.S., Mackay D. (editors), Handbook of Property Estimation Methods for Chemicals. Environmental and Health Sciences, Lews Publishers, 2000

5. Bohacek R.S., McMartin C., Multiple Highly Diverse Structures Complementary to Enzyme Binding Sites: Results of Extensive Application of a de Novo Design Method Incorporating Combinatorial Growth

Abbreviation:
FS: Fall Semester
SS: Spring Semester

Environmental Management

ECTS credits:4 **Hours per week**:2lec + 1ex
Form of Assessment: exam **Type of exam**: written
Semester: II
Departments involved:
Department of Geography , Ecology and Environmental Protection
Faculty: Mathematics and Natural Sciences
Lecturer:Assoc. Prof. M. Michailov, PhD - "GEOOS "

Abstract :

The aim of the course "Environmental Management" is to give the students of "Information technologies in ecology" - degree "Master" basic knowledge of the legal framework, the requirements and approaches in the management of various production activities in order to avoid negative impacts on the environment.

Students acquire skills to analyze and evaluate the various management activities in relation to the use and protection of the environment components including and as regards the clarification of the possible impacts on them.

The course "Environmental Management" provides students with the necessary knowledge to participate in teams in developing strategies, programs, systems and plans for the management of technological processes and management of environmental components.

Course content:

Policy and legal framework of the EU and Bulgaria in the field of environmental management.Criteria for the significance of the impact on the environment components. Environmental requirements for process control. Management company. Environmental requirements and standards.Management of the business activities and requirements for air emissions; in the formation of waste water; in the formation of waste; at load noise, radiation, fields and etc.Ecological risk and responsibility.Strategies and policies. Control in the implementation of environmental management.

Technology of education and grading:

The course "Environmental Management" is done by teaching 30 hours of lectures and 15 hours conducting seminars. The lectures cover the basic questions on the content of the discipline, and various visualizations - multimedia, educational videos, demo software, visual aids (posters and schemes), some of which were developed as term papers for students.

During the practical exercises exercise ongoing control of the acquired knowledge and skills. Students shape their work on individual topics such as assignments that are evaluated and only a positive assessment (at least average 3.25) are examine.

The course ends with a written exam.The final grade is based on the results of the course assignments and the semester examination (50/50%) as developed and adopted at the department "GEOOS" system for monitoring and evaluation of students' knowledge .

4. Мардиросян, Г. Аерокосмически методи в екологията и изучаването на околната среда. Част 1, Част 2. Академично издателство „Марин Дринов“, С. 2003.
5. Мардиросян, Г. Природни екологични катастрофи. Изучаване, превенция и защита. Академично издателство „Марин Дринов“, С. 2009.
6. Недков, Р., Е. Руменина, Л. Филипов, П. Христов, М. Димитрова, М. Захаринова, В. Найденова, Г. Желев. Web-базиран мониторинг наатмосферните замърсявания в района на община Стара Загора набазата на спътникови данни. SENS 2007, Third Scientific Conference with International Participation, SPACE, ECOLOGY, NANOTECHNOLOGY, SAFETY, 27–29 June 2007, Varna, Bulgaria, 264–273.
7. Недков, Р., Пл. Христов, И. Иванова, М. Димитрова, М. Захаринова, Г. Желев, Д. Бонева. Екологично мониторингово изследване в района на полигон Змейово на базата на спътникови и наземни данни. Екологично инженерство и опазване на околната среда, № 4, 2011, 72–78.
8. Свейн, Ф., Ш. Дейвис. ДИСТАНЦИОННОЕ ЗОНДИРОВАНИЕ: количественый подход. М., „Недра“. 1983.
9. Nedkov, R., A. Pavlova; Analysis of Remote Sensing Different Methods for Forest Ecomonitoring in Different Seasons. 2nd International Conference *Recent Advances in Space Technologies, Space in the Service of Society*, RAST–2005, June 09–11, 2005, Istanbul, Turkey, Published by IEEE, 85–88.
10. Nedkov, R. Assessment of Information Efficiency and Data Quality from Microsatellite for the Need of Ecological Monitoring. Aerospace Research in Bulgaria, 2012 ,Volume (24), 146–150.
11. Nedkov, R., I. Ivanova, D. Panayotova, M. Dimitrova, M. Zaharinova. Ecomonitoring Investigation of Land Cover of the Municipality of Kardzhali, Using Aerospace and GPS Data. Екологично инженерство и опазване на околната среда, No 4, 2012.
12. Travaglia, Carlo, LjudmilaMilenova, RoumenNedkov, at all., PREPARATION OF LAND COVER DATABASE OF BULGARIA THROUGH REMOTE SENSING AND GIS, FAO of UN. Rome, 2001.

Technology of education and grading:

Lectures are developed on Power Point and will be presented to the students through a video-projector.

Practical exercises are connected with getting knowledge on GPS measuring and solving of individual problems. In the end of the course students prepare a paper on the basis of their own measuring of an object.

Extracurricular training of students consists in reading books and articles in the library or in the Internet and individual consultations.

The examination procedure involves a written and an oral exam. The final grade takes into consideration both the paper and the student participation in the exercises.

SPECIALIZIED SOFTUER FOR STATISTICAL ANALYSIS

Semester: 2 semester

Type of Course: lectures, and tutorials in computer lab

Hours per week – 2 hours lectures, and 1 hours tutorials in computer lab/winter semester

Credits Numbers:3credits

Lecturers:**Associate Prof. PhD. Elena Karashtranova**
Department:**Informatics, Tel.: +359 73 8889 132**

Course Status:**ElectivecourseincurriculumofMSc Degree, Period of Study1 year (2 semesters).**

Course description:

The course Specialized software /Statistical analysis of data with the help of IT (MS Excel, Statistica, SPSS)/ should introduce students to apply the methods of statistics in practice with the tools of IT.
The main objectives of the modeling the empirical data and application in the IT are introduced in the course.Contemporary technologies used for their application (MS EXCEL, SPSS and STATISTICA) are also included in the course.
Objectives:

- **To give students theoretical knowledge of the main statistical procedures, as well as some specifics of their usage.**
- **To teach students how to create models for statistical analysis of experimental data.**
- **To present contemporary IT for statistical analysis to the students.**
- **To prepare students for their future researches.**

After successfully completing the course the students should:

- **know and be able to apply procedures for statistical analysis of experimental data;**
- **manage to create, edit, export and import data in contemporary IT;**
- **be able to create models for statistical analysis of experimental data.**

Methods of teaching:**seminars, tutorials, discussions, projectbasedmethod, simulations**
Pre- requirements:**Probability and Statistics, Information Technology**

Assessment and Evaluation

Project- 30%
Final Test- 30%

Individual students works-40%

The course is successful completed with at least 50% of all scores.

Registration for the Course: **required**

Registration for the Exam**: coordinated with the lecturer and the Student Service Office**

SCRIPT LANGUAGES

Course Title: Script languages
Semester: 2/4 semester
Course Type: lectures and tutorials
Hours per Week/FS/SS:2 lecture hoursper week/FS
ECTS Credits: 2 credits
Lecturer: Assoc. Prof. Ivan Trenchev, PhD
Department: Informatics, telephone: 073 / 588 532, e-mail: stefm@swu.bg
Course Status: Optional Course in the Bioinformatics M.S. Curriculum

Course Description: The proposed course consider scripting languages used in the solution of certain scientific problems. The main objectives of the course is to acquaint students with scripting languages programming. Students will gain practical skills and knowledge to work with specialized software programs.
The course will demonstrate the ability of some scripting languages for processing data received from from various scientific research. The models will be tested in practice. Examples of scripting languages are: R language, Matlab and others.
Course Objectives: The goal of the studied subject is for students to gain knowledge and skills in scripting languages, programming for data processing.
Teaching Methods: lectures and tutorials
Requirements/Prerequisites: Basic Computer skills

Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).

Registration for the Course: by request at the end of the previous academic year
Registration for the Exam: coordinated with lecturer and Student Service Department

References:

Basic Titles:

1. Norman Matloff. The Art of R Programming, 2011
2. Jim Albert. Bayesian Computation with R, Springer, 2009.
3. Phil Spector. Data Manipulation with R, 2008.
4. Brian S. Torvitt, TorstenHothorn. A Handbook of Statistical Analyses 2006.
5. John Maindonald, John Braun. Data Analysis and Graphics Using R: An Example-Based Approach, Cambridge University Press, 2003.
6. John M. Chambers. Programming with Data, Springer, New York, 1998. This is also called the "Green Book".

Abbreviation:

FS: Fall Semester
SS: Spring Semester