

Environment Science Domain – D
Ecology and Environment Protection Specialization - D1

ANUL I

No. crt.	Obligatory disciplines	Code discipline	Semester I					Semester II				
			C	S	L	Form of examination	Credits no.	C	S	L	Form of examination	Credits no.
1	Plant biology 1	3906DD1F01I001	2	-	2	E1	5	-	-	-	-	-
2	Plant biology 2	3906DD1F02I002	-	-	-	-	-	2	-	2	E2	5
3	Animal Biology 1	3906DD1F01I003	2	-	2	E1	5	-	-	-	-	-
4	Animal Biology 2	3906DD1F02I004	-	-	-	-	-	2	-	2	E2	5
5	Basic human anatomy and hygiene	3906DD1F01I005	2	-	2	E1	4	-	-	-	-	-
6	General ecology	3906DD1F02I006	-	-	-	-	-	3	1	2	E2	6
7	General Chemistry	3906DD1F01I007	1	1	1	E1	4	-	-	-	-	-
8	Environmental chemistry	3906DD1F02I008	-	-	-	-	-	2	1	1	E2	4
9	Physical environment I (Geomorphology with elements of Geology)	3906DD1F01I009	2	1	2	E1	5	-	-	-	-	-
10	Physical environment II (Hydric environment)	3906DD1F02I010	-	-	-	-	-	2	1	1	E2	5
11	Applied special mathematics in ecology	3906DD1S01I011	1	1	-	C1	3	-	-	-	-	-
12	Computer operation	3906DD1C02I012	-	-	-	-	-	-	-	2	C2	3
13	Foreign language 1	3906DD1C01I013	1	1	-	C1	3	-	-	-	-	-
14	Foreign language 2	3906DD1C02I014	-	-	-	-	-	1	1	-	C2	3
15	Physical training 1	3906DD1C01I015	-	2	-	V1	-	-	-	-	-	-
16	Physical training 2	3906DD1C02I016	-	-	-	-	-	-	2	-	V2	-
Total obligatory hours on week			11	4	9	5E2CIV	29	12	4	10	5E3CIV	31
			24					26				
Facultative disciplines												
17	Environmenty physics	3906DD1F02F017	-	-	-	-	-	1	1	-	C1	3
18	General human geography	3906DD1F02F018	-	-	-	-	-	1	1	-	C1	3
Total facultative hours on week								2	2	-	C1	3
								4				

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ANUL II

No. crt.	Obligatory disciplines	Code discipline	Semester I					Semester II				
			C	S	L	Form of examination	Credits no.	C	S	L	Form of examination	Credits no.
19	Environmental plant physiology	3906DD1S03I019	2	-	2	E3	5	-	-	-	-	-
20	Environmental animal physiology	3906DD1S04I020	-	-	-	-	-	2	-	2	E4	4
21	Animal biology III	3906DD1F03I021	3	-	3	E3	5	-	-	-	-	-
22	Ecologia populațiilor	3906DD1S03I022	2	1	1	E3	5	-	-	-	-	-
23	Phytosociology and romanian vegetation	3906DD1S03I023	2	1	1	E3	5	-	-	-	-	-
24	Physical environment III (atmospheric environment)	3906DD1F03I024	2	1	1	C3	4	-	-	-	-	-
25	Hidrobiology	3906DD1S04I025	-	-	-	-	-	2	-	2	E4	4
26	Ecosystems: structure and functions	3906DD1S04I026	-	-	-	-	-	2	1	1	E4	4
27	Genetics	3906DD1F04I027	-	-	-	-	-	2	1	1	E4	4
28	Microbiology	3906DD1F04I028	-	-	-	-	-	2	-	1	E4	3
29	Biochemistry	3906DD1F03I029	2	-	1	C3	3	-	-	-	-	-
30	Physical training 3	3906DD1C03I030	-	2	-	V3	-	-	-	-	-	-
31	Practice 14 dayss x 6 hours = 84 hourse	3906DD1S04I031	-	-	-	-	-	-	-	-	C4	3
	Optional course 1		-	-	-	-	-	1	1	-	C4	3
	Optional course 2		-	-	-	-	-	1	1	1	C4	4
	Optional course 3		-	-	-	-	-	1	1	-	C4	4
			13	3	9	4E2C1V	27	13	5	8	5E4C	33
Total obligatory hours on week			25				26					
Optional disciplines												
Optional course 1												
32	Synecological biogeography	3906DD1F04O032	-	-	-	-	-	1	1	-	C4	3
33	Biogeography	3906DD1F04O033	-	-	-	-	-	1	1	-	C4	3
34	Environmental geography	3906DD1F04O034						1	1		C4	3
Optional course 2												
35	Pollution sources and agents	3906DD1S04O035	-	-	-	-	-	1	1	1	C4	4
36	Ecotoxicology	3906DD1S04O036	-	-	-	-	-	1	1	1	C4	4
Optional course 3												
37	Pedology	3906DD1F04O037	-	-	-	-	-	1	1	-	C4	4
38	Bioproductivity	3906DD1F04O038	-	-	-	-	-	1	1	-	C4	4
Facultative disciplines												
39	Ecological ethics and education	3906DD1F03F039	1	1	-	C3	3	-	-	-	-	-
40	Ecology history	3906DD1F04F040	-	-	-	-	-	1	1	-	C4	3
Total ore facultative pe săptămână			1	1	-	1C	3	1	1	-	1C	3
			2				2					

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ANUL III

No. crt.	Obligatory disciplines	Code discipline	Semester I					Semester II				
			C	S	L	Form of examination	Credits no.	C	S	L	Form of examination	Credits no.
41	Parasitology	3906DD1S05I041	2	-	2	C5	4	-	-	-	-	-
42	Modeling of ecological processes	3906DD1S05I042	2	-	2	E5	4	-	-	-	-	-
43	Forest ecology	3906DD1F05I043	2	1	1	E5	4	-	-	-	-	-
44	Environmental degradation and protection	3906DD1F05I044	2	1	1	E5	4	-	-	-	-	-
45	Ecological genetics	3906DD1S05I045	2	1	1	C5	4	-	-	-	-	-
46	Biodiversity management	3906DD1S06I046	-	-	-	-	-	2	1	1	E6	5
47	Ecological monitoring	3906DD1S06I047	-	-	-	-	-	2	1	1	E6	5
48	Human ecology	3906DD1S06I048	-	-	-	-	-	2	1	1	E6	5
	Optional course 4		2	1	-	C5	5	-	-	-	-	-
	Optional course 5		1	1	1	C5	5	-	-	-	-	-
	Optional course 6		-	-	-	-	-	2	1		C6	5
	Optional course 7		-	-	-	-	-	1	1	-	C6	5
	Optional course 8		-	-	-	-	-	2	1	-	C6	5
Total ore obligatorii pe săptămână			13	5	8	3E4C	30	11	6	3	3E3C	30
License examination												
	License examination		-	-	-	-	-	-	-	-	-	15
	License elaboration		-	-	-	-	-	-	-	-	-	15
Complementary discipline												
Curs opțional 4												
49	Insect ecology	3906DD1S05O049	2	1	-	C5	5	-	-	-	-	-
50	Agroecology	3906DD1S05O050	2	1	-	C5	5	-	-	-	-	-
Curs opțional 5												
51	Plants ecology	3906DD1S05O051	1	1	1	C5	5	-	-	-	-	-
52	Vegetal resources	3906DD1S05O052	1	1	1	C5	5	-	-	-	-	-
Curs opțional 6												
53	Ethology	3906DD1S06O053	-	-	-	-	-	2	1	-	C6	5
54	Evolutionism	3906DD1F06O054	-	-	-	-	-	2	1	-	C6	5
Curs opțional 7												
55	Legislation, politics and environment strategies	3906DD1F06O055	-	-	-	-	-	1	1	-	C6	5
56	Global change of environment	3906DD1C06O056	-	-	-	-	-	1	1	-	C6	5
57	Environment economy	3906DD1F06O057	-	-	-	-	-	1	1	-	C6	5
Curs opțional 8												
58	Environment protection technology	3906DD1S06O058	-	-	-	-	-	2	1	-	C6	5
59	Waste management	3906DD1S06O059	-	-	-	-	-	2	1	-	C6	5
60	Water resources management	3906DD1F06O060	-	-	-	-	-	2	1	-	C6	5

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<i>Facultative disciplines</i>												
61	Pests integrate disprove	3906DD1S05F061	1	1	-	C5	3	-	-	-	-	-
62	Impact assessment studies methodology	3906DD1F06F062	-	-	-	-	-	1	1	-	C6	3
Total ore facultative pe săptămână			1	1	-	1C	3	1	1	-	1C	3
			2						2			

IX. Synthetic situation of the subject matters, number of hours and of their weight in the educational plan

Total of subject matters in the educational plan = 62

Total of subject matters (obligatory and complementary) for the credits achievement = 45

Total hours: 1990 hours + 84 practic hours = 2074 hours

Courses hours in comparison with the seminary and laboratory hours: $69/80 = 0.86$

A. Fundamental discipline = 31; 50% - 1054 ore;

B. Specialization discipline = 24; 38,7% - 844 ore

C. Complementary discipline = 7; 11,29% - 92 ore

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I

PLANTS BIOLOGY 1

Course coordinator : Drd. MIHAI CRACIUNAS titular – Chair of Ecology and environment protection

Year : I semester : 1

No. hours course: 2 ; **no. hours laboratory :** 2

Discipline type : obligatory ; fundamental/basic

ECTS: 5

Prerequisites: -

Aims: Knowledge of peculiarities, form, dimensions and ultrastructure of plant cell. Knowledge of plant tissue types and peculiarities. Knowledge of vegetative and reproductive organs' morphology in plants. Presentation of talophytes phylla' characteristics and description of main representatives. Content: Plant cell; Histology; Plant tissues' peculiarities; Root; Stem; Leaf; Plants' reproduction; Flower; Fruit; Seed; Phylum Chlorophyta; Phylum Phaeophyta; Phylum Rhodopyta; Phylum Myxophyta; Phylum Mycophyta; Phylum Lichenophyta; Phylum Bryophyta.

Skills: Capability to understand and render terms, concepts and principles of Systematic Botany, to explain the living world's unity. Competence to explore the vegetal world at micro- and macroscopic level and capability to identify the main plant species of the region/country.

Assesement :

The final mark will be calculated based on :

Practical examination 25 %

Mid semester examination 25%

Final examination 50%.

References :

Deliu, C., 2003, Morfologia și anatomia plantelor, Univ. Babeș-Bolyai, Cluj-Napoca

Momeu, Laura, Drăgulescu, C., 2008, Algoflora județului Sibiu, Edit. Univ. "Lucian Blaga" Sibiu

Negrean, G., Drăgulescu, C., 2005, Mycobiota județului Sibiu, Edit. Univ. "Lucian Blaga" Sibiu

Pop. I. și colab., 1983, Botanică sistematică, Edit. did. și pedag. București

PLANTS BIOLOGY 2

Course coordinator : Prof. Dr. DRĂGULESCU CONSTANTIN titular – Chair of Ecology and environment protection

Year : I **semester** : 2

No. hours course: 2 ; **no. hours laboratory** : 2

Discipline type : obligatory ; fundamental/basic

ECTS: 5

Prerequisites: Plants biology 1

Aims: The knowledge and understanding by the students of terms, notions, concepts, and principles specific to Botany, focusing on the systematics of plant kingdom. The presentation of cormophytes (superiour plants) phyla's characteristics and the description of main representatives. Highlighting the role of these plants in nature.

Content: General characteristics of Cormobionta ; Phylum Pteridophyta; Phylum Gymnospermatophyta; General characteristics of Phylum Angiospermatophyta. Class Magnoliatae; Class Liliatae.

Skills : Capability to understand and render terms, concepts and principles of Systematic Botany, to explain the living world unity. Competence to explore the vegetal world and capability to identify the main plant species of the region/country and to perform intellectual and practical activities on cormophytic flora.

Assesement :

The final mark will be calculated based on :

Practical examination 25 %

Mid semester examination 25%

Final examination 50%.

References :

Drăgulescu, C., 1993, Botanică sistematică și ecologică (Systematic and ecologic botany), Edit. Univ. Sibiu

Drăgulescu, C., 2003, Cormoflora județului Sibiu (Cormoflora of Sibiu County), Edit. Pelecanus Brașov

Pop. I. și colab., 1983, Botanică sistematică (Systematic botany), Edit. did. și pedagog. București

Ștefan, N., Oprea, A., 2007, Botanica sistematică (Systematic botany), Edit. Univ. "Al. I. Cuza" Iași

BASIC HUMAN ANATOMY AND HYGIENE

Course coordinator: Conf Dr .univ **ZAMFIR ALEXANDRA**

Year, semester: I, 1, EPM; I, 2 BIOLOGIE

No. hours course: 2; **no. hours laboratory:** 2

Discipline type compulsory, ECTS: 5

Prerequisites: Cell Biology, Molecular Cell Biology, Biochemistry

Aims This course present the fundamental structure of human organs and systems in a format that is suitable for undergraduate students, regardless of academic background or fields of study: ecology, biology, or other allied health professions. This course progress from the tissues to the organ of human and finally to the total organism like a biological system

Content Whereas Part 1 focussed mainly on the basic principles of functions and structure of human tissues. Part 2 converges on form and anatomy of nutritional and relational organs of human systems. For each anatomical structure are presented risk factors and how we can prevent the anatomical diseases and protection means.

Skills

- recognize morphological and anatomical features of all systems from human body
- describe anatomical structures of nutrition and relations and control human systems
- point out which actual risk factors related diseases and modified the structures of human organs
- perform to act in specific situation (nutrition, breath, circulatory, excretory, mental, endocrinology, motory, diseases) of the first aim or prevention measures of those diseases

Assessment: The final mark will be calculated based on :

activity during laboratory (%)

practical examination (%)

essay preparation (%)

mid semester examination 25 (%)

final examination 75 (%)

References

Ilie, Daniela, Minodora și Alexandra Zamfir, 2005, Anatomia omului, vol.I, Ed.Univ. "Lucian Blaga", Sibiu

Zamfir Alexandra, 2000, Anatomia și igiena omului, Ed. Alma Mater, Sibiu

ENVIRONMENTAL CHEMISTRY

Course coordinator: Lecturer Dr. CECILIA GEORGESCU, university's holder

Year, I semester: 2

No. hours course: no. hours seminary / laboratory: 2C/1S/1L

Discipline type fundamental,

ECTS: 4

Prerequisites: General Chemistry

Aims: The formation of the necessary basic knowledge and concepts of operation with specific environmental chemistry. Exposure to physical and chemical composition of air, water and soil, knowing the main groups of pollutants. This course aims at training an attitude of reality investigative and environmental behaviour, targeting the care and responsibility towards the quality of the natural environment, with great implications on health.

Content: Scope and definition. Balances in nature. Matter and material cycles. Aspect general alteration land. Water chemistry. The chemical, physical and biological characteristics of water. Water flow in nature. Classification of water sanitation. The sources of surface water and deep. Processes that alter the composition of the water. Adsorption and ion exchange. Concentration by evaporation. General methods of purifying waste water. Atmospheric chemistry. The composition of the atmosphere. Physical properties of the atmosphere. Chemical and photochemical processes in the atmosphere. Chemical processes that form particles in the atmosphere. Soil chemistry. The structure, composition and chemical properties of soil. Humus soil. Acid-basic reaction and ion exchange in soil.

Skills: Knowing and understanding the specific terms of environmental chemistry: air, water, soil, pollution, pollutants, ecosystem, contaminant, dissolved oxygen, condensation, etc. Familiarity with the types of pollutants features for each environmental factor, the laboratory and their implications they have on human health.

Assessment: The final mark will be calculated based on:

activity during seminars (10%)

practical examination (10%)

essay preparation (10%)

mid semester examination (10%)

final examination (60%)

References:

1. Mănescu, S. și colaboratori – Chimia sanitară a mediului, Editura Medicală, București, 1982.
2. Orbeci, C.; Turtoi D. – Chimia mediului, Editura AGIR, București, 2006.
3. Georgescu, C. – Lucrări practice de chimia mediului pentru uzul studenților.
4. Ardelean, A. și colaboratori – Fundamente de chimia mediului, Editura Didactică și Pedagogică, 2008.

PHYSICAL ENVIRONMENT I (Geomorphology with elements of Geology)

Course coordinator: COSTEA MARIOARA, holder, Lect. Dr., Department of Ecology and Environmental Protection, Faculty of Science, "Lucian Blaga" University of Sibiu.

Year, semester: I year, I semester.

No. hours course: no. hours seminary / laboratory: 28 course / 14 seminary / 28 lab.

Discipline type: Basic, obligatory, no. credits: 5

Prerequisites: geographical disciplines of high school.

Aims: knowledge forms of relief, with a gradual shift from global to regional and local scale; reporting permanently forms of relief to the peculiarities of geological substrate and to the modelling; highlighting the differences imposed by tectonic, structure, petrography, modelling agent; identification geomorphological processes of the hazard and their impact on the landscape.

Content: Introductory problems; Tectonic and planetary geomorphologic system structure and intern dynamics of the Earth: The structure of the Earth. Endogenous energies and mass movements. Major relief and subordinate structures; Geological structure and its implications into geomorphological system: Types of structures - horizontal, monoclinical, folding, block - faulting, discord, magmatic structures and relief developed on them); Rocks. Physical and chemical characteristics. Relief developed different types of rocks: volcanic rocks, crystalline schists, limestone, gritstones and conglomerates, marls and clays, sand and loess. Exogenous modelling and generated geomorphologic systems: agents and processes. Fluvial morphology, glacial, periglacial and frost action and relief forms, sea, wind and anthropogenic system modelling.

Skills: recognition of forms of relief, agents and mode of their action on existing relief, explaining, interpreting geomorphological processes and forms of relief by the discovery and providing of other examples, mapping processes and forms, drafting and interpretation of geomorphological maps, comparison of representative geomorphologic indicators and establish correlations between them.

Assessment: Knowledge evaluation is done by calculating the weighted average that takes into account: 25% - work in seminars and laboratory work oral presentation of dossier they work during the semester, 25% - periodically test written in the middle of semester; 50% - final examination based on written exam with questions concerning the definition of agents, phenomena, geomorphological processes, interpretation and comparison of them, observations and personal views about geomorphological characteristics of local horizon.

References:

Ciobanu Rodica (2004), Geologie generală, Edit. Univ. Lucian Blaga din Sibiu.

Grigore, M. (1979), Reprezentarea grafică și cartografică a formelor de relief, Edit. Academiei, București.

Ielenicz, Mihai (2004), Geomorfologie, Edit. Universitară, București.

Velcea, Valeria, Costea, Marioara, (2006), Geomorfologie generală, Edit. Universității "Lucian Blaga", Sibiu.

PHYSICAL ENVIRONMENT II (HYDRIC ENVIRONMENT)

Course coordinator: COSTEA MARIOARA, holder, Lect. Dr., Department of Ecology and Environmental Protection, Faculty of Science, "Lucian Blaga" University of Sibiu.

Year, semester: I year, II semester.

No. hours course: no. hours seminary / laboratory: 28 course / 14 seminary / 14 lab.

Discipline type: Basic, obligatory, no. credits: 5

Prerequisites: geographical disciplines of high school, Physical environment (Geomorphology with elements of Geology).

Aims: knowledge diversity hydrosphere phenomena of global, regional and / or local level, presenting similarities and differentiation in hydrosphere imposed by geographical location, type rivers, drainage, the particular physical and chemical properties of the volumes of water from rivers, lakes, swamps, etc.; reporting hydrological phenomena in particular substrate geological, climatic conditions and topography of the surface coverage; Identifying of imbalance problems that raises hydrosphere at all levels, the analysis of anthropogenic impact on the river and lake systems.

Content: Overview: Scope, methods of work; Circuit and water balance in nature; Hydrogeology: Groundwater. Origin. Division. Typology. Use. Springs; Rivers Hydrology: The fluvial system - morphometrics and morphological elements. Sheet waters. Torrents. Rivers; Dynamics of river water: Sources of river. Drain water and hydrological balance, alluvia leakage. Chemical patterns and water quality of rivers, Lakes: Origin of lacustrine depression, lacustrine morphology and morphometry, the water regime of lakes, heat and frost, chemical regime; Swampy areas: Forms, evolving hydrological features; Glaciology: Limit of the permanent snow. Glacier regime. Types of glaciers. Glacier processes.

Skills: general and basic knowledge of hydrology, understanding the hydrological phenomena and relations between them and the environment, solving problems through modelling and hydrology algorithm, use graphics and cartographic representations and establishing correlations between the hydrographical and hydrological elements, the ability to apply the acquired knowledges into practice through direct measurements and observations, the ability to solve problems of elementary hydrology.

Assessment: Knowledge evaluation is done by calculating the weighted average that takes into account: 25% - work in seminars and laboratory work - oral presentation of dossier they work during the semester, 25% - periodically test written in the middle of semester; 50% - final examination based on written exam with questions concerning the definition of agents, phenomena, hydrological processes, interpretation and comparison of them, observations and personal views about hydrological characteristics of rivers of local horizon.

References:

Pisota, I. Zaharia, Liliana, Diaconu, C.D. (2005), Hidrologie, Edit. Universitară, București.
Sorocovschi, V. (2004), Hidrologia uscatului, Edit. Casa Cărții de Știință, Cluj Napoca.
Ștef, V. (1998), Hidrologie generală, Edit. Universității Lucian Blaga, Sibiu.
Ștef, V., Costea Marioara (coordonatori) (2006), Hidrologie aplicată, Edit. Universității Lucian Blaga, Sibiu.

APPLIED SPECIAL MATHEMATICS IN ECOLOGY

Course coordinator: Lecturer PhD **AMELIA BUCUR**-the subscribed

Year, semester: I,I, the specialization EPM+Biology

No. hours course: no. hours seminary / laboratory: 1C,1S

Discipline type: Gen, ECTS:3

Prerequisites: Basic knowledge of highschool mathematics.

Aims :

Knowing applied mathematical models with applicability in biology and ecology.

Content:

The course contains applications of one and many variable functions, differential equations, mathematical statistics and fractals theory in biology and ecology.

Skills:

Gain the ability to use functions, differential equations and mathematical statistics elements to solve ecology and biology problems.

Assessment:

The final mark is composed by 40% semestrial activity (20% partial exam and 20% activity at course) and 60% the final exam(the final exam has a calssical subject style).

References :

Amelia Bucur,Applied special mathematics in biology and ecology,Ed.ULBS,2008

GENERAL HUMAN GEOGRAPHY

Course coordinator: COSTEA MARIOARA, holder, Lect. Dr., Department of Ecology and Environmental Protection, Faculty of Science, "Lucian Blaga" University of Sibiu.

Year, semester: I year, II semester.

No. hours course: no. hours seminary / laboratory: 14 course / 14 seminary.

Discipline type: Basic, at will, no. credits: 3

Prerequisites: geographical disciplines of high school.

Aims: Knowledge of socio-economic reality, presented in a selective manner, in a gradual succession at the global, regional and local scale; presentation similarities and differentiate human and socio-economic requirements imposed by the position and development level, identify imbalance problems that raises human and socio-economic sphere at all levels.

Content: Basic concepts of human geography. Territorial systems. Population as a demographic resource: spatial distribution, population density, population dynamics, population structure; Human habitat: The concept of human settlement. Components of human habitat, anthropic forms of agglomeration, anthropic ecosystems. Rural village that ecosystem. City as the urban ecosystem. Organization of urban and rural space; Economic development and settlement functions: The functions of human settlements, functional dynamics imposed by economic development. Resources, exploitation, industrialization. Economic space zoning; Current Issues of human habitats: Urbanization, ecological development, quality of life, hazards, risks, sustainable development and management.

Skills: understanding and identifying of relationships between the human and socio-economic phenomena; use and interpretation of graphics and cartographic and establishing correlations between demographic indices; skills in social and human inquiry, in demographic studies and scientific research aimed at human settlements and their functional dynamics.

Assessment: Knowledge evaluation is done by calculating the weighted average that takes into account: 50% - work in seminars work - oral presentation of dossier they work during the semester, 50% - final examination based on written exam with questions concerning the definition of phenomena, anthropic and socio-economic processes, interpretation and comparison of them, observations and personal views about settlements characteristics of local horizon.

References:

Gâștescu, P. (1998), Ecologia așezărilor umane, Edit. Universității, București.

Ianoș, I. (2000), Sisteme teritoriale, Edit. Tehnică, București.

Matei, Elena (2007), Ecosistemele umane, Edit. Universitară, București.

Ungureanu, A (2000), Geografie umană generală, Edit. Univ. "Al. I. Cuza", Iași.

II

ENVIRONMENTAL PLANT PHYSIOLOGY

Course coordinator ZAMFIR ALEXANDRA

Year, semester: II, 1

No. hours course: 28 no. hours laboratory: 28

Discipline type compulsory, ECTS: 5

Prerequisites: Plant Biology, Chemistry, Biochemistry

Aims In this course the student from ecology, biology fields will be acquainted with (possible) correlation between the environmental factors and the physiological mechanism of the plant. It's present, also, how these factors influence the nutrition, respiration, production, in which conditions are positive or negative on the plant life. One of our goals is to correlate the theoretical information with technology in order to protect the primary producers of the ecosystems.

Content: In the first part of the course are present the cell structure of plant and the physiological role of each one. Then is present the interrelation of plant physiological mechanism with environmental factors : water, mineral substances, light, oxygen, another plants. The environmental factors influence the plant physiology in two conditions: quantitative and qualitative.

Skills

- understand the influence and the effects, of environmental factors on the plant physiological mechanisms
- point out the relationship between structure of cell plants and their functionality, anatomical structure of plant organs and the physiological adaptability in optimum condition.
- explain the influence of environmental factor in minimal or maximal condition, the tolerance of plant through the physiological mechanisms.
- integrate and apply his basic knowledge on physiology

Assessment: The final mark will be calculated based on :

essay preparation (%)

mid semester examination (%) 20

final examination (%) 80

References

Atanasiu, L., 1984, Ecofiziologia plantelor, Ed. Șt. și Encicl., București

Zamfir Alexandra, 2000, Noțiuni de fiziologie și ecofiziologie vegetală, Ed. Alma Mater din Sibiu

ENVIRONMENTAL ANIMAL PHYSIOLOGY

Course coordinator ZAMFIR ALEXANDRA

Year, semester: II, 2

No. hours course: 28 **no. hours laboratory:** 28

Discipline type compulsory, ECTS: 4

Prerequisites: Cell Biology, Biochemistry , Animal Biology

Aims In this course the student from ecology, biology fields will be acquainted with (possible) correlation between the environmental factors and the physiological mechanism of the animal. It's present, also, how the receptor sensitive, neuronal, hormonal, the movement systems are implicated in steady station, or homeostasis of animal and human organisms.

Content: In the first part of the course are present the mechanisms of autoregulation in physiological processes. Then is presented sensory system like a part of nervous system, how these receive stimuli from the external and internal environmental. In the third part the course explain the role of nervous system in the movement, the relation of this with endocrine glands, the movement of different animals, and processes of regulation of body temperature in poikilotherm and homeotherm animals.

Skills

- understand the influence and the effects, of environmental factors on the animal physiological mechanisms
 - point out the relationship between structure of cell animal and their functionality, anatomical structure of organs and the physiological adaptability in optimum conditions.
 - explain the influence of environmental factor, like stimulus, the sensitivity and specificity of the receptors, nervous systems capacity to preelaborate the information and the reflex response of animals.
 - integrate and apply his basic knowledge on physiology

Assessment: The final mark will be calculated based on :

essay preparation (%)

mid semester examination (%) 20

final examination (%) 80

References

Ardelean, G., Roşioru, C., 1996, Integrarea și coordonarea organismului animal, Ed.Univ., Baia Mare,

Zamfir Alexandra, Noțiuni de fiziologie și ecofiziologie animală, Ed.Alma Mater,,Sibiu

ANIMAL BIOLOGY III

Course coordinator Lect. univ. dr. VOICHITA GHEOCA

Year, semester: II/3

No. hours course: no. hours seminary / laboratory: 48/48

Discipline type fundamental, ECTS: 5 credits

Prerequisites: Animal biology I, Animal biology II

Aims : The course offers information concerning vertebrates' morphology, structure, development, systematics and phylogeny; distribution, biology, relationships with the environment. Presentation of Earth's fauna diversity, and especially of Romania's fauna. Highlighting the theoretical and practical importance of animal biology study, of the knowledge of the role animals play in nature and man's life.

Content:

Chordata phylum – general characters, Cephalochordata and Urochordata, Underphylum Vertebrata: general characters, origin, principles of classification, Supraclass Agnatha, Supraclass Gnathostoma, Class Chondrichthyes and Osteichthyes; Class Amphibia; Class Reptilia; Class Aves; Class Mammalia.

The laboratory includes the following themes: Cephalochordata: morphology and transversal section in *Branchiostoma lanceolatum*; Supraclass Agnatha – classification and representatives; Class Chondrichthyes-Elasmobranchiate; Class Osteichthyes – elements of morphology and anatomy, dissection of *Cyprinus carpio*; classification; Class Amphibia - elements of morphology and anatomy, dissection of *Rana sp.*, classification; Class Reptilia, morphology, anatomy, classification and representatives; Class Aves, morphology, anatomy, classification and representatives; Class Mammalia, morphology, anatomy, classification and representatives.

Skills :

Ability of understanding and reproducing specific terms, principles of animal biology, of structural and physiological unity of living world, of evolution from simple to complex. Capacity of identifying the main animal species in the field and in the lab. Ability of exploring the animal world in order to forecast local diversity based on own observations and experiments.

Assessment: The final mark will be calculated based on :

practical examination (25%)

essay preparation (10%)

mid semester examination (15%)

final examination (50%)

References:

Gheoca, V., 2000, Biologie animala III, Ed. Alma Mater Sibiu

Stugren, B., Coroiu, I., 1996, Sistemática filogenetică, anatomia comparată și zoologia vertebratelor, vol. I-II, Univ. "Babeș Bolyai", Cluj-Napoca

PHYTOSOCIOLOGY AND ROMANIAN VEGETATION

Course coordinator : Prof. Dr. **DRĂGULESCU CONSTANTIN** titular – Chair of Ecology and environment protection

Year : II **semester** : 3

No. hours course: 2 ; **no. hours laboratory** : 1 ; **no. hours seminary** : 1

Discipline type : obligatory ; speciality

ECTS: 5

Prerequisites: Plants biology 2 (for ecologists), Systematic of cryptogams (for biologists), General ecology, Mathematics with applications in biology and ecology

Aims:

The knowledge and understanding by the students of terms, notions, concepts, and principles specific to Phytosociology, mainly those regarding the phytocoenoses' structure, functions, dynamics and systematics. Getting the students familiarized with the main plant associations from the zones and vegetation levels from Romania.

Content:

Phytocoenological schools. The structure of phytocoenoses. Phytocoenological indices. The technique of samples' achievement. The functions of phytocoenoses. Coenotaxonomy of vegetal groups. The mapping of vegetation. General characterization of Romanian vegetation. The zones of vegetation from Romania with principal associations. The levels of vegetation from Romania with principal associations.

Skills :

Capability to understand and render terms, concepts and principles of Phytosociology and to communicate using Phytosociology specific language. Capability to identify the main plant associations within the country and to perform applicative activities. Capability to explore the vegetal world in order to make prognoses and extrapolations on phyto-ceno-diversity.

Assesement :

The final mark will be calculated based on :

Practical examination 25 %

Mid semester examination 25%

Final examination 50%.

References :

Borza, Al., Boşcaiu, N., 1965, Introducere în studiul covorului vegetal (Introduction in the study of vegetal carpet), Edit. Acad. Bucureşti

Cristea V., Gafta, D., Pedrotti F., 2004, Fitosociologie (Phytosociology), Edit. Presa Universitară Clujană, Cluj-Napoca

Drăgulescu, C., Sîrbu, I., 2002, Practicum de fitocenologie (Practicum of phytocoenology), Edit. Alma Mater Sibiu

Sanda V., 2002, Vademecum ceno-structural privind covorul vegetal din România (Coeno-structural vademecum of Romanian vegetal carpet), Edit. Vergiliu Bucureşti

PHYSICAL ENVIRONMENT III (ATMOSPHERIC ENVIRONMENT)

Course coordinator: COSTEA MARIOARA, holder, Lect. Dr., Department of Ecology and Environmental Protection, Faculty of Science, "Lucian Blaga" University of Sibiu.

Year, semester: II year, III semester.

No. hours course: no. hours seminary / laboratory: 14 course / 14 seminary / 14 lab.

Discipline type: Basic, obligatory, no. credits: 4

Prerequisites: geographical disciplines of high school, Physical environment I (Geomorphology with elements of Geology), Physical environment II (Hydric Environment).

Aims: presentation of the basic concepts of general meteorology and climatology, clarify concepts related to weather and climate phenomena, their quantification and representation, highlighting the impact of weather/climatic phenomena on weather time appearance and on the climate, genetic factors contributing to the formation of the climate of a different territory, zoning of climate and levelling of climatic conditions, clarifying the concept of ecoclimate and the presentation of different ecoclimate.

Content: Notions of meteorology. Terrestrial atmosphere. Radiant energy and its sources; Atmospheric pressure; Air temperature. Thermic regime of soil; Water vapours. Rainfall, Horizontal movements of air. Winds, local winds; Climatology as branch of the meteorology. Genetic factors of climate and ecoclimate. Air masses. Monsoons. Trade Winds; Main elements of the climate. Earth Climates. Climates of Romania; Ecoclimatology and their place in the climatology. The influence of weather and ecoclimate on the ecosystems productivity; solar radiation and environmental factors as temperature, air humidity and rainfall with their significance in the ecoclimates. Evapotranspiration and the role it played in the ecoclimate. Phytoclimate and them different types.

Skills: basic knowledge in meteorology and climatology and correct use of terminology; understanding the mechanisms of production of weather phenomena; achievement of links between genetic factors of climate and the type of climate, the ability to analyse the climate elements by using graphics and cartographic methods and setting correlations between items, the ability to apply into practice the acquired knowledge through direct measurements and observations on the ground.

Assessment: Knowledge evaluation is done by calculating the weighted average that takes into account: 25% - work in seminars and laboratory work - oral presentation of dossier they work during the semester, 25% - periodically test written in the middle of semester; 50% - final examination based on written exam with questions concerning the definition of meteorological and climatically elements, phenomena, interpretation and comparison of climates, observations and personal views about climate characteristics of local horizon.

References:

Bogdan, Octavia, 2006, Bazele metodologice ale meteorologiei, Edit. Univ. Lucian Blaga, Sibiu.
Ciulache, S., 1988, Meteorologie și climatologie, Univ. București
Buiuc, M., 2000, Meteorologie generală – Fizica atmosferei, vol.II, Edit. Alma Mater Sibiu.
Neacșa, O., Berbecel, O., 1979, Climatologie și agrometeorologie, Ed. Did. și Ped., București

HIDROBIOLOGY

Course coordinator: Dr. ANGELA BĂNĂDUC, (titular) associate professor Catedra E.P.M.

Year, semester: II, IV

No. hours course: 28, **no. hours laboratory:** 28

Discipline type obligatory, specialty, ECTS: 4

Prerequisites: General ecology, Populations ecology, Physical environment 2.

Aims: Underling the knowledges related with the aquatic ecosystems structure and the characteristic processes of these ecosystems. The cognition by the students of the structural and functional of the continental ecological systems, the understanding of the aquatic biocoenosis - biotope interactions.

Content: Course: Water as environment for life; Aquatic biotope characteristics; Aquatic communities classification: characterization, adaptations; Structural and functional characteristics of the main types of continental lotic aquatic ecosystems, hyporeic environment, lakes as ecosystems, ponds, swamps; General notions regarding the ecological assessment of the aquatic continental systems; Black Sea ecology.

Laboratory: Particularities of the aquatic ecosystems research; research phases; Water physic-chemical characteristics; Aquatic community's structure analyze.

Skills: The capacity to understand and reproduce the concepts, terms and principles specific for hydrobiology. The knowledge and understanding of the structures and processes characteristic for the aquatic ecologic systems. The capacity to communicate using the specific terms and concepts, to explain and interpret the way of structuring and functioning of the aquatic ecological systems. The capacity to analyze the aquatic biotope characteristics, the aquatic communities structure (benthos, plankton, ichtyofauna).

Assessment: The final mark will be calculated based on:

practical examination -20% of the final mark

essay preparation - 10% of the final mark

mid semester examination - 10% of the final mark

final examination - 60% of the final mark

References:

1. Curtean-Bănăduc A., 2006, Hidrobiologie. Note de curs (format electronic)
2. Curtean-Bănăduc A., 2001, Practicum de hidrobiologie, Ed. Mira Design, Sibiu

ECOSYSTEMS: STRUCTURE AND FUNCTIONS

Course coordinator: dr. **IOAN SÎRBU** - professor in ordinary, Department of Ecology and Environmental Protection, Faculty of Sciences, "Lucian Blaga" University in Sibiu

Year, semester: II, 4

No. hours course: no. hours seminary / laboratory: 28 hours course, 14 hours seminary, 14 hours laboratory

Discipline type: compulsory, ECTS: 4

Prerequisites: General Ecology, Population Ecology

Aims:

Study of ecological systems hierarchy, analysis and synthesis of communities' and ecosystems' structure, dynamics and functions, interspecific relations, ecological succesions, energetics and productivity of ecological systems, biogeochemical cycles and ecological stability.

Content:

Communities' and ecosystems' structure analysis, types and functions of interspecific relations, ecological niches concepts and measures, biodiversity and ecological diversity, the trophodynamic and biochemical structure of the ecosystem, dynamics and ecological succesions, stability and ecological equilibria, biosphere evolution. Techniques and methods used in communities' analysis, association, similarity, biodiversity, energetical analysis, methods of ordination and classification of ecological systems.

Skills:

Knowledge of terms and concepts specific to this science; right use of speciality terms; understanding of fundamental phenomena specific to ecology, perception of some relations and connections, analitic and synthetic capacity; use of some specific investigations methods, techniques, and instruments; manifestation of a positive and responsible attitude towards this scientific field.

Assessment: The final mark will be calculated based on activity during seminars (10%), practical examination (10%), mid semester examination (10%), homeworks (10%), and final examination (80%).

References :

Sîrbu, I., 2003 - Ecologia comunităților (partea a 2-a). Ed. Univ. Lucian Blaga, Sibiu (note de curs; tipărit și suport electronic, disponibil prin internet).

Sîrbu, I., Benedek, A.M., 2004, Ecologie practică, Ed. Univ. Lucian Blaga, Sibiu.

Stugren, B., 1982, Bazele ecologiei generale, Ed. St. și Enciclopedică, București.

Botnariuc, C., Vădineanu, A., 1982, Ecologie, Ed. Did. Și Ped., București.

GENETICS

Course coordinator Lect. dr. VOICHITA GHEOCA

Year, semester: II/IV

No. hours course: no. hours seminary / laboratory: 28/14/14

Discipline type fundamental, ECTS: 5

Prerequisites: General chemistry, Biochemistry

Aims:

Knowledge of the main notions of general and population genetics, of the structures and processes representing the basis of hereditary transmission of the characters. Presenting the way the genetic material changes influenced by the natural and artificial factors and the main groups of mutagen agents and their mode of action.

Content

Genetic material - nucleic acids – types, structure, role. Biochemical coding and genetic regulation – replication, transcription, translation, modalities of genetic regulation. Mendel's laws of segregation and other types of segregation. Cellular basis of heredity. Cell division. Genetic recombination in eukaryotes and prokaryotes. Chromosomal mechanism of heredity. Chromosomal theory of heredity and chromosomal maps. Sex heredity. Extranuclear heredity. Morphological and numerical changes of chromosomes. Mutations – mutation types. Molecular mechanisms of mutations. Mutagen factors. Mutation process and genetic code. Population genetics. Populations in equilibrium. The frequency of genes and genotypes in populations. Hardy. Weinberg law – applications. Genetic diversity.

Skills:

Ability of understanding and reproducing specific terms, principles of general genetics. Capacity of identifying with the microscope of normal and modified genetic structures. Ability of identification of different mutations in plant and animal species.

Assessment: The final mark will be calculated based on :

essay preparation (15%)

mid semester examination (20%)

final examination (65%)

References:

3.Coman, N., 1991, Genetica, vol. I, Univ. "Babeş-Bolyai" Cluj-Napoca

4.Raicu, P., 1991, Genetica, EDP, Bucureşti

BIOCHEMISTRY

Course coordinator: Assoc. Prof. biochemist **SIMONA OANCEA**, Ph.D.

Year, semester: II, III

No. hours course: no. hours seminary / laboratory: 28/14

Discipline type : fundamental

ECTS: 3

Prerequisites: General Chemistry, Environmental Chemistry, Animal Biology

Aims Knowledge of the cell composition: bioelements and biomolecules
Knowledge of essential biochemical aspects of cellular components
Presentation of biochemical intra- and interspecific types of communication
Development of students ability to use analytical methods to study biological active compounds

Content: Molecular and macromolecular organization of cells. Structure, functions and eco-biochemical implications of main cell constituents: saccharides, lipids, proteins, enzymes, nucleic acids, hormones. Primary metabolism of animal and vegetal organisms. Photosynthesis. Allelopathy. Biochemical communication between same species. Biochemical communication between different species. Biochemical methods of analysis of cell constituents

Skills : At completion of the course and practical activity, the student must know the main biochemical characteristics of cellular chemical constituents, the effects and functions of biomolecules, biochemical communication in living organisms and analytical methods used to study biomolecules.

Assessment: The final mark will be calculated based on :
activity during seminars, essay preparation (20 %); practical examination (30%) ; final examination (50%)

References :

1. Oancea S., Biochimie ecologică, Editura Alma Mater, Sibiu, 2007.
2. Oancea S., Căi metabolice primare în sistemele biologice, Editura Universității "Lucian Blaga" Sibiu, 2005.
3. Lehninger A., Biochimie, vol. I și II, Editura Tehnica, București, 1987.
4. Neamtu G., Biochimie vegetală, Editura Ceres, București, 1981.
5. Dumitru I.F., Mager S., Biochimie, Editura Didactică și Pedagogică, București, 1980.

SYNECOLOGICAL BIOGEOGRAPHY

Course coordinator: dr. **DANIELA MINODORA ILIE**

Year, semester: II, IV

No. hours course: no. hours seminary / laboratory: 14 hours course, 14 hours seminary

Discipline type optional, ECTS: 3

Prerequisites: Ecology, Plant biology II, Animal biology I, II, III, Physical Environment I, II, Phytosociology and vegetation of Romania

Aims: Introduction in synecological biogeography issues. Presentation of biosphere's synecological division and of main synecological units.

Content: Issues of synecological biogeography. Fundamental limiting factors in terrestrial environment, freshwaters and seas. Main terrestrial biomes: supralittoral, arboreal, eremial, tundra, islands, anthropogea. Aquatic macroecosystems: benthic, lotic, oceanic, marine.

Skills: Knowledge of terms and concepts specific to this science; understanding of fundamental phenomena specific to synecological biogeography; identification of terms, relations and processes; perception of some relations and connections; explanation and interpretation of some processes and theoretical and practical ideas of synecological biogeography; analitic and synthetic capacity; research abilities; participation in the own professional development.

Assessment: The final mark will be calculated based on : activity during seminars (30%) mid semester examination (20%), final examination (50%)

References

1. PÎRVU, C. (sub redacția), 1980, Ecosistemele din România, Ed. Ceres, București
2. POP, I., 1977, 1979, Biogeografie ecologică, vol. I, II, Ed. Dacia, Cluj-Napoca
3. STUGREN, B., DORDEA, M., 1988, Ecologie, Univ. „Babeș Bolyai”, Cluj-Napoca

BIOGEOGRAPHY

Course coordinator: dr. DANIELA MINODORA ILIE

Year, semester: III, V

No. hours course: no. hours seminary / laboratory: 14 hours course, 14 hours seminary

Discipline type optional, ECTS: 3

Prerequisites: Plant biology II, Animal biology I, II, III, Ecology, Phytosociology and vegetation of Romania

Aims: Exposure of chorology's main issues. Presentation of Earth's and Romania's biogeographical regionalization

Content: Biogeography's definition and object. Its relations with other sciences. Importance of biogeography. Speciation. Organisms' dispersal. Chorology concepts. Ranges' size and shape. Distribution of organisms within their range. Ranges' evolution. Marine biogeographical regions and their evolution. Terrestrial and freshwater biogeographical regions. Introduction in the biogeography of Romania. Flora and fauna's evolution in Romania. Biogeographical regions in Romania. Biogeographic peculiarities of Romania.

Skills: Knowledge of terms and concepts specific to this science; right use of speciality terms; understanding of fundamental phenomena specific to biogeography, perception of some relations and connections, analytic and synthetic capacity; use of some specific investigations methods, techniques, and instruments; manifestation of a positive and responsible attitude towards the scientific field.

Assessment: The final mark will be calculated based on activity during seminars (25%) and final examination (75%).

References :

1. DRĂGULESCU, C., ILIE, DANIELA MINODORA, 2001, Biogeografie, Edit. Univ. "Lucian Blaga" Sibiu
2. BĂNĂRESCU, P., BOȘCAIU, N., 1973, Biogeografie, Ed. Științifică, București

ENVIRONMENTAL GEOGRAPHY

Course coordinator: COSTEA MARIOARA, holder, Lect. Dr., Department of Ecology and Environmental Protection, Faculty of Science, "Lucian Blaga" University of Sibiu.

Year, semester: II year, IV semester.

No. hours course: no. hours seminary / laboratory: 14 course / 14 seminary.

Discipline type: Basic, optional, no. credits: 3.

Prerequisites: Physical environment I (Geomorphology with elements of Geology), Physical environment II (Hydric Environment), Physical environment III (Atmospheric Environment), General Human Geography.

Aims: clarify concepts and issues of environment; study of relations between human society and the environment, understanding the environment as a system: limits, composition, structure and function, laws; highlighting the relationship between the environment components; determining the man place and his rank/place the in the environment system; characterization main categories of geographic environments in the world.

Content: Introduction into Environmental Geography. Developments and concepts. The environment as a system. Levels of time-space structure. The concept of ecosystem, geosystem, sociosystem. Functionality and dynamic of environmental systems. Functional features, the concept of equilibrium, organization and type of relationship. The components of the natural environment and their potential. Lithosphere, atmosphere, hydrosphere, biosphere, pedosphere. Antroposphere and two-way determination relationship. Anthropogenic components of the environment, the human – environment and the environment – man terms. The geographical environments on Earth. The zonal geographical environments on Earth. Leveling and mountain environment. The azonal environment. Global environmental problems: Causes and effects. Pollution, global warming, desertification, geomorphological hazards, aging population, migration, etc.

Skills: appropriation of terminology that is operating in environmental geography, understanding the relationship between environmental components, capacity in summary presentation of environmental phenomena and processes, the ability to identify the functionalities and disfunctionalities of environment and to emphasize the component that induces the imbalance in the system.

Assessment: Knowledge evaluation is done by calculating the weighted average that takes into account: 50% - the work completed by conducting seminars and support oral essays they work during the semester, 50% - Final examination - written colloquium based on questions concerning definition, concepts, world environments characterization, comparison and interpretation of environmental components of different environment, examples from personal observations by the local horizon.

References:

- Costea, Marioara (2002), Bazele teoretice ale geografiei, Edit. Univ. "Lucian Blaga" din Sibiu.
Pehoiu, G., Muică, Cristina, Sencovici, Mihaela (2006), Geografia Mediului cu elemente de ecologie, Edit. Transversal, Târgoviște.
Velcea, Valeria, Bogdan, Octavia (2008), Geografia mediului, Edit. Univ. "Lucian Blaga" din Sibiu.
Voiculescu, M. (2004), Geografia Mediului, Edit. Universității Timișoara.

ECOTOXICOLOGY

Course coordinator: Prof.dr.ing. **CONSTANTIN-HORIA BARBU** (ULBS staff)

Year, semester: II/1

No. hours course: no. hours seminary / laboratory: 2/2 (28/28)

Discipline type: O, ECTS: ????

Prerequisites: General Ecology, Analytic Chemistry, Hydrobiology

Aims: To familiarize the students with the principles of toxicology (dose/response, toxicokinetics, toxicodynamics), with the pollutants effects at different biological organization levels, from individuals to ecosystems. The action of the main pollutants classes (heavy metals, pesticides) on ecosystems will be presented. Students will also be familiarized with risk assessment methodology, according to the European Environmental Standards.

Content:

Definition of Ecotoxicology. Specific terms: pollutant, toxic, contaminant. Classification of pollutants. Examples. Lethal doses and concentrations. Acute and chronic intoxications. Factors determining toxicity. Methods and techniques for environmental analysis. Bioindicators. Pollutants bioavailability. Toxicokinetics (absorption, distribution, storage/accumulation, biotransformation, elimination). Toxicodynamics (interactions at sub- and supra-cellular level). Pollutants effects on populations and ecosystems. Accumulation along food chains. Case studies. Risk assessment. Case studies.

Skills

Capability to understand and render the terms, concepts and principles of ecotoxicology and to realize how sublethal doses may severely influence communities/populations. Competence to decide on the potential toxic effects of certain substances. Work skills for modern laboratories.

Assessment: The final mark will be calculated based on :

-practical examination (%): 20

-essay preparation (%): 20

-final examination (%) : 60

References

- 1.Barbu, C.H. Ecotoxicologie, curs, Ed. Alma Mater, Sibiu, 2004.
- 2.Rojanschi V. și colab. Protecția și ingineria mediului, Ed. Economică, Buc. 2005.
- 3.Landis, W.G., Yu, M.H. Introduction to Environmental Toxicology, Lewis Publishers, 2004.
- 4.Newmann, M.C., Unger, M.A., Fundamentals of Ecotoxicology, Lewis Publishers, 2002.

III

PARASITOLOGY

Course coordinator: Lect. drd. DANIEL GHEOCA

Year, semester: III/V

No. hours course: no. hours laboratory: 28/28

Discipline type specialisation, ECTS: 4

Prerequisites: Animal biology I, Animal biology II.

Aims

Knowledge of the main groups of parasites, of their hosts and the relations parasite-host, of the interactions between the two groups of organisms, with the implications related to the life cycles' strategies, immunity and specific adaptations. Presentation of general issues of parasitisms, of origins and distribution of parasitic organisms in the animal kingdom

Content

Parasites and parasitism – general notions. Parasites and behaviour of parasitised organisms, parasit-host relation, host specificity. Life cycles strategies. Adaptations to parasitism – morphological and physiological adaptations of different classes of parasites. Parasitic protozoa – species, life cycles. Parasitic cestodes – parasite species, life cycles and control methods. Parasitic nematodes – biology, parasite species and their life cycles. Parasitic arthropods: biology, life cycles, their role as vectors of other parasites. Parasites and immunity. Parasitic diagnosis. Parasites control – classic control methods, integrated control. Exotic parasitosis. Classic methods used in parasitosis' treatment. Traditional methods in folk medicine.

Skills

Ability of understanding and reproducing terms, concepts and principles of parasitology. Acquiring knowledge related to parasit-host coevolution as a system in equilibrium. Capacity of identification of different classes of parasites and the changes caused by these in their hosts.

Assessment: The final mark will be calculated based on :

practical examination (10%)

essay preparation (25%)

mid semester examination (15%)

final examination (50%)

References:

Nitzulescu V., I. Gherman: 1985 Parazitologie clinica, Ed. Medicala, Bucuresti,

Oprean, L. 1999, Microbiologie- Parazitologie II, Ed. Univ. "Lucian Blaga" Sibiu

MODELING OF ECOLOGICAL PROCESSES

Course coordinator: dr. **IOAN SÎRBU** - professor in ordinary, Department of Ecology and Environmental Protection, Faculty of Sciences, "Lucian Blaga" University in Sibiu

Year, semester: III, 6

No. hours course: no. hours seminary / laboratory: 28 hours course, 28 hours laboratory

Discipline type: compulsory, ECTS: 4

Prerequisites: Population Ecology, Ecosystems: structure and functions, Mathematics applied in Ecology, Computer Operation

Aims:

Knowledge and skills in building modeling algorithms, categories and concepts, techniques of ecological data acquisition, analysis and management, computer techniques and operation involved in ecological modeling, building population and communities models.

Content:

Ecological research design, data design and acquisition, transforming in information and knowledge, data management systems, modeling algorithm, categories and classification of ecological models, conceptual and quantitative models, population, communities' and ecosystems' models, theoretical and statistical models, linear and nonlinear, uni- and multivariate models, interpolation, time series analysis, computer techniques and software applied in ecological modeling.

Skills:

Knowledge of terms and concepts specific to this science; right use of speciality terms; understanding of fundamental phenomena specific to ecological modeling, perception of some relations and connections, analytic and synthetic capacity; use of some specific investigations methods, techniques, and instruments; manifestation of a positive and responsible attitude towards this scientific field.

Assessment: final theoretical examination 50%, practical examination from laboratories 50%.

References :

Sîrbu, I., 2006 - Bazele modelării sistemelor și proceselor ecologice (available on CD or via internet).

Sîrbu, I., Benedek, A.M., 2004 - Ecologie practică, Ed. Univ. Lucian Blaga, Sibiu

Jørgensen, S.E., 2002 - Fundamentals of Ecological Modelling. Developments in Environmental Modelling, Elsevier; Amsterdam, Oxford, New York, Tokyo.

Gillman, M., Hails, R., 1997 - An Introduction to Ecological Modelling; Putting Practice into Theory. Methods in Ecology (eds. J.H. Lawton, G. E. Likens). Blackwell Science.

FOREST ECOLOGY

Course coordinator: dr. **DANIELA MINODORA ILIE**

Year, semester: III, V

No. hours course: no. hours seminary / laboratory: 28 hours course; 14 hours seminary; 14 hours laboratory

Discipline type: compulsory, ECTS: 4

Prerequisites: Plant biology I, II, Animal biology I, II, III, Ecology, Population ecology, Ecopedology, Phytosociology and vegetation of Romania

Aims: Presentation of the forest as ecosystem, from structural and functional point of view. Understanding of forest's complex character, of its multifunctional role. Knowledge of forest ecosystem's dynamics. Highlighting the role of ecological fundaments of forest management.

Content: Forest ecology: definition, object and activity area, theoretical and practical importance. The structure of forest as an ecosystem. Characteristics of forest ecosystem. Production and organic matter circuit in forest ecosystem. The concept of tree stands. Qualitative and structural characteristics of tree stands. Processes specific to forests. Dynamics of forest ecosystem. Multifunctionality of forest ecosystems. Functional division into zones of forests in Romania. Forest typology. Principles of forest ecosystems' classification. Classification units. Typological classification of forest ecosystems. Anthropic intervention in forest ecosystems. The need of forest management. Principles of management. Types of human intervention.

Skills: Knowledge of terms and concepts specific to this science; understanding of fundamental phenomena specific to forest ecology; perception of some relations and connections; explanation and interpretation of some processes and theoretical and practical issues of forest ecology; use of some specific investigations methods, techniques, and instruments; implication in scientific activities related to forest ecology; taking part in research teams.

Assessment: The final mark will be calculated based on: activity during seminars and practical examination (25%), mid semester examination (25%), final examination (50%)

References:

1. Doniță, N., 1977, Ecologie forestieră, Ed. Ceres, București.
2. Ilie, D., 2006, Practicum de ecologie forestieră. Dendrologie, Ed. Universității "Lucian Blaga", Sibiu

ENVIRONMENTAL DEGRADATION AND PROTECTION

Course coordinator: Dr. **DORU BĂNĂDUC**, (titular) lecturer Catedra E.P.M.

Year, semester: III, V

No. hours course: 28, **laboratory:** 14, **seminary:** 14

Discipline type obligatory, fundamental, ECTS: 4

Prerequisites: General ecology, Ecosystems: structure and functions, Physical environment 1, Physical environment 2, Physical environment 3,

Aims: Underling the knowledges related with the environment degradation and protection. The cognition by the students of the assessment methods for the human impact activities, degradation phenomenon, environment management instruments, ecological rehabilitation methods.

Content: Operational concepts: environment, environment degradation, ecologic impact, environment protection, environment protection tools, sustainable development / eco-development, natural capital and its functions. The causes of the environment degradation: resources overexploitation, the natural ecosystems transformation, the biogeochemical cycle's perturbation. Environment degradation prevention and control. Ecological recovery. Administrative tools for the environment protection: environment agreement and authorization, environment protection standard. The used instruments in the environment management: impact assessment on the environment (EIM), products life cycle evaluation (ECV), environment risk assessment (ER). Audit. Environment management systems. Eco-labeling.

Skills: The capacity to understand and reproduce the concepts, terms and principles specific for the environment protection. The knowledge and understanding of the causes of the environment degradation and of the methods and measurements for the environment protection. The capacity to identify the causes for the environment degradation and measurements for the environment protection, to apply different assessment methods for the human activities impact on the environment, to use the international standards for the environment management.

Assessment: The final mark will be calculated based on:

activity during seminars - 10% of the final mark

practical examination -10% of the final mark

essay preparation - 10% of the final mark

mid semester examination - 10% of the final mark

final examination - 60% of the final mark

References:

1. Curtean - Bănăduc A., 2005, Degrdarea și protecția mediului, Ed. Alma Matter Sibiu.
2. Negrei, C., 1999, Instrumente și metode în managementul mediului, Ed. Economică, București
3. Rojanski, V, Bran, F., Diaconu, G, 1997, Protecția și ingineria mediului, Ed. Economică, București
4. Vădineanu, A. și colab., 1999, Dezvoltarea durabilă. Teorie și practică. Mecanisme și instrumente, vol. II, Ed. Universității din București, București

ECOLOGICAL GENETICS

Course coordinator Lect. Dr. VOICHITA GHEOCA

Year, semester: III/V

No. hours course: no. hours seminary / laboratory: 28/14/14

Discipline type specialisation, ECTS: 4

Prerequisites: Genetics

Aims:

Knowledge of the main genetic notions on ecological scale. Structural aspects are studied on four components: molecular ecology, population genetics, conservation genetics and quantitative ecological genetics.

Content:

Introduction – object of ecological genetics. Genetic variation – quantitative aspects. Genetic diversity and differentiation. Variation origin – mutation, recombination, gene flow. Factors influencing gene flow; methods of measuring gene flow. Mating systems. Consanguine reproduction and random genetic drift, panmixia. Phylogeny and intraspecific phylogeography: homology, phylogenetic trees, construction and interpretation. Nuclear and extranuclear variability phylogeny. Spaciation and hibridization. Conservation genetics – genetics of endangered and invasive species. Specialized genetic ecology – medical ecological genetics, microbiological genetics, immunogenetics.

Skills:

Ability of understanding and reproducing terms, concepts and principles of ecological genetics. Capacity of construction and analysis of phylogenetic trees that use genetic data, interpretation of some genetic analysis' results.

Assessment: The final mark will be calculated based on :

essay preparation (25%)

mid semester examination (15%)

final examination (65%)

References :

Coman, N., 1991, Genetica, vol. I, Univ. "Babeş-Bolyai" Cluj-Napoca

Raicu, P., 1991, Genetica, EDP, Bucureşti

Cristea, M., 1991, Genetica ecologică și evoluția, Ed. Ceres, Bucureşti, pp. 261

BIODIVERSITY MANAGEMENT

Course coordinator: Dr. ANGELA BĂNĂDUC, (titular) associate professor Catedra E.P.M.

Year, semester: III, VI

No. hours course: 28, **laboratory:** 14, **seminary:** 14

Discipline type obligatory, complementary, ECTS 5

Prerequisites: General ecology, Ecosystems: structure and functions, Vegetal biology 1, Vegetal biology 2, Animal Biology 1, Animal Biology 2.

Aims: Underling the knowledges related with the biodiversity management: the biodiversity concept, the causes of the biodiversity perdition, the necessity of biodiversity conservation, biodiversity conservation strategies. The cognition by the students of the biodiversity assessment methods, of the operational units identification for its conservation, of the related legislation and of the administrative structures with responsibilities in the field of biodiversity conservation.

Content: The biodiversity concept. The biodiversity component elements. The biodiversity conservation necessity. The philosophic concepts evolution regarding the human-nature relation. The evolution in time of the measurements and methods for biodiversity conservation. The strategies and methods for biodiversity conservation. The methods of biodiversity assessment. The protected natural entities classification. The zoological categories of species. International programmers for biodiversity assessment and conservation. The protected natural areas management. The biodiversity conservation in Romania.

Skills: The capacity to understand and reproduce the concepts, terms and principles specific for biodiversity conservation. The strategies, measures and methods knowledge and understanding. The capacity to communicate using the specific terms and concepts, to explain and interpret the causes of the biodiversity perdition, the necessity of its conservation and the strategies of biodiversity conservation. The capacity of systemic approaching and interpretation of the biodiversity conservation problems in the context of the sustainable development. The capacity to identify the operational units for the biodiversity conservation and to apply methods for biodiversity assessment.

Assessment: The final mark will be calculated based on:

activity during seminars - 10% of the final mark

practical examination -20% of the final mark

essay preparation - 10% of the final mark

mid semester examination - 10% of the final mark

final examination - 50% of the final mark

References:

1. Cogălniceanu, D., 1999, Managementul capitalului natural, Ed. Univ. București
2. Cristea V., Denaeyer S., 2004, De la biodiversitate la OGM-uri ?, Ed. Eikon, Cluj-Napoca
3. Curtean – Bănăduc Angela, 2006, Strategii si metode pentru conservarea biodiversității, Ed. Universității „Lucian Blaga” din Sibiu.

ECOLOGICAL MONITORING

Course coordinator: Dr. **DORU BĂNĂDUC**, (titular) lecturer Catedra E.P.M.

Year, semester: III, VI

No. hours course: 28, **laboratory:** 14, **seminary:** 14

Discipline type obligatory, specialty, ECTS: 5

Prerequisites: General ecology, Ecosystems: structure and functions

Aims: Underling the knowledges related with the integrated monitoring of the environment. The cognition by the students of the environment integrated monitoring system components, of the designing of the monitoring systems, of the use and management of the information obtained through the monitoring.

Content: The monitoring concept; introductive notions; the necessity of the existence of the integrate monitoring systems; the history and evolution of the ecological monitoring. The necessary elements for the construction of the unitary systems for the environment quality control The Integrated Monitoring System of the environment in Romania; the national monitoring subsystems; the regional and national ecologic monitoring; the base data analysis and use; the environment parts which are targets for the monitoring activities. Teledetection and fotogrametry in monitoring. The monitoring subsystems: atmosphere, seas and oceans, continental water bodies, soil, vegetation and fauna. Biologic monitoring. The surveillance in the field of: radioactivity, epidemiology, sociology, economy. The monitoring subsystems on emissions and types of pollutions.

Skills: The capacity to understand and reproduce the concepts, terms and principles specific for the ecologic monitoring. The knowledge and understanding of the used methods in the ecologic monitoring. The knowledge regarding the ecologic monitoring data management. The capacity to identify the operational units for the ecologic monitoring and to apply methods of monitoring for the environment factors.

Assessment: The final mark will be calculated based on:

activity during seminars - 10% of the final mark

practical examination - 25% of the final mark

essay preparation - 5% of the final mark

mid semester examination - 10% of the final mark

final examination - 50% of the final mark

References:

1. Bănăduc D., 2007, Monitoring ecologic – note de curs (format electronic).
2. Godeanu S, 1997, Elemente de monitoring ecologic integrat, Ed. Bucura Mond, București.

INSECT ECOLOGY

Course coordinator: dr. DANIELA MINODORA ILIE

Year, semester: III, V

No. hours course: no. hours seminary / laboratory: 28 hours course, 14 hours seminary

Discipline type: optional, ECTS: 5

Prerequisites: Animal biology II, Ecology, Population ecology

Aims: Presentation of main aspects of insect ecology and its practical applications in the insect-man relationship.

Content: Introductory concepts. Elements of insect autecology. Insects populations' ecology. Insects communities' ecology. Integration of insects in different ecosystems. Applications of insect ecology.

Skills: Understanding of fundamental phenomena specific to insect ecology; perception of some relations and connections; right use of speciality terms; generalization, customization, integration of some domains; making connections between results; use of some specific investigations methods, techniques, and instruments; capacity of using in practice the acquired knowledge; implication in scientific activities related to insect ecology; ability of working with specialists in other fields.

Assessment: The final mark will be calculated based on: activity during seminars (30%), mid semester examination (20%), final examination (50%)

References

- 1.STAN, G., 1993-1996, Metode statistice cu aplicații în cercetări entomologice, SRL Buletin de informare, vol 4-7, Cluj-Napoca
- 2.TEODORESCU, I., VĂDINEANU, A., 1999, Controlul populațiilor de insecte, Ed. Universității, București

PLANTS ECOLOGY

Course coordinator : Prof. Dr. DRĂGULESCU CONSTANTIN titular – Chair of Ecology and environment protection

Year : III semester : 5

No. hours course: 1 ; **no. hours laboratory** : 1 ; **no. hours seminary** : 1

Discipline type : optional ; speciality

ECTS: 4

Prerequisites: Plants biology 1, 2, General ecology, Phytosociology and Romanian vegetation

Aims:

The knowledge and understanding by the students of terms, notions, concepts, and principles regarding the plants' preferences and adaptations to abiotic and biotic factors and the classification of plants' species according to these. Getting the students familiarized with the practical importance of plant ecology and its applications.

Content:

The ecological factors which act on the plants: abiotic factors: climatic and orographic factors; edaphic factors. Biotic factors: cooperation (symbioses) and competition; parasitism and saprophytism; Carnivorous plants; Alelopathy; Primar consumers. The ecological factors and primar productivity. The influence of ecological factors on photosyntheses. The vegetal bioindicators.

Skills :

Capability to understand and render terms, concepts and principles of Plant Ecology, to explain plants ecological and cenotical preferences. Competence to explore the vegetal world in order to make prognoses and extrapolations based on own observation and experiments, and on specific methods and techniques in this field.

Assesement :

The final mark will be calculated based on :

Activity during seminars 50%.

Final examination 50%.

References :

Borza, Al., Boşcaiu, N., 1965, Introducere în studiul covorului vegetal (Introduction in the study of vegetal carpet), Edit. Acad. Bucureşti

Cristea V., Gafta, D., Pedrotti F., 2004, Fitosociologie (Phytosociology), Edit. Presa Universitară Clujană, Cluj-Napoca

Rawald, W., 1963, Planta, mediul și natura (The plant, environment and nature), Edit. științ. Bucureşti

Sîrbu, I, Benedek Ana Maria, 2004, Ecologie practică (Practical ecology), Edit. Univ. "Lucian Blaga" Sibiu

VEGETAL RESOURCES

Course coordinator : Prof. Dr. DRĂGULESCU CONSTANTIN titular – Chair of Ecology and environment protection

Year : I semester : 1 Master

No. hours course: 2; **no. hours laboratory** : 1 ; **no. hours seminary** : 1

Discipline type : optional ; speciality

ECTS: 5

Prerequisites: Plants biology 2, Phytosociology and Romanian vegetation

Aims:

The knowledge of spontaneous plant categories with economic value (alimentary, fodder, medicinal, meliferous, industrial, decorative) and of the most representative species from each category. Means of revaluating these plants without jeopardizing the phytocoenoses' equilibrium in order to secure a sustainable development.

Content:

The main economic categories of spontan plants. Edible plants. Forage plants. Medicinal plants. Melliferous plants. Industrial plants. Ornamental plants. The estimation of vegetal potential of regions. The rational harvest of plants.

Skills :

Capability of understanding and rendering of terms and scientific names of plants. Capability to identify the main useful plant species. Capability to explore the vegetal world in order to make prognoses and extrapolations on phytodiversity. Participation in work/research teams.

Assesement :

The final mark will be calculated based on :

Practical examination 33%.

Final examination 66%.

References :

Cîrnu V.I., 1968, Plante melifere (Melliferous plants), Edit. Agro-silvică București

Crăciun F., Bojor O., Alexan M., 1976-1977, Farmacia naturii I-II (Pharmacy of Nature), Edit. Ceres București

Drăgulescu, C., 2008, Plante comestibile din România (Edible plants of Romania), Edit. Alma Mater Sibiu

Pușcaru-Soroceanu, Evdochia (coord.), 1963, Pășunile și fânețele din Republica Populară Română. Studiu geobotanic și agroproductiv (The grass-plots of Romania), Edit. Acad. București

ETHOLOGY

Course coordinator: dr. IOAN SÎRBU - professor in ordinary, Department of Ecology and Environmental Protection, Faculty of Sciences, "Lucian Blaga" University in Sibiu

Year, semester: III, 6

No. hours course: no. hours seminary / laboratory: 28 hours course, 14 hours seminary

Discipline type: optional, ECTS: 5

Prerequisites: Animal Biology 1 and 2, Animal Ecophysiology

Aims:

Study of behaviour as an environmental integration factor, proximal and distal ethological analysis, background, expressions, mechanisms and functions of the different behavioural patterns. Adaptive and evolutionary values of the animal behaviour. Developing skills for description, analysis, explanation and synthesis of different behaviours.

Content:

Definition, historical development, significance, causal analysis and mechanisms of behaviour; motivations, stimulus, adaptive character, phylogeny and behavioural evolution. Ontogenetic development and learning. Study of ethological methods, describing and debating on the main behaviour categories, ethograms accomplishment, documentaries preview. Introduction in human ethology.

Skills:

Knowledge of terms and concepts specific to this science; right use of speciality terms; understanding of fundamental phenomena specific to ethology, perception of some relations and connections, analitic and synthetic capacity; use of some specific investigations methods, techniques, and instruments; manifestation of a positive and responsible attitude towards this scientific field.

Assessment: The final mark will be calculated based on activity during seminars (10%), mid semester examination (10%), and final examination (80%).

References :

Sîrbu, I., 2008 - Etologie - note de curs (available through CD or via www).
Cociu, M., 1999 - Etologie. Comportamentul animal. Ed. ALL, București.

EVOLUTIONISM

Course coordinator: dr. **IOAN SÎRBU** - professor in ordinary, Department of Ecology and Environmental Protection, Faculty of Sciences, "Lucian Blaga" University in Sibiu

Year, semester: III, 6

No. hours course: no. hours seminary / laboratory: 28 hours course, 14 hours seminary

Discipline type: optional, ECTS: 5

Prerequisites: Plant Biology, Animal Biology, Genetics, Ecosystems: structure and functions, Population Ecology

Aims:

Conceptual and scientific foundations of evolutionism, proofs, theories and mechanisms of Universe, Earth and life evolution. Basics of evolutionary ecology. Knowledge of evolutionary forces and intimate mechanisms, theories of life origin and diversification, geochronological scale and features, descent of humanity.

Content:

Definition and proofs of evolutionary theory, the meaning and scope of evolutionary thinking in science and daily life, genesis and history of the Universe, Earth and life, background and reasons for biodiversity, geochronological scale correlated with life development analysis, forces and mechanisms of evolution, natural selection, adaptation, phylogenetic reconstruction, species and speciation, superior taxa and their significance, origin and evolution of the hominids and of the modern humans.

Skills:

Knowledge of terms and concepts specific to this science; right use of speciality terms; understanding of fundamental phenomena specific to evolutionism, perception of some relations and connections, analitic and synthetic capacity; use of some specific investigations methods, techniques, and instruments; manifestation of a positive and responsible attitude towards this scientific field.

Assessment: Final examination 80%, activity during the seminars 10%, mid semester examination 10%.

References :

Sîrbu, I., 2008 - Evoluționism (in electronic format, available via internet)

Mayr, E., 2004 - De la bacterii la om. Evoluția lumii vii. Ed. Humanitas, București.

Mustață G., Mustață M., 2001 - Origine, Evoluție și Evoluționism. Ed. „Vasile Goldiș” University Press, Arad.

Mustață G., Mustață M., 2002 - Homo sapiens sapiens L. Origine și evoluție. Ed. „Vasile Goldiș” University Press, Arad.

GLOBAL CHANGE OF ENVIRONMENT

Course coordinator: COSTEA MARIOARA, holder, Lect. Dr., Department of Ecology and Environmental Protection, Faculty of Science, "Lucian Blaga" University of Sibiu.

Year, semester: III year, IV semester.

No. hours course: no. hours seminary / laboratory: 14 course / 14 seminary.

Discipline type: Specialty, optional, no. credits: 5.

Prerequisites: General Ecology, Ecosystems: structure and functions Hydrobiology, Physical environment I (Geomorphology with elements of Geology), Physical environment II (Hydric Environment), Physical environment III (Atmospheric Environment), General Human Geography, Environmental Geography.

Aims: emphasizing the interdisciplinary character of global environmental changes; the presentation of systemic changes (climate warming, the destruction of the ozone layer, increasing Planetary Ocean level) and the cumulative global changes deforestation, soil degradation, desertification, etc.; identify problems of imbalance in the Earth global system and disruption of regional level; knowledge concerns environmental protection on international and national levels and significant results.

Content: Interdisciplinary research of environment. The Earth global system. Geomorphological system, hydrosphere, climatosfera, biosphere and antroposfera. Human development and environmental pressure. The dynamics in time and space of the population. Demographic transition. Areas of human pressure. The features of global urbanization. Systemic changes: changes in global climate, changes of bio-geo-chemical cycles, changes in hydro-cycles; Cumulative changes: land use as changes factors, deforestation, desertification, degradation of ecosystems and the reduction of biodiversity, soil erosion, pollution. Spatial differentiation of environmental changes. Extreme phenomena and critical geographic spaces. Sustainable development. The concept of sustainable development in the global context.

Skills: appropriation of terminology that is operating in environmental issues, understanding the relationship between human development, population trends and global issues of humanity, quantifying risk natural and / or anthropogenic, modelling and algorithm; realization of links between phenomena related to global changes, the capacity of synthesis of issues concerning global environmental changes.

Assessment: Knowledge evaluation is done by calculating the weighted average that takes into account: 25% - the work completed at seminars and support oral essays worked during the semester, 75% - Final examination on the basis of written exam with questions that concern definition of agents, events, extremely processes and interest areas related to global changes.

Bibliografie:

Bălteanu D., Șerban Mihaela (2005), Modificările globale ale mediului, Edit. Coresi, București.

Brown L. (1996), Probleme globale ale omenirii, Edit. Tehnică București.

Costea, Marioara (2002), Bazele teoretice ale geografiei, Edit. Universității Lucian Blaga din Sibiu.

Vădineanu A. (1998), Dezvoltarea durabilă. Teorie și practică, Vol. I Edit. Universității București.