INTERNATIONAL SCIENTIFIC-EDUCATIONAL

CENTER OF NAS RA

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INTERNATIONAL SCIENTIFIC
EDUCATIONAL CENTER

Guidebook on Courses in English

ENVIRONMENTAL PROTECTION AND NATURE MANAGEMENT
Master's Degree Program

ENVIRONMENTAL MONITORING AND MEASUREMENT DEVICES

Module _1_ credit _4_

INTRODUCTION

1. Course goal is to develop students' knowledge about modern environmental monitoring programs, its significance, control system and methods, familiarize with some field and laboratory devices and develop the ability to assess environmental pollution levels in field and laboratory conditions.

2. Course objectives

a) to develop students' knowledge about:

- environmental monitoring as a necessary system for obtaining reliable information for solution of the most important ecological problems;
- the levels of environmental monitoring, their hierarchy, principles of formation, limitations of the research and observation
- the local and international standards applied in the environmental monitoring system
- main environmental compartments, peculiarities of their monitoring, and basic controlled processes
- statistical treatment of obtained data

b) to develop students' skills and abilities to:

- select the sampling method
- design a sampling plan,
- perform sampling of various environmental compartments,
- perform some in situ measurements,
- choose the relevant analytical method,
- perform statistical analysis of the obtained data,
- perform assessment of environmental contamination.

EXPECTED LEARNING OUTCOMES

As a result of learning course modules, the students will:

1. **Know**

- the levels of environmental monitoring, their hierarchy, principles of formation.
- the local and international standards applied in the environmental monitoring systems
- the peculiarities of monitoring of different environmental compartments, and main controlled processes and pollutants.
- the analytical provision of monitoring of environmental radioactivity, the main analytical methods and equipment used, as well as their limitations.

2. **Be able to**

- design the sampling plan
- choose sampling method

- perform sampling of different environmental compartments
- perform some in situ measurements
- choose the analytical method
- perform statistical treatment of the obtained data
- assess contamination level of environmental compartments

3. **Master**
- skills to plan environmental studies
- skills of sampling of different environmental compartments,
- ability to perform some in situ measurements
- skills of statistical analysis of obtained data,
- implementation of environmental contamination assessment

COURSE CONTENT

Total 120 hours, out of which lecures 24 hours, 2 seminars and 6 practicals, independent work: 88 hours

ASSESSMENT CRITERIA AT THE END OF COURSE

Assessment is based on the knowledge of the core content of the course, the ability to present what has been perceived in writing and oral form, and the demonstration of the ability to acquire additional knowledge independently.

- Assessment forms: midterm examination in writing and oral presentations,
- Assessment procedures: the aggregate of two midterm examinations, final examination and the component of attendance and active participation in classes,
- Assessment components: (assessment scale - 0.5)

Examination type	**Point**
1. First midterm	0-4
2. Second midterm	0-4
3. Final examination	0-10
Attendance	**Point**
Attendance and active participation in classes	0-2

Module _1_ credit _4_

INTRODUCTION

1. Course goal is to develop students' knowledge about natural and artificial radioactivity, application of radioactive materials and environmental consequences of such applications, principals of radiation protection, to familiarize students with the analytical methods and equipment that applied in environmental radiological monitoring, to develop skills of human dose and dose rate estimation

2. Course objectives

a) to develop students' knowledge about:

- structure of the atom and radioactive decay;
- interaction of ionizing radiation with matter and biological objects;
- modern methods and equipment that applied in radiation identification and measurement;
- naturally occurring radioactive material (NORM) and technological enhancement of natural radioactivity (TENR);
- application of technologically enhanced naturally occurring radioactive material (TENORM) in atomic energy, medicine, nuclear weapons;
- environmental consequences of application of TENORM and artificial radionuclides;
- monitoring of environmental radioactivity;
- principals of environmental and human radiation protection;
- international convention and treaties related to radiation protection.

b) to develop students' skills and abilities to:

- use databases and databases of radioactive decay
- select the analytical method for the radionuclide identification and measurement of activity
- perform in situ measurements of the absorbed dose in air
- calculate the specific activity of a radionuclides based on law of radioactive decay
- identify hazardous radioactive sources in order to inform the relevant authorities.

EXPECTED LEARNING OUTCOMES

As a result of learning course modules, the students will:

4. Know

- law of radioactive decay, basic parameters of radionuclides, types of ionizing radiation and their effects on living matter;
- methods and modern equipment used in measuring of radioactivity;
- naturally occurring radioactivity and the technological processes that lead to the enhancement of naturally occurring radioactity;
- application of the technologically enhanced naturally occurring radioactive materials and artificial radionuclides as well as on the environmental consequences of such applications;
- organization and implementation of radiological monitoring of the environment;
- environmental radiation protection and safety principals.

5. **Be able to**

- use databases and databases of radioactive decay
- use existing databases and datasets in the field of dosimetry
- choose the relevant analytical methods for identification and measurements of alpha, beta and gamma emitting isotopes;
- identify hazardous radioactive sources in order to inform the relevant authorities;
- calculate individual and collective effective doses based on the specific activity of the radioactive source.

6. **Master**

- in situ measurement of the absorbed dose rate in air;
- the calculation of specific activity of radionuclides based on law of radioactive decay;
- the calculation of the individual doses and assess dose rate;
- the calculation of individual annual effective dose;
- the calculation of collective annual effective dose;
- the extraction of information from the existing databases and datasets in the field of radiology and dosimetry.

COURSE CONTENT

Total 120 hours, out of which lecures 24 hours, 4 seminars and 4 practicals, independent work: 88 hours

ASSESSMENT CRITERIA AT THE END OF COURSE

Assessment is based on the knowledge of the core content of the course, the ability to present what has been perceived it in writing and oral form, and the demonstration of the ability to acquire additional knowledge independently.

- Assessment forms: midterm examination in writing and oral presentations,
- Assessment procedures: the aggregate of two midterm examinations, final examination and the component of attendance and active participation in classes,
- Assessment components: (assessment scale - 0.5)

Examination type	**Point**
1. First midterm	0-4
2. Second midterm	0-4
3. Final examination	0-10
Attendance	**Point**
Attendance and active participation in classes	0-2

Environmental Geochemistry

Module _1_ credit _4_

INTRODUCTION

1. Course goal is to acquaint future specialists with the basic features of geochemical processes, phenomena, the main features of geochemical research methods, to provide the necessary theoretical-practical knowledge and skills for the assessment of the types, scales, levels, hazards, risk and pollution pathways of the various environmental Media. It will also enable them to become familiar with measures to reduce the level of environmental pollution.

2. Course objectives are to introduce:

- The methodological bases, approaches, study objects and subject, scientific goal and problems of the "Environmental geochemistry" science.
- Basic geochemical processes, phenomena, conceptual apparatus
- Basic scientific research methods used in environmental geochemistry.
- Geochemical features of urban, mining and agricultural areas
- Possible directions and application in the researches of environmental geochemistry
- Environmental pollution issues, including Worldwide and RA environmental pollution
- The process of geochemical research, involving students in the actual research carried out within the framework of practical work

EXPECTED LEARNING OUTCOMES

As a result of learning course modules, the students will:

1. **know** the basic principles of the science of "Environmental Geochemistry", the methodological basis, the peculiarities of the formation of geochemical phenomena and processes. Main areas of geochemical knowledge application.
2. **be able to** conduct research, analyze and evaluate the results of other similar research
3. **master** research methods of the Environmental geochemistry

COURSE CONTENT

Total __90__hours, out of which lecures _24__hourse, __4__seminars and __4_practicals

ASSESSMENT CRITERIA AT THE END OF COURSE

Assessment is based on the knowledge of the core content of the course, the ability to present what has been perceived it in writing and oral form, and the demonstration of the ability to acquire additional knowledge independently.

- Assessment forms: midterm examination in writing and oral presentations,
- Assessment procedures: the aggregate of two midterm examinations, final examination and the component of attendance and active participation in classes,
- Assessment components: (assessment scale - 0.5)

Examination type	**Point**
1. First midterm	0-4
2. Second midterm	0-4
3. Final examination	0-10
Attendance	**Point**
Attendance and active participation in classes	0-2

Research Logic

Module _1_ credit _3_

INTRODUCTION

1. Course goal to develop research skills for early researchers, teach future professionals the basics, stages, methods, and logic of conducting scientific research. To develop students' scientific written-oral skills, in particular, writing skills of master's thesis, scientific article and other scientific works, for oral reports.

2. Course objectives

- The general logic of conducting research and stages implementation
- General-scientific research methods
- The necessary information searching and information coordination Methods
- Use of information sources and citation literacy
- competent writing of master's theses and other scientific works
- competent design of oral reports

EXPECTED LEARNING OUTCOMES

As a result of learning course modules, the students will:

1. know fundamentals of scientific research, logic, stages and steps

2. be able to competently formulation of oral and writing results

3. master research conducting skills, information search tools, literate use of literature, competent formulation of master's thesis

COURSE CONTENT

Total _90_hours, out of which lecures _24__hourse, __4__seminars and _4__practicals

ASSESSMENT CRITERIA AT THE END OF COURSE

Assessment is based on the knowledge of the core content of the course, the ability to present what has been perceived it in writing and oral form, and the demonstration of the ability to acquire additional knowledge independently.

- Assessment forms: midterm examination in writing and oral presentations,
- Assessment procedures: the aggregate of two midterm examinations, final examination and the component of attendance and active participation in classes,
- Assessment components: (assessment scale - 0.5)

Examination type	**Point**
1. First midterm	0-4
2. Second midterm	0-4
3. Final examination	0-10

Attendance	**Point**
Attendance and active participation in classes	0-2

LANDSCAPE PLANNING

Module _1_ credit _3_

INTRODUCTION

1. Course goal is to introduce to the main principles of the landscape planning as a core step of the spatial and human activity planning policy and a platform for scientifically justified decision making oriented to the sustainable development.

2. Course objectives

- Introducing the natural complexes, landscape-forming natural and social-economical factors and to the geoecological properties of the modern landscape.
- Introducing the main principles, definitions, methods and steps of the landscape planning.
- Teaching the regional characteristics of the landscape planning based on the studying the experience of several countries (including Armenia) in the context of spatial planning and regional policy.

EXPECTED LEARNING OUTCOMES

As a result of learning course modules, the students will:

1. **know** the geoecological charachtertistics of modern natural complexes (landscapes), the main principles, definitions, methods and steps of the landscape planning.
2. **be able** to analyze and systemize the information related to the state, significance and sensitivity of the natural complexes according to the spatial planning norms and requirements.
3. **master** the modern approaches of assessing the geoecological state of the modern landscapes.

COURSE CONTENT

Total _32___hours, out of which lecures _24__hourse, _4___seminars and __4_practicals

ASSESSMENT CRITERIA AT THE END OF COURSE

Assessment is based on the knowledge of the core content of the course, the ability to present what has been perceived it in writing and oral form, and the demonstration of the ability to acquire additional knowledge independently.

- Assessment forms: midterm examination in writing and oral presentations,
- Assessment procedures: the aggregate of two midterm examinations, final examination and the component of attendance and active participation in classes,
- Assessment components: (assessment scale - 0.5)

Examination type	**Point**
1. First midterm	0-4
2. Second midterm	0-4
3. Final examination	0-10
Attendance	**Point**
Attendance and active participation in classes	0-2

Environmental Toxicology

Module 1 Credit 4

INTRODUCTION

1. Course goal is to acquaint students with the main types of toxins, their fate in the environment, as well as the side effects and potential risks for the human organism.

2. Course objectives

- introduce the terminology of the environmental toxicology;
- get acquainted with the classification of toxins, their properties, toxicity levels and the mechanisms of side effects on living organisms;
- introduce the essentials of toxicokinetics and toxicodynamics;
- describe ա discuss the main mechanisms of target organ toxicology;
- get acquainted with the databases for the toxicology of environmental contaminants.

EXPECTED LEARNING OUTCOMES

As a result of learning course modules, the students will:

1. know the sources and main types of toxic substances, their toxicological properties, as well as the types and levels of side (toxic) effects.

2. be able to understand the mechanisms of toxic effects of environmental pollutants on living organisms, as well as the dose-response ratio.

3. master the basic principles of mitigation and prevention of side effects of toxin subtances on the human organism and environment, as well as the use of databases for the toxicology of contaminants.

COURSE CONTENT

Total 120 hours, out of which lecures 32 hourse, 20 seminars and practicals, 68 hours of individual work.

ASSESSMENT CRITERIA AT THE END OF COURSE

Assessment is based on the knowledge of the core content of the course, the ability to present (both written and oral forms) what has been perceived, and the demonstration of the ability to acquire additional knowledge independently.

- Assessment forms: midterm examination (written) and oral presentations,
- Assessment procedures: the aggregate of two midterm examinations, final examination and the component of attendance and active participation in classes,
- Assessment components: (assessment scale - 0.5)

Examination type	***Point***
1. First midterm	0-4
2. Second midterm	0-4
3. Final	0-10
Attendance	***Point***

Attendance and active participation in classes	0-2

SPATIAL DATA INFRASTRUCTURE AND MANAGEMENT

Module _1_ credit _4_

INTRODUCTION

1. Course goal is to introduce to the geographical Information systems (GIS) and spatial data infrastructures, as main tools of systemizing spatial data and making scientifically justified decisions.

2. Course objectives

- Introducing GIS technologies and the skills, methods and principals of the geospatial data processing, maintaining, analyzing, and producing.
- Introducing the main structural components of the spatial data infrastructures, software, global data repositories and the benefits of their application.
- Introducing geospatial standards, the experience of creating the nationally distributed processing capacities for geospatial data in Armenia as well as the benefits of geospatial data and metadata sharing and exchange.

EXPECTED LEARNING OUTCOMES

As a result of learning course modules, the students will:

4. **Know**
   a. The role and significance of geospatial information technologies in scientifically justified decision making in relation to the sustainable land-use planning and development.
   b. The structure of GIS, the types of data models in GIS, the methods of data analysis, visualization and generation.
   c. The role and opportunities of web-GIS for data standardization and sharing.

5. **Be able** to analyze and systemize the information related to the state, significance and sensitivity of the natural complexes according to the spatial planning norms and requirements.

6. **Master** the modern approaches and methods of processing, analyzing, visualizing and exchanging and sharing the geospatial data.

COURSE CONTENT

Total _32___hours, out of which lecures _24__hourse, _2_seminars and __6_practicals

ASSESSMENT CRITERIA AT THE END OF COURSE

Assessment is based on the knowledge of the core content of the course, the ability to present what has been perceived it in writing and oral form, and the demonstration of the ability to acquire additional knowledge independently.

- Assessment forms: midterm examination in writing and oral presentations,

- Assessment procedures: the aggregate of two midterm examinations, final examination and the component of attendance and active participation in classes,
- Assessment components: (assessment scale - 0.5)

Examination type	**Point**
1. First midterm	0-4
2. Second midterm	0-4
3. Final examination	0-10
Attendance	**Point**
Attendance and active participation in classes	0-2

ENVIRONMENTAL STATISTICS

Module _1_ credit _3_

INTRODUCTION

1. Course goal is to familiarize students with the methods of environmental statistics for environmental data acquisition, generation, treatment and analysis by statistical softwares.

2. Course objectives

1. Study the main descriptive statistical parameters
2. Perform a sample design
3. Test the Normality of data
4. To perform different statistical transformations
5. To perform correlation and regression analysis
6. To understand the peculiarities of principal component analysis (PCA) and cluster analysis (CA) and their role in environmental data treatment

EXPECTED LEARNING OUTCOMES

As a result of learning course modules, the students will:

1. Know

- the main descriptive statistical parameters
- the main statistical transformations
- the common methods of the study of the relationship between the environmental variables
- the environmental variables grouping methods

2. Be able to

- select appropriate statistical method based on the features of environmental data set
- perform statistical transformations
- use different statistical softwares
- study the relationship of environmental variables
- create and interpret different graphs
- perform PCA and CA

3. Master

- the application of statistical methods in environmental monitoring and assessment
- data sets and conduct statistical analysis
- statistical programs

COURSE CONTENT

Total _90_hours, out of which lecures 24_hourse, __8__seminars and __58_practicals

ASSESSMENT CRITERIA AT THE END OF COURSE

Assessment is based on the knowledge of the core content of the course, the ability to present what has been perceived in writing and oral form, and the demonstration of the ability to acquire additional knowledge independently.

- Assessment forms: midterm examination in writing and oral presentations,
- Assessment procedures: the aggregate of two midterm examinations, final examination and the component of attendance and active participation in classes,
- Assessment components: (assessment scale - 0.5)

Examination type	**Point**
1. First midterm	0-4
2. Second midterm	0-4
3. Final examination	0-10
Attendance	**Point**
Attendance and active participation in classes	0-2

Food Safety Risk Assessment
Module 1 credit 4

INTRODUCTION

1. Course goal is to introduce the basics of food safety defense, highlighting modern and internationally accepted food safety standards and principles.

2. Course objectives

) Investigation of the hazards of the food chain, the main sources and negative effects for human health
2) Expertise of the hygiene requirements and indicators of quality and safety for raw materials and processed food
3) Risk analysis concept, food safety management systems and pre-requisite programs
4) Get acquainted with the RA and international approaches of food safety
5) Get acquainted with the approaches and criteria of food safety risk analysis
6) Get acquainted with modern methods of food safety risk assessment
7) Introduce acute and chronic risk assessment methods
8) Familiarize with the exposure assessment and risk characterization procedures

EXPECTED LEARNING OUTCOMES

As a result of learning course modules, the students will:

1. know the peculiarities of food contamination at different stages of the food supply chain, as well as the potential hazards and risks associated with food consumption.
2. be able to apply food safety standards, distinguish both counterfeit and potentially dangerous food which can pose adverse health effects.
3. master qualitative and quantitative methods of acute and chronic risk assessment.

COURSE CONTENT

Total 120 hours, out of which lecures 32 hourse, 20 seminars and practicals, 68 hours of individual work.

ASSESSMENT CRITERIA AT THE END OF COURSE

Assessment is based on the knowledge of the core content of the course, the ability to present what has been perceived it in writing and oral form, and the demonstration of the ability to acquire additional knowledge independently.

- Assessment forms: midterm examination in writing and oral presentations,
- Assessment procedures: the aggregate of two midterm examinations, final examination and the component of attendance and active participation in classes,
- Assessment components: (assessment scale - 0.5)

Examination type	**Point**
1. First midterm	0-4

2. Second midterm	0-4
3. Final examination	0-10
Attendance	**Point**
Attendance and active participation in classes	0-2

URBAN ECOLOGY

Module 18, credit 4

INTRODUCTION

1. **Course goal** of this course intended for students is developing a science-based ecological perception, acquiring a comprehensive knowledge in building an environmentally friendly habitat, gaining relevant decision making skills.

2. **Key issues** to be addressed include the status of urban geo-sociosystem and forecasting the ways of its development as a whole, interaction of its compartments, the influence of urban environment on adjacent sites and their ecosystems.

COURSE OBJECTIVES:

- get acquainted with the environmental problems of the cities, as well as the components of urban systems
- study the magnitudes (volumes) of anthropogenic impact on the urban ecosystem ա intensity (intensity),
- get acquainted with the measures of quality protection and regulation of water and air systems of cities, as well as land protection;
- master the theoretical and practical foundations of urban environment monitoring and management methods.

EXPECTED LEARNING OUTCOMES

Students as a result of learning subject modules will

1. know urban infrastructure components of urban environment
2. be able to assess the problems in the cities
3. master all the necessary environmental measures that will lead to their effective solution

COURSE CONTENT

Total 120 hours, out of which 24 hours, 8 seminars and practicals, independent work: 88

ASSESSMENT CRITERIA AT THE END OF COURSE

Assessment is based on the knowledge of the core content of the course, the ability to present what has been perceived it in writing and oral form, and the demonstration of the ability to acquire additional knowledge independently.

- assessment forms: midterm examination in writing and oral presentation,
- assessment procedures: the aggregate of two midterm examinations, final examination and the component of attendance and active participation in classes.
- assessment components: (assessment scale – 0.5)

Examination type	**Point**
1. First midterm	0-4

2. Second midterm	0-4
3. Final examination	0-10

Attendance	**Point**
Attendance and active participation in classes	0-2