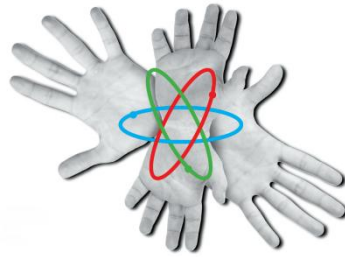




Tempus



|HUMAN Security|

(environment, quality of food, public health and society) on Territories Contaminated by Radioactive Agents

530644-TEMPUS-1-2012-1-ES-TEMPUS-JPCR



*Zhytomyr State Technological University*

**Masters training on specialty  
8.04010605 «Radioecology»**

**Specialization “Human Security & Quality of Food on Territories  
Contaminated by Radioactive Agents”**

2013

Training Masters on specialty 8.04010605 “Radioecology”. Specialization: “Human Security & Quality of Food on Territories Contaminated by Radioactive Agents”. – Zhytomyr: ZhSTU, 2013. – 36 p.

Compilers:

- |                      |   |   |
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| Svitlana Sukhovetska | – | Senior Lecturer, the vice dean of the Faculty of Mining and Ecology, ZhSTU.                                   |

The main information about Ecologist Training in Zhytomyr State Technological University is given. Curriculum for Training Masters on specialty “Radioecology”, specialization: “Human Security & Quality of Food on Territories Contaminated by Radioactive Agents” is provided. Comparative characteristics of Curriculum for training Masters on specialty 8.04010605 “Radioecology” (2013) and Curriculum for Training Masters on specialty “Ecology and Environment Protection” (2008 year) is done. The changes in a new Curriculum which were done after studying the experience of European partner Universities and considering interdisciplinary approach for training Masters were described. The Syllabuses include some sections which realize objectives of the project 530644-TEMPUS-1-2012-1-ES-Tempus-JPCR “Human Security (environment, quality of food, public health and society) on Territories Contaminated by Radioactive Agents”. The list of general requirements as for the competencies of specialists is shown.

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- 2 General characteristics of training ecologists in ZhSTU
- 3 Distribution of educational and professional programs content according to the total volume and to the cycles of Master training, specialty 8.04010605 "Radioecology"
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- 5 A comparison of curricula for Master training, specialty "Ecology and Environment Protection" (2008) and specialty "Radioecology" (2013)
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## INTRODUCTION

In 2013, such Partner Countries as Belarus, the Russian Federation, Ukraine and some other countries celebrated the 20<sup>th</sup> anniversary of the European Union Tempus Program. The aim of the program is to encourage modernization process of higher education in partner countries (neighboring countries) supporting financially the balanced cooperation of higher educational establishments (universities, first of all) of the EU member states and Partner Countries (PC). The fourth phase of the Program (Tempus IV) is to be finished in 2016.

The Brochure is worked out in the framework of the Joint European Project «Human Security (environment, quality of food, public health and society) on Territories Contaminated by Radioactive Agents» according to the Tempus Program IV that was chosen to get funding in 2012. The members of the Project from the European Union are: Cordoba University (Spain) – the Project coordinator, the University of Parma (Italy), the University of Florence (Italy), Swedish University of Agricultural Sciences (Sweden) and Riga Technical University (Latvia). Three Partner Countries participate in the Project: Belarus, the Russian Federation and Ukraine.

Members of the Project from Belarus are the following: Belarusian State University (Minsk), International Sakharov Environmental University (Minsk), Grodno State Medical University, and Grodno State Agrarian University. Russian members of the Project are the following: Voronezh State University, Tyumen State Medical Academy, Ural Federal University (Yekaterinburg), Chelyabinsk State University and Nuclear Information-Educational Center. Ukrainian members of the Project are the following: Vinnitsa National Medical University, Zhytomyr State Technological University, Kyiv International University, Sevastopol National University of Nuclear Energy and Industry, Polissia Branch of G.M. Vysotsky Ukrainian Research Institute of Forestry and Forest Melioration.

The wider project objective is training of new generation of professionals which can fully decide multidisciplinary problems existing on the BY, RU and UA territories contaminated by radioactive nuclear agents during the Chernobyl and Kyshtym disasters taking into consideration interconnection of their environmental, public health and social psychological components, experts, who will be able to ensure safe and comfort living conditions for population of these territories (more than 10 million people)/

The main project specific objectives are:

1. To develop interdisciplinary Master and PhD Programs focused on Human Security (HS) of population lived on territories suffered by accidents at Nuclear Power Plants/ nuclear fuel reprocessing plants in frames of following specialities:

- Ecology and Environment Sciences – “Human Security and Environment”;
- Food quality control – “Human Security and Quality of Food”;
- Medicine – “Human Security and Public Health”;
- Political and Social Sciences – “Human Security and Society”;

and introduce them in 12 PC Universities (4 universities in Belarus, 4 universities in Russia, 4 universities in Ukraine) since September 2014.

2. To improve professional and pedagogical qualification of PC teachers and modernize teaching infrastructure of PC Universities for providing of advanced level of Master and PhD students’ training on appropriate Human Security Programs.

Following results are considered to be achieved after finishing the Project:

- Worked out interdisciplinary Master's and Doctoral Degree (PhD) Curricula in the field of Human Security considering people who live on contaminated territories after Nuclear Power Plants accidents/ Nuclear Fuel Reprocessing Plants accidents according to four different directions of students' training: "Human Security and Environment", "Human Security and Quality of Food", "Human Security and Public Health" and "Human Security and Society";
- Teachers of Belarusian, Russian and Ukrainian Universities participated in the project who upgraded their professional skills (at the EU Universities inclusively) in the field of Human Security and Modern Teaching Methods;
- Worked out, published and stored in an electronic library teaching and methodical materials which help students in their study according to the Syllabi;
- The first intake of Masters who studied according to the interdisciplinary programs (at the EU Universities inclusively);
- The results of the Project are spread among the universities of Belarus, the Russian Federation and Ukraine.

Given Brochure contains information on Master's Curriculum which was worked out in Zhytomyr State Technological University according to the specialty 8.04010605 "Radioecology", specialization "Human Security and Quality of Food": general characteristics of ecologists training in ZhSTU; distribution of educational and professional programs content according to the total volume of credits and to the cycles of training; specialty, schedule of training; Curriculum; syllabi; the list of the main competencies of a specialist, and some other documents.

The brochure is written for students, teachers, and other participants of training process and for administration personnel who are engaged in planning and organization of students' training. Besides, the teachers and administration personnel of the educational establishments of Partner Countries can use the Brochure to know the results of the Tempus Project. The results can be used in the process of training specialists for the regions suffered after Nuclear Power Plants and Nuclear Fuel Reprocessing Plants accidents.

## General characteristics of training ecologists in ZhSTU

1998 year	Started Bachelors training, direction 6.040106 “Ecology, Environment Protection and Balanced Environmental Management”, educational qualification 3439 «Environmental manager» Duration of training 4 years – 240 credits ECTS
2003 year	Started specialists and masters training on specialty 7/8.04010601 “Ecology and environment protection”. Qualification 2149.2 “Safe Environment Engineer” Duration of training: 1 year– 60 credits ECTS
2013 year	Masters training is divided into 2 specialties: <ul style="list-style-type: none"> <li>• Specialty 8.04010601 “Ecology and environment protection”, educational qualification 2211.2 “Ecologist”, 2310.2 “The teacher of higher educational institution”</li> <li>• Specialty 8.04010605 “Radioecology”, educational qualification 2111.2 “Radiology engineer”</li> <li>• Duration of training: 1 year– 60 credits ECTS</li> </ul>

### Distribution of educational and professional programs content according to the total volume and to the cycles of Master training, specialty 8.04010605 "Radioecology"

Training cycles	Total hours	ECTS credits	% of the total training time
The cycle of professionally oriented humanitarian and socio-economic training, Total:	216	6,0	10,0
The cycle of natural-scientific, professional and practical training, Total:	1188	33,0	55,0
including:			
- subjects	486	13,5	22,5
- pre-degree practice	216	6,0	10,0
- graduation projects	486	13,5	22,5
<b>Total hours at the statutory part, Total:</b>	<b>1404</b>	<b>39,0</b>	<b>65,0</b>
The cycle of subjects selected by the university. Total:	540	15,0	25,0

The cycle of subjects selected by the university. Total:	540	15,0	25,0
The cycle of subjects selected by students. Total:	216	6,0	10,0
<b>The total amount of hours for the selective part:</b>	<b>756</b>	<b>21,0</b>	<b>35,0</b>
<b>TOTAL FOR MASTER TRAINING:</b>	<b>2160</b>	<b>60,0</b>	<b>100,0</b>

Ministry of Education and Science of Ukraine  
Zhytomyr State Technological University

AUTHORIZED

The Rector of  
ZSTU P.P. Melnychuk

2023 у.



Educational-qualification level: Master

The period of training after getting Bachelor's/

Specialist's degree: 1 year

Qualification Radiology engineer

The form of training Full-time

# CURRICULUM

## Masters training

**Speciality** 8.04010605 "Radioecology"  
**Specialization** "Human Security & Quality of Food on Territories Contaminated by Radioactive Agents"  
**Direction** 6.040106 "Ecology, environment protection and balanced environmental management"  
**Branch of knowledge** 0401 "Natural sciences"

### I. The Schedule of training

SEPTEMBER					OCTOBER					NOVEMBER					DECEMBER					JANUARY					FEBRUARY					MARCH					APRIL					MAY					JUNE				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43							
								П	П								С	С	К	К									С	П	П	Д	Д	Д	Д	Д	Д	Д	Д	Д	Д	Д	А						
Conventional signs:					Theoretical training					Exams					Practice					Vacation					Diploma writing					Government certification																			
										С					П					К					Д					А																			

### II. Total time (weeks):

Theoretical training	Examination session	Practice	Diploma writing	Government certification	Vacation	Total
24	3	4	9	1	2	43

### III. Governmental certification : Diploma project

IV. Practice:	weeks	The term
Pre-degree (scientific-production)	2	1
Pre-degree (scientific-production)	2	2

## V. Curriculum

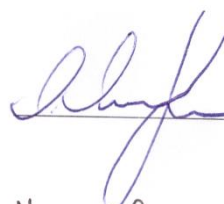
№№	NAME OF THE SUBJECT	Semester control		Course project	Hours					Number of classroom hours				
		Exams	Credits		Total number/credits ECTS	Classroom hours				Individual work	1 semester		2 semester	
						Total	Lectures	Laboratory work	Practical classes		1	2	3	4
		Number of weeks in a quarter												
		8	8		8	8								
		<b>I. Theoretical training of the educational part of the program</b>												
1.	<b><i>Professionally oriented, humanitarian and socio-economic training part</i></b>													
	<i>Occupational safety and health</i>		1		1	36			8	28	1			
	<i>Civil defense</i>		1		1	36			8	28	1			
	<i>Sustainable Development Strategy</i>		2		2	72	8		16	48			3	
	<i>Methodology and Research design</i>		2		2	72	8		16	48			3	
	<b><i>Total, hours</i></b>				<b>6</b>	<b>216</b>	<b>16</b>		<b>48</b>	<b>152</b>				
2.	<b><i>Natural science and professional training part</i></b>													
	<i>Radioecology (by branches)</i>	1	10.3	1	4,5	162	32		32	98	4	4		
	<i>Radiation safety</i>	1			3	108	16		16	76	4			
	<i>Radiation monitoring</i>	1			3	108	16		16	76		4		
	<i>Rehabilitation of areas contaminated with radionuclides</i>	2			3	108	16		16	76			4	
	<b><i>Total, hours</i></b>				<b>13,5</b>	<b>486</b>	<b>80</b>		<b>80</b>	<b>326</b>				
3.	<b><i>Training courses selected by the University</i></b>													
	<i>Environmental Management and Auditing</i>		1		3	108	16		16	76	4			
	<i>Bioindication and bioassay</i>		1		3	108	16		16	76		4		
	<i>International environmental activities (in Radioecology)</i>		2		3	108	16		16	76			4	
	<i>Foreign Language for Special Purposes</i>	2			3,5	126			48	78	2	2	2	
	<i>Higher education in Ukraine and Bologna process</i>		1		1,5	54	8		8	38	2			



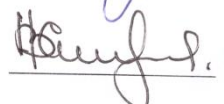
	<i>Intellectual Property</i>		1		1	36	8			28		1	
	<i>Total, hours</i>				15	540	64		104	372			
4.	<b>Training courses selected by the student</b>												
	<i>Silviculture</i>		2		3	108	16		16	76			2
	<i>Geotechnology of mining</i>		1		3	108	16		16	76		2	
	<i>Agriculture</i>				3	108	16		16	76			
	<i>Total, hours</i>				6	216	32		32	152			
	<b>Total hours of theoretical training</b>				40,5	1458	192		248	960	18	17	18
	Number of examinations	5											
	Number of credits		12										
	Course project	1											
5.	<b>II. Practical part of training</b>												
	<i>Pre-diploma practice</i>				6	216							
	<i>Diploma planning</i>				13,5	486							
	<i>Total, hours</i>				19,5	702							
	<b>Total, hours/credits</b>				60	2160							

\* student selects 2 out of 3 suggested subjects

The Pro Rector

 O.V. Oliynyk

The Dean of the Faculty of Mining and Ecology

 V.V. Kotenko

The Chief of the Department of Ecology

 V.P. Krasnov

**A comparison of curricula for Master  
specialty "Ecology and Environment Protection" (2008)  
and specialty "Radioecology" (2013)**

2008		2013		Changes in curricula and inter-disciplinary approach
Subjects	ECTS	Subjects	ECTS	
<b>I. Theoretical training</b>				
<b>1. Compulsory courses</b>				
<b>1.1. Professionally oriented, humanitarian and socio-economic training part</b>				
Civil defense	1,5	Occupational safety and health	1	Reduction of credits by 0,5
Occupational safety and health	1,5	Civil defense	1	Reduction of credits by 0,5
Methodology and Research design	1,5	Sustainable Development Strategy	2	Reduction of credits by 1,0 Shifted from the cycle 1.2 into the cycle 1.1 <i>3modules are included "Human Security and Society":</i> 1. International and national documents, legal acts which takes into account principles of socio-economic systems 2. Environmental Policy and Alternative Technologies 3. Strategies of local sustainable development, their monitoring; scenarios and plans forecast based on the consumption of the available environment-friendly products
Higher education in Ukraine and Bologna process	3	Methodology and Research design	2	Reduction of credits by 1,0
Pedagogy and Methods of Teaching in higher education	1,5			Excluded
<b>Total for the part</b>	<b>9</b>	<b>Total for the part</b>	<b>6</b>	<b>3 credits are taken from the total amount of the part and added to the professionally oriented subjects</b>
<b>1.2. Natural science subjects and practical training part</b>				
Sustainable Development Strategy	3	Radioecology (by branches)	4.5	A new subject is added

				<p><i>8 modules are added "Human Security and Environment":</i></p> <ol style="list-style-type: none"> <li>1. Scientific basis of Radiology and stages of development</li> <li>2. Current radiation situation in Ukraine and radiological consequences of the Chernobyl accident</li> <li>3. Methodological principles, basic principles and concepts of modern radioecological research</li> <li>4. Radioecology of forest ecosystems</li> <li>5. Radioecology of aquatic ecosystems</li> <li>6. Migration of radionuclides in open and mountainous landscapes</li> <li>7. The behavior of radionuclides in agrocenosis</li> <li>8. Character of the radionuclides transfer, their distribution and redistribution in urban systems</li> </ol> <p><i>1 module is added " Quality of Food and Human Security ":</i></p> <p>Migration of radionuclides to humans through a food chain</p>
Information Technologies	3	Radiation safety	3	<p>A new subject is added</p> <p><i>3 modules are added "Public Health and Human Security ":</i></p> <ol style="list-style-type: none"> <li>1. Norms and principles of radiation safety</li> <li>2. Organization of Radiation Safety of a territory, a facility, of staff and public</li> <li>3. Management decisions and organizational measures to ensure radiation safety</li> </ol>
Environmental Management and Auditing	3	Radiation monitoring	3	<p>A new subject is added</p> <p><i>2 modules are added "Quality of Food and Human Security":</i></p> <ol style="list-style-type: none"> <li>1. Dosimetric and radiometric equipment</li> <li>2. Sampling, and database formation and processing</li> </ol>
		Rehabilitation of areas contaminated with radionuclides	3	<p>The number of credits increased by 1,5</p> <p>Taken from the selective courses (selected by</p>

				<p>students) and added to the compulsory courses  <i>1 module is added "Human Security and Environment":</i>  Environmental rehabilitation of natural ecosystems, of agrocenosis and of the Chernobyl zone  <i>3 modules are added "Quality of Food and Human Security":</i>  1. Optimization of nature use on contaminated territories  2. Countermeasures to prevent and reduce contamination of agriculture, fishery and forestry products  3. Technological processing and recycling of products contaminated by radionuclides</p>
<b>Total for the part</b>	<b>9</b>	<b>Total for the part</b>	<b>13,5</b>	<b>The total for the part is increased by 4,5 credits</b>
<b>Total for the compulsory part of theoretical training</b>	<b>18</b>	<b>Total for the compulsory part of theoretical training</b>	<b>19,5</b>	<b>The total for the compulsory part is increased by 1,5 credits</b>
<b>2. Selective courses</b>				
<b>2.1. Training courses selected by the University</b>				
Systems theory and systems analysis in ecology	3	Environmental Management and Auditing	3	Taken from the compulsory courses and added to the selective courses
Bioindication and bioassay	3	Bioindication and bioassay	3	Without changes
Assessment	3	International environmental activities (in Radioecology)	3	A new subject is added <i>3 modules are added "Human Security and Society":</i> 1. Institutions and official organizations working in the field of nuclear safety and nuclear technologies 2. Social movement in the field of nuclear technology use 3. International and interstate agreements that govern radiation safety 4. Recommendations UNSCEAR, NCRP
		Foreign Language for Special Purposes	3,5	The number of credits is increased Taken from the selective courses (selected by students) and added to the selective courses (selected

				by the university)
		Higher education in Ukraine and Bologna process	1,5	Taken from the compulsory to the selective courses
		Intellectual Property	1	A new subject is added
<b>Total for the part</b>	<b>9</b>	<b>Total for the part</b>	<b>15</b>	<b>The total for the selective part of theoretical training (selected by the university) is increased by 6 credits</b>
<b>2.2. Training courses selected by students</b>				
Unit 1				
Optimization and land reclamation	1,5	Silviculture	3	A new subject is added
Foreign Language for Special Purposes	1,5	Geotechnology of mining	3	A new subject is added
Unit 2		Agriculture	3	A new subject is added
Rehabilitation of areas contaminated with radionuclides	1,5			
Foreign Language for Special Purposes	1,5			
Total for the part (student selects 1 unit)	3	Total for the part (student selects 2 out of all suggested subjects)	6	The total for the selective part of theoretical training (selected by students) is increased by 3 credits
Total for the elective part of theoretical training	12	Total for the elective part of theoretical training	21	The total for the selective part of theoretical training is increased by 9 credits
Total for the theoretical part	30	Total for the theoretical part	40,5	The total for theoretical training is increased by 10,5 credits
<b>II. Practical training</b>				
Research and teaching practice	6	Pre-diploma practice	6	The focus is brought into professionally-oriented practice
Preparation of master's thesis	24	Diploma planning	13,5	The number of credits is reduced
<b>Total for practical training</b>	<b>30</b>	<b>Total for practical training</b>	<b>19,5</b>	<b>Total for practical training is reduced by reducing credits for diploma writing (reduced by 10,5 credits and added to professional training).</b>
<b>Total for Master's Training: 60 ECTS credits</b>				

## Changes in the curriculum

Changes	Results
1.the schedule of the training	Reducing the credits for writing diploma project the total number of hours for theoretical training (both lessons and independent work) increased from 30 credits to 40,5. Thus, the total number of hours for academic subjects increased from 13 to 17.
2.corelation between training cycles	<p>The total number of hours for academic subjects of professionally oriented humanitarian and socio-economic training was reduced from 9 to 6 credits.</p> <p>The total number of hours for academic subjects of natural-scientific, professional and practical training increased from 9 to 13,5 credits.</p> <p>The total number of hours for the selective part of theoretical training increased from 9 to 15 credits.</p>
3. changes in the theoretical training	<p>The worked out Curriculum contains 8 new academic subjects; 4 subjects are excluded and 9 subjects are taken from the previous curriculum.</p> <p>The number of credits for separate subjects is changed.</p>
4. changes in the practical training	Research and pedagogical practice is replaced by pre-degree professionally oriented practice.

### Realization of the interdisciplinary approach

- The total for masters training is 60 credits ECTS; according the educational program 40,5 credits ECTS (67,5%) are subjects for theoretical training (lessons, independent work and exams). The total number of subjects in the curriculum is 17, which consists of 79 modules.
- Subjects which show the objectives of the project are 18,5 credits ECTS. It is 30,8% of the Curriculum credits and 45,7% of the subjects' credits.
- 6 subjects (35% of total number of subjects) respond to the objectives of the project. These 6 subjects consist of 37 modules.
- 25 modules (68%) off 37 modules of these 6 subjects realize the tasks of the project.

## Syllabi

(\*abilities and modules that respond to the project objectives are in *bold*)

### **1. OCCUPATIONAL SAFETY**

**Credits ECTS: 1**

**Total hours: 36**

**Form of control: final test-credit**

**Term: 1**

#### **Learning objectives:**

- ability to apply methods for radiation situation assessment using radiometric and dosimetric devices of different systems;
- ability to provide the required level of labor safety and personal security in the case of radiation hazardous situations;
- ability to apply means to prevent radiation damage and to provide first aid in emergency situations;
- ability to apply ionizing radiation diagnostic techniques and skills to use devices of individual and total radiation monitoring.

#### **Teaching activities:**

Practical lessons – 8 hours

#### **Short content:**

Safety management in the industry and science institutions:

- International and national standards on occupational safety
- Safety of technological processes and of equipment
- Certification of jobs and injury prevention

#### **Literature:**

1. Kucheryavyy V.P., Pavlyuk Y.Y., Kuzyk A.D., Kucheryavyy S.V. Occupational Safety: Tutorial. – L: “Oriyana Nova”, 2007. – 368 p. (in ukr.)
2. Syvko V.Y. Legal basis and management of occupational safety in Ukraine: Tutorial. – Zhytomyr: ZhITI, 2003. – 127 p. (in ukr.)
3. Occupational safety: Laboratory workshop, part I. /Edited by Syvko V.Y. – Zhytomyr: ZhITI, 2001. – 63 p. (in ukr.)

## **2. CIVIL PROTECTION**

***Credits ECTS: 1***

***Total hours: 36***

***Form of control: final test-credit***

***Term: 1***

### ***Learning objectives:***

- skills to assess collective and individual risks during accidents and disasters caused by natural and man-made factors;
- knowledge and skills of farming in anthropogenically contaminated and disturbed areas.

### ***Teaching activities:***

Practical lessons – 8 hours

### ***Short content:***

Population and territory protection from the emergency situations of anthropogenic and natural character:

- Planning of measures, situation forecasting, organization of the emergency and salvage operations, support measures and actions within a uniform system of civil protection
- Assessment of a Facility readiness to function in emergency situations and principles of its implementation
- Means, methods of analysis, principles of assessment, classification and monitoring of emergency

### ***Literature:***

1. Steblyuk M.G. Civil protection. Textbook. – K: «Znannya-press», 2003 – 456 p. (in ukr.)
2. Civil protection. Tutorial/Edited by B.S.Franchuk. –Lviv: Afisha, 2000. – 334 p. (in ukr.)
3. State Standard of Ukraine Б А.2.2-7:2010. Projecting. Engineering in civil protection (civil defence) and engineering as a part of project documentation of objects. – Kyiv: MinRegion Build of Ukraine, 2010. (in ukr.)



### 3. SUSTAINABLE DEVELOPMENT STRATEGY

*Credits ECTS: 2*

*Total hours: 72*

*Form of control: final test-credit*

*Term: 2*

*Learning objectives:*

- knowledge of the basic regularities of the open systems' dynamics, the relationship between the factors of sustainable development;
- **ability to use indicators of sustainable development to confirm decisions related to the development of socio-economic systems at global and regional levels;**
- **skills to use sustainable development indicators to assess environmental risks of economic development perspectives in the region;**
- **ability to analyze and predict social aspects of environmental policy;**
- ability to use the principles of sustainable development in the professional activities.

*Teaching activities:*

Lectures – 8 hours

Practical lessons – 16 hours

*Short content:*

Theoretical principles of sustainable development:

- The concept of system and development
- **International and national documents, legal acts which takes into account principles of socio-economic systems**
- Education and sustainable development and their concepts

Socio-economic aspects of sustainable development:

- Socio-economic status of the society during the transition to sustainable development
- **Environmental Policy and Alternative Technologies**
- **Strategies of local sustainable development, their monitoring; scenarios and plans forecast based on the consumption of the available environment-friendly products**

*Literature:*

1. Sustainable development strategy. Tutorial / Edited by V.M.Bogolyubov. – K.: NAU, 2008. – 248 p. (in ukr.)
2. Ukrainian national tutorial of the use of strategic environmental assessment in the framework of national system of prognosis, planning and environmental assessment. / Edited by O. Borysov., A.Yurkevichyute., G.Martonakov. – Kharkiv: Publishing House of Academy of Sciences of Ukraine, 2007. (in ukr.)
3. Hulse J. H. Sustainable Development at Risk: Ignoring the Past. / J. H. Hulse — New Delhi: Cambridge University Press India Pvt. Ltd. Ottawa: International Development Research Centre, 2007. — 390 p.
4. <http://www.rnbo.gov.ua/news/12.html>
5. <http://www.wbcds.ch/home.aspx>
6. <http://www.undp.org/content/undp/en/home.html>

#### **4. METHODS AND RESEARCH**

***Credits ECTS: 2***

***Total hours: 72***

***Form of control: final test-credit***

***Term: 2***

***Learning objectives:***

- knowledge of the methodology and organization of research activities in radiology and other branches of ecology;
- skills of acquisition, storage, processing and distribution of professional scientific information;
- ability to use information technology in professional activities; ability to work in computer networks using specialized software;
- ability to analyze professional, scientific literature and to use it in professional activities;
- skills of natural and man-made environment components sampling for analysis;
- ability to conduct a comprehensive evaluation of ecosystems exposed to radioactive contamination;
- ability to assess the radiosensitivity and radioresistance of communities in ecosystems.

***Teaching activities:***

Lectures – 8 hours

Practical lessons – 16 hours

***Short content:***

Methodological and organizational basis for research:

- Methodological research organization
- Techniques for scientific information processing
- Analysis, generalization and presentation of research results

Practical organization of scientific research:

- Requirements for certification and accreditation of laboratories and laboratory equipment
- Sampling and preparation for analysis
- Methods of results processing and fundamentals of mathematical statistics

***Literature:***

1. Bezvesilna J.M. and others. Tools for environmental parameters assessment.: Textbook. – Zhytomyr: ZhSTU, 2009. – 508 p. (in ukr.)
2. Feshchenko V.P. and others. Metrology and methodology of research in radioecology. – Zhytomyr: ZSAU, 2004. – 160 p. (in ukr.)
3. Krushelnytska O.V. Methodology and organization of scientific research. – K.: Condor, 2003. – 190 p. (in ukr.)
4. Lavric V.I. Methods of mathematical modeling in ecology. Tutorial. – K.: Publishing House «KM Academy», 2002 – 203 p. (in ukr.)

## 5. RADIOECOLOGY

*Credits ECTS: 4,5*

*Total hours: 162*

*Form of control: exam, final differentiated test-credit*

*Term: 1*

### *Learning objectives:*

- knowledge of the biological mechanisms of the action of ionizing radiation on living organisms and of the patterns of radionuclide metabolism;
- knowledge about the natural and artificial radioactivity of biota; biogenic radionuclides migration in ecosystems;
- knowledge of physical, chemical and biological principles of living organisms protection from ionizing radiation and radioactive contamination;
- knowledge of the ways of radioactive isotopes penetration into the body of plants, animals and humans; their redistribution;
- knowledge of the ways radionuclides behave in the main types of terrestrial and aquatic ecosystems of natural and anthropogenic origin;
- ability to assess an overall environmental situation resulting from radionuclides contamination of environment;
- ability to apply knowledge of basic laws of ecosystems functioning that determine the behavior of radionuclides for radiation monitoring and radioecological research;
- ability to conduct a comprehensive evaluation of ecosystems exposed to radioactive contamination;
- ability to identify environmental factors that can lead to radiation safety disturbance;
- ability to determine dose load on the main ecosystem components;
- ability to prioritize and pick out significant radioecological problems when performing system analysis; to make reasonable inferences on the basis of the results;
- ability to use dataware to make prognosis of radioecological situation in a zone of contamination;
- ability to predict ecological-economic status of contaminated by radionuclides areas;
- ability to assess the radiosensitivity and radioresistance of communities in ecosystems;
- ability to use mathematical modeling and GIS technologies to assess impact, behavior, distribution and redistribution of radionuclides in different landscape conditions.

### *Teaching activities:*

Lectures – 32 hours

Practical lessons – 32 hours

Yearly project – independently according an individual task

### *Short content:*

General principles of Radiology:

– **Scientific basis of Radiology and stages of development**

– **Current radiation situation in Ukraine and radiological consequences of the Chernobyl accident**

– **Methodological principles, basic principles and concepts of modern radioecological research**

Radioecology of natural ecosystems:

- **Radioecology of forest ecosystems**
  - **Radioecology of aquatic ecosystems**
  - **Migration of radionuclides in open and mountainous landscapes**
- Radioecology of agrocenosis and of urbanized territories:
- **The behavior of radionuclides in agrocenosis**
  - **Migration of radionuclides to humans through a food chain**
  - **Character of the radionuclides transfer, their distribution and redistribution in urban systems**

***Literature:***

1. - V.P.Krasnov, O.O.Orlov, V.A.Buzun.,V.P.Landin, Z.M.Shelest. Applied forest radioecology./ Monography. Edited by V.P.Krasnov/ - Zhytomyr: Polissia. – 2007. – 680 p. (in rus.)
2. Gudkov I.M., Gaychenko D.F., Kashparov V.O., Rutlakhmedov Y.O., Gudkov D.I., Lazarev M.M. Radioecology. Tutorial.- Kherson: Oldy-plus, 2013. – 462 p. (in ukr.)
3. Gudkov I.M., Vinichuk M.M. Radiobiology and Radioecology (in English). Manual for students of higher educational institutions. – K.: NAUU, 2006. – 294 p.
4. Yarmonenko S.P., Vaynson A.A. Radiobiology of humans and animals. Higher School, 2004. – 427 p. (in rus.)
5. Prister B.S. The issues of agricultural radioecology and radiobiology in the conditions of environment contamination by a fresh mixture of nuclear fission products: monography. - Chernobyl: Institute of ANPP safety, 2008. - 320 p. (in rus.)
6. Radioactivity in Terrestrial Environment. Edited by G. Shaw. - Hardbound, 2007. – 306 p.
7. Streffer C. at all Low Doze Exposures in the Environment. – Springer, 2004. – 471 p.
8. Orlov A., Krasnov V. Role of various components of ecosystems in biochemical migration of pollutants of anthropogenic origin in forests. Eguidosimetry ecological Standardization and Eguidosimetry for Radioecology and Environmental Ecology. – Series C: Environmental Security. – Vol. 2 /Eds. F. Dordrecht: Springer. 2005. – P. 257 – 272.
9. Orlov A., Krasnov V. Biological Peculiarities of the Cranberry (*Oxycoccus palustris* Pers.) and Ecological Parameters of its Environment: Influence on Accumulation <sup>137</sup>Cs by Phytomass // Journal of Radioecology, 6, 1998 (1). – P. 23 – 29.
10. Krasnov B.P., Orlov O.O., Getmanchuk A.I. Radioecology of medicine herbs.. – Zhytomyr: Polissia, 2005. – 214 p. (in ukr.)
11. Balonov M., Krasnov V. Handbook of parameter values for the prediction of radionuclide transfer in terrestrial and freshwater environments Technical reports series, № 472. – Vienna: International Atomic Energy Agence, 2010. – 197 p.
12. Ivanov Y.A. Radioecological research. Tutorial. – Lviv: Publishing House. I.FrankoLNU, 2004. – 149 p. (in ukr.)
13. Grodzynsky D.M. Radiobiology. – K.: Lybid', 2000. – 447 p. (in ukr.)

## 6. RADIATION SAFETY

*Credits ECTS: 3*

*Total hours: 108*

*Form of control: exam*

*Term: 1*

### *Learning objectives:*

- **knowledge of the basic principles of state policy in the field of radiation safety; radioactive substances use;**
- **knowledge of physical, chemical and biological principles of living organisms protection from ionizing radiation and radioactive contamination;**
- **knowledge of methods and means to assess conditions of labor safety;**
- ability to apply safe methods of radioactive wastes use;
- ability to identify environmental factors that can lead to radiation safety disturbance;
- ability to determine radioactive waste and fallout causes and effects on the ecosystem; ability to keep appropriate records;
- ability to use the principles of radiation standardization to assess acceptable levels of radionuclides emissions and discharges to the environment;
- ability to use principles and valuation methods for radiation risks in accidents and in the case of normal mode operation of nuclear power plant and other radiation-hazardous objects;
- ability to apply measures to prevent radiation damage and to provide first aid in emergency situations.

### *Teaching activities:*

Lectures – 16 hours

Practical lessons – 16 hours

### *Short content:*

Norms and standards for radiation safety:

- **Norms and principles of radiation safety**
- **Organization of Radiation Safety of a territory, a facility, staff and of the public**
- **Management decisions and organizational measures to ensure radiation safety**

Radioactive waste utilization:

- Environmental risks of the nuclear fuel cycle
- Regulations in the field of nuclear technology
- Nuclear fuel and radioactive waste utilization

### *Literature:*

1. Radiation safety standards of Ukraine (RSSU-97): State hygienic standards. – K: The Department of Polygraphy of Ukrainian Center of state sanitarian epidemiologic agency, Ministry of health of Ukraine, 1997. – 121 p. (in ukr.)
2. Nuclear energy: myth and reality. Subject research in nuclear energetic / Edited by F. Mattes. – K: Heinrich Böll Fund, 2010. – 308 p. (in ukr.)
3. Chernobyl – Catastrophe and Consequences / Editors J. T. Smith and N. A. Beresford. – Praxis Publishing, Chichester, UK, 2005. – 310 p.
4. Krasnov V.P., Landin V.P., Orlov O.O. National report of Ukraine. 25 years after Chernobyl catastrophe. Safe future. Section 2.2.4. Kyiv: KIM, 2011. – p.91 – 97. (in ukr.)
5. Furdychko O.I., Kuchma M.D., Vozniak R.R., Krasnov V.P. Recommendations for forest management in the conditions of radiation contamination. – Kyiv: Ministry of emergency situations, 2008. – 104p. (in ukr.)

6. <http://www.snrc.gov.uk/nuclear/uk/>
7. [nkrzu.gov.ua](http://nkrzu.gov.ua)
8. Thomod Henriksen and David Maillie "Radiation & Health", 2003. – 226 c.
9. Elizabeth LaTorre Travis "Medical Radiobiology", 2000. – 302 c.

## 7. RADIATION MONITORING

*Credits ECTS: 3*

*Total hours: 108*

*Form of control: exam*

*Term: 1*

### *Learning objectives:*

- knowledge of the methodology and organization of research activities in radiology and other branches of ecology;
- **ability to master and use advanced equipment; to use the latest technologies for conducting research;**
- knowledge of the ways of radioactive isotopes penetration into the body of plants, animals and humans; their redistribution;
- ability to conduct a comprehensive evaluation of ecosystems exposed to radioactive contamination;
- **ability to apply methods for radiation situation assessment using radiometric and dosimetric devices of different systems;**
- **ability to apply the methods of surveillance and control of contaminated by radionuclides areas;**
- **ability to determine dose load on the main ecosystem components;**
- ability to monitor the condition of the environment objects by parameters that characterize radioecological situation both in a zone of contamination and out of it;
- ability to use dataware to make prognosis of radioecological situation in a zone of contamination;
- ability to analyze the tendencies in changes of social and environmental status of the population living on contaminated territories;
- ability to predict ecological-economic status of contaminated by radionuclides areas;
- ability to assess the radiosensitivity and radioresistance of communities in ecosystems;
- ability to use mathematical modeling and GIS technologies to assess impact, behavior, distribution and redistribution of radionuclides in different landscape conditions.

### *Teaching activities:*

Lectures – 16 hours

Practical lessons – 16 hours

### *Short content:*

Organization of environmental radiation monitoring:

- Scientific basis, aims and objects of radiation monitoring
- Radioecological monitoring of contaminated ecosystems
- Basic principles of the integrated radiation monitoring

Methods and tools for radiation monitoring:

- **Dosimetric and radiometric equipment**
- **Sampling and database formation, and processing**
- Application of GIS technologies in radiation monitoring

### *Literature:*

1. Rashparov V.A., Kalinenko L.V., Perepeliatnikov G.P. and others. Technique for complex radiation examination of territories contaminated after Chernobyl catastrophe (except exclusion zone).– K.: Atika-N, 2007. – 60 p. (in ukr.)

2. Resolution of Cabinet of Ministers of Ukraine №391, (30.03.1998y.) «Approval of regulations about state system of environment monitoring» – internet resource: <http://www.rada.kiev.ua/cgi-bin/putfile.cgi>. (in ukr.)
3. Radioecological state of territories contaminated by radiation. – internet resource: <http://mns.gov.ua> (in ukr.)
4. Orlov O.O., Krasnov V.P. Radiation monitoring of forest ecosystems. // Vesnik NNC RK „Radioecology, environment protection”, № 3. – 2002. – P. 45 – 54. (in rus)
5. Orlov O.O., Krasnov V.P. Radiation monitoring of forest ecosystems.: conceptual regulations // Forestry and agriculture melioration, edition. 102. –Kharkiv, 2002. – P. 10 – 19. (in ukr.)
6. Krasnov V., Orlov A. Multiyear monitoring of radiocontamination of wild berry-plants from the Ericaceae family in Ukraine // Botanica Lithuanica, 2004, 10 (3). – p. 209-215.
7. Krasnov V. Orlov A. Methods and tasks of radiation monitoring of forest ecosystems Eguidosimetry ecological Standardization and Eguidosimetry for Radioecology and Environmental Ecology. – Series C: Environmental Security. – Vol. 2 /Eds. F. Dordrecht: Springer, 2005. – P.307-312.



## 8. REHABILITATION OF CONTAMINATED AREAS

*Credits ECTS: 3*

*Total hours: 108*

*Form of control: exam*

*Term: 2*

### *Learning objectives:*

- knowledge of the basic principles of state policy in the field of radiation safety; radioactive substances use;
- ability to apply knowledge of basic laws of ecosystems functioning that determine the behavior of radionuclides for radiation monitoring and radioecological research;
- **ability to conduct a comprehensive evaluation of ecosystems exposed to radioactive contamination;**
- ability to identify tendencies in environmental changes caused by functioning of radiologically hazardous facilities and by exclusion of contaminated areas;
- ability to distinguish peculiarities of autorehabilitation territories contaminated with radionuclides to develop measures of their technological rehabilitation;
- **ability to identify and evaluate measures to minimize radionuclides intake into agriculture, forestry and fishing industry products;**
- **knowledge of technological methods of production on contaminated by radionuclides areas;**
- **knowledge and skills of farming in anthropogenically contaminated and disturbed areas;**
- ability to prioritize and pick out significant radioecological problems when performing system analysis; to make reasonable inferences on the basis of the results;
- **ability to predict ecological-economic status of contaminated by radionuclides areas;**
- **ability to use the principles of radiation standardization to assess acceptable levels of radionuclides emissions and discharges to the environment.**

### *Teaching activities:*

Lectures– 16 hours

Practical lessons – 16 hours

### *Short content:*

Autorehabilitation of ecosystems and rehabilitation semi-natural territories:

– **Environmental rehabilitation of natural ecosystems, of agrocenosis and of the Chernobyl zone**

– Countermeasures used in the Chernobyl zone

– **Optimization of nature use on contaminated territories**

Technologies and measures to minimize the intake of radionuclides into economic production:

– **Countermeasures to prevent and reduce contamination of agriculture, fishery and forestry products**

– **Technological processing and recycling of products contaminated by radionuclides**

– The use of the applied GIS technologies and mathematical models to predict the situations and to make decisions as for the rehabilitation of contaminated areas

### *Literature:*

1. State hygienic standards. Available levels of  $^{137}\text{Cs}$  i  $^{90}\text{Sr}$  radionuclides' content in food products and drinking water. (DR-2006). – K., 2006. – 13 p. (in ukr.)

2. Krasnov V.P., Orlov O.O., Vedmid' M.M., Landin V.P. Methodical recommendations for rehabilitation radiation-contaminated forests after accident on Chernobyl NPP. // Kyiv. State committee of forestry of Ukraine– 2006. – 20 p. (in ukr.)
3. Radioecology, radioactivity and ecosystems. The effect of radiation on biocoenoses. An update on radionuclides transfer in the food Web. – Van der Stricht and Krchmann, Editors, 2007. – 624 p.
4. Krasnov V.P., Orlov O.O. Radioecology of berry-like plants. Monography. Zhytomyr: Volyn'. – 2004. – 264 p.
5. Krasnov V.P., Orlov O.O., Kurbet T.V. Radioecology of edible fungus. Monography. Zhytomyr: Polissia. – 2006. – 220 p. (in rus)
6. Krasnov V.P., Shelest Z.M. and others. Radioecology of European roe deer in Ukrainian central Polissia. Monography. Zhytomyr: Volyn'. – 1998. – 128 p. (in ukr.)
7. Kashparov V., Conney S., Fesenco S., Krasnov V. Miscellaneous Topics. Food processing. Quantification of Radionuclide Transfer in Terrestrial and freshwater Environments for radiological Assessments. Tecdoc-1616. – Vienna: International Atomic Energy Agency, 2009. – p. 577 – 605.
8. Krasnov V.P., Orlov O.O., Kurbet T.V., Landin V.P. Technique for examination radiation-contaminated forests for their further rehabilitation (years 2010 – 2015). – Zhytomyr, 2010. – 16 p. (in ukr.)
9. Remediation of Contaminated Environments. Edited by G. Voigt and S. Fesenko, 2009. – 496 p.
10. Andersson K.G., Rantavaara A., Roed J., Rosen K., Salbu B., Skipperud L. A Guide to Countermeasures for Implementation in the Event of a Nuclear Accident Affecting Nordic Food-Producing Areas. – 2000. – 78 p.

## **9. ENVIRONMENTAL MANAGEMENT AND AUDITING**

**Credits ECTS: 3**

**Total hours: 108**

**Form of control: final test-credit**

**Term: 1**

### **Learning objectives:**

- scientific comprehension of problems and of natural processes relationship; ecosystems functioning and the changes caused by human activity;
- theoretical and methodological foundations for knowledge base of environmental management;
- knowledge of principles, forms, and methods of environmental management;
- ability to use theoretical regulations and methodological foundations of environmental management in practice;
- ability to work out the structure of environmental management of an enterprise (institution) identifying functional reporting and responsibility for accomplishing environmental issues;
- ability to carry out environmental audit of an enterprise.

### **Teaching activities:**

Lectures – 16 hours

Practical lessons – 16 hours

### **Short content:**

The environmental management system of enterprise:

- Organization of the environmental department of the company
- Information system of environmental management of an enterprise.

Environmental audit and control:

- Organization of the primary audit of raw material flows in the enterprise within industrial or productive systems
- Methodology and program of environmental audit of an object, industry and an enterprises

### **Literature:**

1. Shevchuk V.Y., Satalkin Y.M., Biliavskyy G.O. and others. Environmental management. Manual. – K.: Lybid, 2004. – 432p. (in ukr.)
2. . Environmental management. Tutorial./ Edited by. V.F.Semenova., O.L.Mykhaylyk. — K.: Center of educational literature, 2004. – 407 p. (in ukr.)
3. Babina Y.V., Varfolomeyeva E.A. Environmental management. Tutorial. – M.: Perspective, 2002. – 207p.(in rus)
4. Papenov K.V. Economics and nature management. – M.: press MSU, 1997. – 240 p. (in rus)
5. Pakhomova N.V., Andress A., Richter K. Environmental management. – st.Petersburg.: Peter, 2003. – 544 p. (in rus)

## **10. BIOINDICATION AND BIOTESTING**

***Credits ECTS: 3***

***Total hours: 108***

***Form of control: final test-credit***

***Term: 1***

### ***Learning objectives:***

- knowledge of specific morphological, physiological, ethological and other organisms' changes caused by the disturbances in their environment
- knowledge about methodical foundations of individual and overorganism structures in environment biomonitoring;
- knowledge about problems connected with the use of bioindication and biotesting methods;
- ability to develop foundations and research methods in biomonitoring;
- ability to analyze single and complex effect of environmental factors on organisms-bioindicators and biotesters;
- ability to work out tables for quantitative and qualitative identification of separate toxicants in an environment and for measuring indices of environment general toxicity.

### ***Teaching activities:***

Lectures– 16 hours

Practical lessons – 16 hours

### ***Short content:***

The use of living organisms for environment indication:

- Living organisms as indicators of the environment state and features
- Environment quality indication through living systems

Practical application of biotesting:

- Contaminated environment testing by plants and animals
- Microbiological and biochemical testing

### ***Literature:.***

1. Melekhova O.P., Egorova E.I., Evseeva T.I. and others. Biocontrol of environment: bioindication and biotesting. Tutorial / edited by. Melekhova O.P., Egorova E.I. – M.: Academy, 2007. – 288 p. (in rus)
2. Bioindication of contaminated surface ecosystems. / Edited by R.Shubert.– M.: Mir, 1988.–350 p (in rus)
3. Alekseenko V.A. Environmental geochemistry. Manual. – M.: Logos, 2000. – 627 p. (in rus)
4. Bioindication of radiation contamination.– M.: Naukv, 1999. – 384 p. (in rus)

## 11. INTERNATIONAL ENVIRONMENTAL ACTIVITIES (IN RADIOLOGY)

*Credits ECTS: 3*

*Total hours: 108*

*Form of control: final test-credit*

*Term: 2*

### *Learning objectives:*

- **ability to use indicators of sustainable development to confirm decisions related to the development of socio-economic systems at global and regional levels;**
- **ability to analyze and predict the social aspects of environmental policy;**
- **knowledge of the basic principles of state policy in the field of radiation safety; radioactive substances use;**
- **skills to assess collective and individual risks during accidents and disasters caused by natural and man-made factors**
- **ability to identify tendencies in environmental changes caused by functioning of radiologically hazardous facilities and by exclusion of contaminated areas;**
- **ability to prioritize and pick out significant radioecological problems when performing system analysis; to make reasonable inferences on the basis of the results;**
- **ability to analyze the tendencies in changes of social and environmental status of the population living on contaminated territories;**
- **ability to predict ecological-economic status of contaminated by radionuclides areas;**
- **ability to use principles and valuation methods for radiation risks in accidents and in the case of normal mode operation of nuclear power plant and other radiation-hazardous objects;**
- **ability to use the principles of sustainable development in the professional activities.**

### *Teaching activities:*

Lectures – 16 hours

Practical lessons – 16 hours

### *Short content:*

International and Ukrainian organizations and institutions:

– **Institutions and official organizations working in the field of nuclear safety and nuclear technologies**

– **Social movement in the field of nuclear technology use**

Legal regulation of the use of nuclear technologies and of radiation safety:

– **International and interstate agreements that govern radiation safety**

– **Recommendations UNSCEAR, NCRP**

### *Literature:*

10. Nuclear energy: myth and reality. Subject research in nuclear energetic / Edited by F. Mattes. – K: Heinrich Böll Fund, 2010. – 308 p. (in ukr.)

1. Gardashuk T. Environmental policy and environmental movement: modern context. – K.: Znannia, 2000. – 252 p. (in ukr.)

2. Shevchuk V., Pylypchuk V., Karpenko N. and others. Reference-book on economics and on financing nature management and nature conservation activity.– K.: Geoprint, 2000. – 412 p. (in ukr.)

3. [http://www.un.org/ru/documents/decl\\_conv/conv\\_nuclear.shtml](http://www.un.org/ru/documents/decl_conv/conv_nuclear.shtml) (Conventions and treatments on nuclear safety)

4. [www.snrc.gov.ua/nuclear/uk/](http://www.snrc.gov.ua/nuclear/uk/)

5. [www.nkrzu.gov.ua](http://www.nkrzu.gov.ua)
6. [www.unscear.org](http://www.unscear.org)
7. [www.un.org/ru/development/progareas/global/nuclear](http://www.un.org/ru/development/progareas/global/nuclear).

## **12. FOREIGN LANGUAGE FOR SPECIAL PURPOSES**

**Credits ECTS: 3,5**

**Total hours: 126**

**Form of control: exam**

**Term: 1,2**

### **Learning objectives:**

- ability for professional communication in foreign language orally and in written form (mainly English) with foreign partners;
- skills to get, to keep, to work out and to share professional scientific information in foreign language;
- ability to analyze, to process foreign professional, scientific literature and to use it in professional activity.

### **Teaching activities:**

Practical lessons – 48 hours

### **Short content:**

Grammatical and linguistic features of scientific literature:

- Grammar material
- Lexical material
- Official correspondence and papers in a foreign language

Work on professional literature:

- Translation and textual analysis of a Radiobiology textbook
- Translation and textual analysis of a Radiobiology textbook
- Master's Project essay in foreign language

### **Literature:**

1. Ilchenko O.M. English for scientists. O.M. – K.: Naukova dumka, 1996. – 241 p. (in ukr.)
2. Mogelnytska L.F., Sukhovetska S.V., Kobzar S.K., Shadura V .A. Radioecology: English for special puposes. – Zhytomyr: ZhSTU, 2013 – 193 p.

### **13. HIGHER EDUCATION OF UKRAINE AND THE BOLOGNA PROCESS**

***Credits ECTS: 1,5***

***Total hours: 54***

***Form of control: final test-credit***

***Term: 1***

***Learning objectives:***

- knowledge of peculiarities in scientific research organization and in the system of higher education in Ukraine and in the world;
- ability to compare structures of higher education in different countries;
- knowledge of the main tasks, conceptions and stages of Bologna process;
- analyzes of the main ways and mechanisms of reforming the system of higher education in Ukraine;
- knowledge of legislative acts about reforming the system of higher education in Ukraine towards European integration;
- ability for modeling educational-methodical and organizational documents which provide training of modern specialist (on the basis of the Industry Standard of higher education in Ukraine).

***Teaching activities:***

Lectures – 8 hours

Practical lessons – 8 hours

***Short content:***

Characteristics of Ukrainian Education in the framework of the Bologna Process:

- Global education systems and their characteristics
- Branch standards of higher education in the framework of Bologna Process

***Literature:***

1. Stepko M.F., Bolyubash Y.Y., Shynkaruk V.D., Grubinko V.V., Babyn I.I. Higher education of Ukraine and the Bologna process/ Edited by V.G.Kremen'. – Ternopil': Manual – Bogdan, 2004. – 384 P. (in ukr.)
2. Zhuravsky V.S., Zgurovsky M.Z. Bologna process: the main principles of integration in European system of higher education. – K.: IBIQ "Publishing House «Politechnica»", 2003. – 200 p. (in ukr.)
3. Main principles of the development of the higher education system in Ukraine in the framework of Bologna process. (Documents and materials May– December 2004 y.). Part 2. /Editors: Stepko M.F., Bolyubash Y.Y., Shynkaruk V.D., Grubinko V.V., Babyn I.I – Kyiv – Ternopil': Publishing House V.Gnatyuk TNPU, 2004. – 201 p. (in ukr.)
4. Main principles of the development of the higher education system in Ukraine. Part3. / Edited by S.M.Nikolayenko, Editors: Stepko M.F., Bolyubash Y.Y., Shynkaruk V.D., Grubinko V.V., Babyn I.I. – Kyiv – Ternopil': Publishing House V.Gnatyuk TNPU, 2006. – 180 p. (in ukr.)
5. Industry standard of higher education in Ukraine: educational and professional program for training bachelors. – Official edition, Ministry of education and science, youth and sport of Ukraine. – K.: 2011. – 36 p. (in ukr.)
6. Industry standard of higher education in Ukraine: Educational–qualification characteristics. – Official edition, Ministry of education and science, youth and sport of Ukraine. – K.: 2011. – 45 p. (in ukr.)



## **14. INTELLECTUAL PROPERTY**

***Credits ECTS: 1***

***Total hours: 36***

***Form of control: final test-credit***

***Term: 1***

### ***Learning objectives:***

- knowledge about the substance and the types of intellectual property; the use of intellectual property peculiarities in the conditions of modern economy ;
- knowledge about the order to draw rights for intellectual property on objects of intellectual property; subjects' rights and obligations which are discussed in the title of protection;
- ability to use objects of intellectual property in enterprise economic activity;
- ability to make a contract in the sphere of intellectual property.

### ***Teaching activities:***

Lectures – 8 hours

### ***Short content:***

Legislative regulation of intellectual property and patenting:

- Regulation characteristics and legislation of intellectual property in Ukraine
- Fundamentals of Patenting

### ***Literature:***

1. Grishaev S.P. Intellectual property: Tutorial. – M.: Jurists, 2003. – 238 p. (in rus)
2. Poltorak A., Lerner A. Fundamentals of intellectual property: Translation from English.. – M.: Publishing House “Williams”, 2004. – 208 p. (in rus)
3. Rights for intellectual property. Textbook. / Edited by. O.A.Pidprygora, O.D.Svyatotsky. – K.: “Publishing House “In Yure”, 2004. – 672 p. (in ukr.)

## 15. FORESTRY

**Credits ECTS: 3**

**Total hours: 108**

**Form of control: final test-credit**

**Term: 1,2**

### **Learning objectives:**

- knowledge about the requirements for techniques and technologies of lumbering based on forestry science;
- apprehension of arboreal productivity of forest plantations and of physiological nature of the processes which provide production of organic mass;
- knowledge about progressive technologies of silviculture and the results of its use in different Ukrainian forest zones;
- ability to define the main species for proper forest conditions and the appropriateness to grow it in mixed or in complex forests;
- ability to define morphological features of trees on forest plantations; the parameters which increase arboreal productivity;
- ability to work out measures to use natural renewal after or during the forest cutting on the territory of Ukrainian Polissia and Forest-steppe.

### **Teaching activities:**

Lectures – 16 hours

Practical lessons – 16 hours

### **Short content:**

Applied forestry:

- Methods for forest growth and means of its improving
- Forestry engineering standardization

Forest as an ecological system:

- Fundamentals of forestry and silvics
- Forest management in conditions of radioactive contamination

### **Literature:**

1. Krasnov V.P., Shelest Z.M., Davydova I.V. Phytoecology and fundamentals of forestry. Textbook – Kherson: Oldi-plus, 2013. – 478 p. (in ukr.)
2. Sviridenko V.Y., Babich O.G., Kyrychok L.S. Forestry Textbook.– K.: Aristey, 2008. - 544 p. (in ukr.)
3. Kaletnyk N.N., Patlay I.N., Krasnov V.P. Radioactive contamination of the Forest of Ukraine - organization of Forestry management and Forest and Tree resources // Proceeding of the XI World Forestry Congress.- Antalya, 13-22 October 1997. – p.184.
4. Recommendations for forest management in the conditions of radiation contamination. / Edited by.. V.P.Krasnov. – K.: Derzhkomlisgosp of Ukraine, 2008. – 84 p. (in ukr.)
5. Krasnov V.P., Orlov O.O., Vedmid M.M. Atlas of plants-indicators and the types of forest conditions of ukrainian Polissia. – Novograd-Volynsky, 2009. – 488 p. (in ukr.)
6. Krasnov V.P., Tkachuk V.I., Orlov O.O. Reference book on forest protection. – K.: Eco-inform, 2011. – 528 p. (in ukr.)

## **16. GEOTECHNOLOGIES OF MINING**

***Credits ECTS: 3***

***Total hours: 108***

***Form of control: final test-credit***

***Term: 1,2***

### ***Learning objectives:***

- knowledge of the main ways to prepare rocks for extraction;
- knowledge about the elements of the system of open cast and underground mining and their parameters;
- knowledge about the principles of complex mechanization, and the classification of equipment complexes;
- ability to choose systems of the open cast mining and to calculate the main parameters of mining elements considering the parameters of the given equipment;
- ability to form the freight flow of mining mass considering the ways of horizon opening;
- ability to form the main and the auxiliary complexes of equipment and to calculate exploitation productivity of the complex.

### ***Teaching activities:***

Lectures– 16 hours

Practical lessons – 16 hours

### ***Short content:***

The development of minerals:

- The development of minerals by open cast mining
- Underground Mining

Ecology of mining:

- Reclamation of mining companies and its technological methods
- Radiation safety in mining and mining products

### ***Literature:***

1. The fundamentals of mining technologies: Tutorial / Edited by K.F.Capysky . – K.: VF ISDO, 1993. – 196 p. (in ukr.)
2. Rzhnevsky V.V. Open cast mining, the 4<sup>th</sup> edition, parts 1-2. M: Nedra, 1985. (in rus)
3. Bakka M.T. The fundamentals of mining: tutorial. – Zhytomyr : ZhITI, 1999 – 430 p. (in ukr.)
4. Tomakov P.I. and others. Technology, mechanization and organization of open cast mining. / P.I.Tomakov., I.K.Naumov. – the 3-d edition – M. : MGI, 1992. – 464 p. (in rus)

## **17. AGRICULTURE**

***Credits ECTS: 3***

***Total hours: 108***

***Form of control: final test-credit***

***Term: 1,2***

### ***Learning objectives:***

- knowledge about the reasons of negative phenomena which were caused by agriculture activity;
- to know characteristics of soil quality and the ways to conserve it and to restore the fertility;
- knowledge of sparing system of farming and cattle-breeding on radiation contaminated territories;
- ability to see the way and the character of environment changes in the process of agricultural production;
- ability to use fundamental knowledge while making environmental research and while expertising the objects of agriculture;
  - ability to work out and to recommend measures on rational land use and land conservation; to work out measures on cattle-breeding on the territories contaminated by radiation; to control realization of the said measures.

### ***Teaching activities:***

Lectures – 16 hours

Practical lessons – 16 hours

### ***Short content:***

Fundamentals of agronomy:

- Crop production and its main agrotechnical practices
- Characteristics of crop production in the conditions of radioactive contamination

Fundamentals of livestock sector:

- Characteristics of livestock sector management in the conditions of radioactive contamination
- The metabolism of radionuclides in agricultural animals

### ***Literature:.***

1. Bakka M.T., Bozhok P.T., Strelchenko V.P. Fundamentals of agriculture management and land conservation: Tutorial. – Zh.: Publishing House ZhITI, 2000. – 232 p. (in ukr.)
2. Aleksakhin R.M., Vasilyev A.V., Dikarev V.G. and others. Agricultural radioecology. – M.: Ecology, 1991. – 398 p. (in rus)
3. Annenkov B.N., Yudintsova E.V. Fundamentals of agricultural radioecology. – M.: Agropromizdat, 1991. – 288 p. (in rus)
4. Gudkov I.M., Vinichuk M.M. Agricultural radioecology. – Zhytomyr: Publishing house SAU, 2003. – 472 p. (in ukr.)
5. Korneev N.A., Sirotkin A.N. Fundamentals of the radioecology of agricultural animals. – M.: Energoatomizdat, 1987. – 208 p. (in rus)
6. Prister B.S., Loshchilov N.A., Nemets O.F., Poyarkov V.A. Fundamentals of agricultural radioecology. – K.: Urozhaj, 1991. – 472 p. (in rus)



## **Generalized requirements as for the specialist competencies**

### **SOCIO-PERSONAL COMPETENCIES:**

- ability to organize and define the goals and objectives of the personal and collective activities and to ensure their efficient and safe performance;
- adaptability and tolerance, capability for creative activity, including collective;
- ability to systematic creative thinking, perseverance in professional and research activities;
- ability to organize the activity as an individual or as a part of collective activity;
- ability to use professional skills in social activities; an active civil position;
- ability to present personal and collective results of professional and research activities;
- ability to solve problems of innovative character;
- ability to search for alternative solutions in professional activities;
- creativity, the ability for individual scientific research activities;
- professional ability to communicate in foreign languages (English) with foreign scientific partners;
- capacity for criticism and self-criticism;
- capacity for self-development and self-improvement;
- leadership and autonomy in the implementation of innovative projects;
- social responsibility for the results of making professional decisions.

### **GENERAL SCIENTIFIC COMPETENCIES:**

- knowledge of the basic dynamics' regularities of open systems, the relationship between the factors of sustainable development;
- ability to use indicators of sustainable development to confirm decisions related to the development of socio-economic systems at global and regional levels;
- skills to use sustainable development indicators to assess environmental risks of economic development perspectives in the region;
- ability to analyze and predict the social aspects of environmental policy;
- knowledge of the methodology and organization of research activities in radiology and other branches of ecology;
- knowledge of the physicochemical features of the interaction of radiation with matter, natural and artificial sources of ionizing radiation;
- knowledge of the biological mechanisms of the action of ionizing radiation on living organisms and of the patterns of radionuclide metabolism;
- knowledge about the natural and artificial radioactivity of biota; biogenic radionuclides migration in ecosystems;
- knowledge of the basic principles of state policy in the field of radiation safety; radioactive substances use;
- knowledge of physical, chemical and biological principles of living organisms protection from ionizing radiation and radioactive contamination.

### **INSTRUMENTAL COMPETENCIES:**

- skills of acquisition, storage, processing and distribution of professional scientific information;

- ability to use information technology in professional activities; ability to work in computer networks using specialized software;
- ability to analyze professional, scientific literature and to use it in professional activities;
- skills of natural and man-made environment components sampling for analysis;
- ability to master and use advanced equipment; to use the latest technologies for conducting research;
- knowledge of methods and means to assess conditions of labor safety;
- skills to assess collective and individual risks during accidents and disasters caused by natural and man-made factors.