СИЛАБУС ДИСЦИПЛІНИ
« Biological methods in radiation research »

Ступінь вищої освіти - Master
Спеціальність – 101 «Ecology»
Освітня програма « Ecology and Environmental Protection»
Рік навчання - 1-st, семестр 1-st
Форма навчання - full-time education
Кількість кредитів ЄКТС - 3
Мова викладання - English

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Сторінка курсу в eLearn	

COURSE DESCRIPTION

The goal of teaching "Biological Methods in Radiation Research" is to d provide students with knowledge about the possibilities of using living organisms to determine the ability of radioactive isotopes migration in the environment and living organisms (income, output, accumulation) and the use of labeled isotopes in biological research.

The task is to provide opportunities for using the acquired knowledge and skills to describe, analyze and predict the accumulation of radioactive isotopes and their migration in the environment under conditions of limited information, as well as for the implementation of master's thesis.

The student should know the characteristics of ionizing radiation and the physico-chemical basis of the interaction of ionizing radiation with substances, methods of radiometry and spectrometry of ionizing radiation, physical and chemical properties of natural and artificial radioactive isotopes of chemical elements, the basis of statistical processing of experimental data.

STRUCTURE OF COARSE

Topic	Hours (lectures/ practical works)	Results of study	Task	Evaluation
Module 1. Migration of radioactive substances in the environment and microorganisms				
Topic 1. Features of the radionuclides migration in the environmental objects	2/6	**Know** foliar uptake of radionuclides into plants. Receipt of soluble radionuclides in plants from the air. Influence of physico-chemical properties of radionuclides on their transition from soil to plants through the roots. Influence of biological characteristics of plants, phases of their development and physiological state on the transition of radionuclides from the soil to plants. **Understand** features of migration of radionuclides in	**Delivery of practical work №1.**	**10 point**

		forest biogeocoenoses. Ways of radionuclides uptake into the body of animals. Quantitative indices of accumulation of radionuclides in the animal body: concentration factor (CF), absorption coefficient (C_a), biological elimination half-life of radionuclides (T_{biol}). The main ways of radionuclides withdrawal from the body of animals.		
Topic 2. Metabolism of uranium and products of its disintegration in contaminated natural ecosystems	2/4	**Know** interaction of microorganisms with elements of nuclear fuel. Extremely radio-resistant microorganisms. **Understand** mechanisms of various interactions of bacteria and uranium: bioreduction, biomineralization, biosorption and bioaccumulation.	**Delivery of practical work №2.**	**10**
Topic 3. Features of cesium and strontium migration in the environment	2/4	**Know** metabolism of strontium in natural contaminated ecosystems. Biogeochemistry of cesium and its interaction with soil microorganisms. **Understand** accumulation of ^{137}Cs by bacteria and their effect on the biological availability of radionuclides.	**Delivery of practical work №3.**	**10**
Total module 1				**30**
Module 2. Influence of microorganisms on the state of radionuclides in the soil and their accumulation by plants				
Topic 4. The role of microorganisms in the fixation and migration of ^{137}Cs and ^{90}Sr in soil	2/4	**Know** dependence between type of soil, mineral content and rate of radionuclide migration. Bacteria and actinomycetes as factors of influence on the redistribution of isotopes in the soil. **Understand s**ymbiosis of plants and fungi - ectotrophic and endotrophic mycorrhiza.	**Delivery of practical work №4.**	**10**
Topic 5. Changing the bioavailability of ^{137}Cs under the influence of soil microflora	2/6	**Know** bacteria-components of bio-fertilizers and their application in agriculture. Inoculation and	**Delivery of practical work №5.**	**10**

		bacterization of seeds to reduce the accumulation of radionuclide in biomass of plants under different growing conditions.		
Topic 6. The method of isotopic indicators in biology and ecology	2/4	**Know** labeled atoms. Radioactive and stable isotopes. Labeled compounds. Indicative dose. Basic ways of using isotopic indicators in research with plants. Investigation of transport and distribution of separate elements in plant. **Understand** features of the use of radioactive isotopes in vegetative and field studies. Radioautography. Features of the use of stable isotopes.	**Delivery of practical work №6.**	**10**
Total module 2				**30**
Module 3. Radiosensitivity of microorganisms and their diversity in territories contaminated with radionuclides				
Topic 7. Radiosensitivity of microorganisms	2/2	**Know** extremely radioresistant bacterium *Deinococcus radiodurans, Arthrobacter radiotolerans*. Isolation of strains of radiosensitive bacteria in an environment with extreme conditions of existence. **Understand** radiosensitivity of micromycetes.	**Delivery of practical work №7.**	**10**
Topic 8. Classical approaches to estimating the diversity of bacterial microflora in radionuclide contaminated soil	2/4	**Know** assessment of microbial cenosis of territories contaminated by radioactive isotopes after the Chernobyl accident. Level of radioactivity of soil and biodiversity of soil microflora. Determination of soil cellulosic activity. **Understand** dynamics of ecological and trophic groups of soil microorganisms on contaminated radionuclide territories.	**Delivery of practical work №8.**	**10**
Topic 9. New technologies in the evaluation of soil microflora diversity	2/4	**Know** Metagenomics as a complex branch of knowledge. Metageno data analysis. Sequencing metagenoids. Bioinformatics analysis of 16s rRNA metagenome	**Delivery of practical work №9.**	**10**

		data. Metadata in metagenome analysis and their integration. Determination of the main metrics of biodiversity. Check the quality of the sequencing data by the FastQC program. **Understand** MetaGenom data preprocessing in the QIIME software package. Clustering metagenome data in QIIME.		
Topic 10. Selection of methodology for bioinformatic processing of DNA sequencing results from soils contaminated with radionuclides	2/2	**Know** Concentration of the isolated DNA. The general biodiversity of microbial soils of the Chornobyl NPP exclusion zone. Biodiversity metrics. Calculation of alpha microbioma diversity. Calculation of microbial beta diversity. **Understand** Functional microbial reconstruction. Working with PICRUSt. Working with HUMAnN. Visualization of data and the construction of clusters.	**Delivery of practical work №10.**	**10**
Total module 3				**40**
Additional points				**10**
Total for the semester (30+30+40)*0,7				**70**
Exam				**30**
Total for the course				**100**

EVALUATION POLICY

Deadline and recompilation policy:	Works that are submitted in violation of the deadlines for more than a week without good reason are evaluated at a lower score (maximum - 20% of the maximum). Rearrangement of modules takes place with the permission of the lecturer if there are good reasons (for example, hospital or family problems).
Academic Integrity Policy:	Writing while writing modular test papers and the final exam is prohibited. The use of mobile devices during these periods is also prohibited.
Visiting policy:	Attendance is mandatory. For objective reasons (for example, illness, international internship) training can take place individually (in online form in consultation with the dean of the faculty). In case of violations and abuses (non-attendance more than 50% of the time - non-admission to the exam)

STUDENT EVALUATION SCALE

Rating of the applicant of higher	**The assessment is national for the results of examinations**	
	exams	**offsets**

education, points		
90-100	perfectly	credited
74-89	good	
60-73	satisfactorily	
0-59	unsatisfactorily	not credited