Environmental and Natural-Technogenic Safety
Working program of the component (Syllabus)

Details of the component	
Level of higher education	**The second (master) (educational scientific programme)**
Branch of knowledge	G Engineering, Manufacturing and Construction
Speciality	G1 Chemical technology and engineering
Educational program	Chemical technology and engineering
Status of component	Elective component
Form of training	full-time/remote/mixed
Year of preparation, semester	1st year, spring semester
Volume of component	4 ECTS credits (120 hours))
Semester control/ control measures	Test/modular test work/homework test work
Schedule of classes	http://rozklad.kpi.ua
Language of instruction	Ukrainian
Information about course leader / teachers	Lecturer: https://eco-paper.kpi.ua/pro-kafedru/vykladachi/shablij-tetyana-oleksandrivna.html Practical: https://eco-paper.kpi.ua/pro-kafedru/vykladachi/shablij-tetyana-oleksandrivna.html
Course placement	https://do.ipo.kpi.ua/course/view.php?id=6475

Program of component

1. Description of the component, its purpose, subject of study and learning results

1.1. The purpose of the component.

The purpose of studying the component is the formation of students' complex of knowledge about the environmental safety of territories, a clear understanding of the main laws of environmental hazard formation and safety management, the acquisition of practical skills and abilities to ensure environmental safety.

In accordance with the purpose of training bachelors requires the formation of the following competencies:

- The ability to apply knowledge in practical situations;
- The ability to identify, analyze and, with scientifically based arguments, plan a strategy for solving chemical-technological problems and problems of chemical industries.

1.2. The main tasks of the component.

In accordance with the requirements of the educational and professional program, students after mastering the component must demonstrate the following learning outcomes:

- develop and implement projects in chemical technologies and related interdisciplinary projects with consideration to social, economic, environmental, and legal aspects.

2. Prerequisitions and requisition of component (place in the structural and logical scheme of training according to the relevant educational program)

The study of the component "Environmental and natural and man-made safety" is based on the principles of integration of various knowledge obtained by students during the study of the following components: "Green chemistry for clean chemical technologies", "Chemical technologies of environmental protection".

3. Contents of the component

Section 1. General provisions of the component

Law and policy in the field of environmental and technogenic safetyand

General provisions of ecological and technogenic safetyand

Section 2. *Emergencies*

Emergencies

Assessment of hazards and risk of accidents of man-made systems

The most important factors of accidents and disasters. Characteristic features of current and future emergencies, accidents and disasters

Section 3. Risk assessment methods

Methodology of risk analysis and management

Methods for assessing risk levels

Classification of risks

Section 4. Features of technogenesis in Ukraine

Environmental safety of the regions of Ukraine: comparative estimates

Legal aspects of risk analysis and security management

Habitat impact on demographics of regions with developed infrastructure

4. Training materials and resources

Basic

1. Охорона навколишнього природного середовища. Екологічна безпека. Законодавство, методики / А.В. Григоренко. – ТОВ «Центр учбової літератури», 2017. – 288 с.

2. Екологічна безпека: навчальний посібник / Краснянський М.Ю. – К.: Видавничий дім «Кондор», 2018. – 180 с.

3. Системний аналіз якості навколишнього середовища: підручник. / А. М. Прищепа, С. М. Лико, О. І. Портухай .– К: Кондор-Видавництво, 2016.– 496 с.

4. Техноекологія: підручник / О.І. Іваненко, Ю.В. Носачова. — Київ: Видавничий дім «Кондор», 2017. — 294 с.

5. Екологічна та природно-техногненна безпека України: регіональний вимір загроз і ризиків: монографія / С.П. Іванюта, А.Б. Качинський. – К.: НІСД, 2012. – 308 с.

Auxiliary (d)

1. Основи сучасної екологічної безпеки / Є.П. Буравльов. – К., 2002. – 236 с.

2. Безпека навколишнього середовища / Є.П. Буравльов. – К., 2004. – 320 с.

3. Екологічна безпека України: системний аналіз покращення / А.Б. Качинський. – К., 2001. – 312 с.

4. Методологія оцінювання екологічних ризиків / Г.В. Лисиченко, Г.А. Хміль, С.В. Барбашев. – Одеса: Астропринт, 2011. – 368 с.

5. Екологічний атлас України / В.А. Барановський. – К.: Географічка, 2002. – 42 с.

6. Запорожець О.І. Безпека життєдіяльності - К.: ЦУЛ, 2013. - 448 с.
7. Управління техногенною безпекою України / Є.П. Буравльов. – К., 2006. – 209 с.
8. Державна політика у сфері забезпечення екологічної безпеки (пропедевтичний аспект). Наук.-метод. Посібник / А.Б. Качинський. – К.: Вид-во НА СБ України, 2005. – 117 с.
9. Основи екологічної безпеки територій та акваторій / В.К. Сівак, В.Д. Солодкий. – Чернівці, 2000. – 156 с.
10. Природний, техногенний та екологічний ризики: аналіз, оцінка, управління / Г.В. Лисиченко, Ю.Л. Забулонов, Г.А. Хміль. – К.: Наук. думка, 2008. – 542 с.
11. Екологічна безпека інженерної діяльності / О.І. Іваненко, Ю.В, Носачова, В.В. Вембер. – К.: Видавничий дім «Кондор», 2020. – 212 с.
12. Екологічна експертиза / М.І. Федючка, М.М. Світельський, Т.М. Коткова та ін. — Одеса: Гельветика 2019. — 144 с.
13. Глобалізація і безпека розвитку / За ред. О. Г. Білоруса. — К., 2001. — 733 с.
14. Управління техногенною безпекою України / Є.П. Буравльов, В.В. Гетьман. — К., 2006. — 235 с.
15. Малахов І.М. Техногенез у геологічному середовищі. – Кривий Ріг: ОКТАНТ-ПРИНТ, 2003. – 252с.
16. Мобільні формування державної служби медицини катастроф як механізм управління процесом подолання медико-санітарних наслідків надзвичайних ситуацій/ під ред. Гур'єва С. О. – К.: Вид. СПД Лопушанський В.Ф., 2009. – 384 с.
17. Жигуц Ю.Ю., Лазар В.Ф. «Інженерна екологія»: Навч. пос. – К.: Кондор-Видавництво, 2015. - 170 с.
18. Клименко М.О., Залеський І.І. Техноекологія: Навчальний посібник К.: ВЦ «Академія», 2011. – 256 с.
19. Екологічна безпека: Підручник / В.М. Шмандій, В.Ю. Некос. – Харків: НВФ «Екограф», 2008. – 438 с.
20. Radovenchyk V. Development of air quality monitoring system in Kyiv on the way of modernization environmental safety of sustainable development / V. M. Radovenchyk, O. I. Ivanenko, T. O. Shabliy, T. V. Krysenko, I. V. Radovenchyk // IOP Series: Earth and environmental science. 2022. P. 1-10.

Information resources on the Internet

1. Ministry of Environmental Protection and Natural Resources of Ukraine - https://mepr.gov.ua/
2. State Statistics Service of Ukraine - http://www.ukrstat .gov.ua
2. Ecological portal of Ukraine – http://www.ecolog.org.ua/
3. Vernadsky Library – www.nbuv.gov.ua
4. Electronic archive of scientific and educational materials of KPI named after Igor Sikorsky - ELAKPI URL: https://ela.kpi.ua

Educational content

5. Methods of mastering the component

Lecture classes

Lectures are aimed at:

- *providing modern, holistic, interdependent knowledge in the discipline "Environmental and Natural-Technogenic Safety", the level of which is determined by the target installation for each specific topic;*

- *ensuring in the process of lecturing the creative work of students together with the teacher;*
- *education of students of professional and business qualities and development of their independent creative thinking;*
- *formation of the necessary interest in students and providing direction for independent work;*
- *determination of the level of modern development of activities in the field of human safety, population, environment, their content and interrelationship;*
- *reflection of methodical processing of the material (allocation of main thoughts and provisions, underlining conclusions, repeating them in different formulations);*
- *acquisition of visual, combination, if possible, with the demonstration of visual materials, layouts, models and samples;*
- *teaching in a clear and clear language, explaining all the newly introduced terms and concepts;*
- *accessibility for perception of this audience.*

Title of the lecture topic and list of main questions (list of didactic means, references to literature and tasks on the IWS)	*Number of hours*
Law and policy in the field of environmental safety *International law in the field of environmental safety. International policy in the field of environmental safety. National law in the field of environmental safety.* *Literature: [2d] p. 6-29.* *Tasks at the IWS: World Experience of Environmental Policy in a Market and Centralized Planned Economy. Environmental Technologies and the Environment. "The Rio Declaration." Club of Rome, its purpose, structure, functions, role in the international arena [2d, 11d].*	*2*
General provisions of the discipline *Subject and objectives of the course. History of the concept of "environmental safety" and the concept of sustainable development. Environmental laws and main principles of environmental safety.* *Literature: [3d, chapter 2]].* *Tasks at the IWS: Common goals to be achieved to solve environmental problems (research of global energy and biogeochemical cycles, substantiation of observation systems for assessing global changes, analysis of global changes in biodiversity, development of theoretical and methodological foundations for understanding environmental changes, analysis and support of international efforts) [12d, 13d].*	*1*
Emergencies *Classification of emergencies. Emergencies of ecological nature. Emergencies of technogenic nature. Emergencies of socio-political nature. Emergencies of a military nature.* *Literature: [2d, chapter 4] , [3d, subsection 4.2.3]* *Tasks at the IWS: Criteria for assessing the ecological state of the ecosystem, population health.*	*2*
The most important factors of accidents and disasters. Characteristic features of current and future emergencies, accidents and disasters *The most important factors of accidents and disasters in Ukraine, the countries of the near and far abroad. Characteristic features of modern emergencies, accidents and disasters.*	*1*

Literature: [48d, chapter 3]. *Tasks at the IWS: The transformation of some types of emergencies into others. non-traditional threats.*	
Methodology of risk analysis and management *Basic concepts and terms. Risk analysis methodology. Risk management. The decision-making algorithm to ensure security for the object of potential danger. Technical diagnostics, equipment monitoring and risk management.* *Literature: [8d, 4d, 9d, 6d, 2d].* *Tasks at the IWSP: Density of accidents and ways to reduce the risk of undesirable technical situations [2d, 18d]. Economic aspect of environmental safety. organizational and managerial aspect of environmental safety. Technological aspects of environmental safety. ecological [1d, 2d, 14d, 12d].*	*2*
Methods for assessing risk levels *Potential environmental risk. Method of maximum permissible values (GDV). Method of risk factors. Mapping the distribution of risk levels. Ecological and geographical analysis and evaluation of the territory on the basis of cartographic modeling. Mapping of hazards and risks caused by accidents at nuclear power plants. Mapping the distribution of risk levels of the city of Ukraine. Expert method. The main methods of quantifying the risk levels of emergencies, accidents and disasters at environmentally stressful and potentially dangerous enterprises and facilities. Risk assessment by Monte Carlo method.* *Literature: [5d, 16d].* *Tasks at the IWS: Determination of the index of pollution of environmental components.*	*2*
Engineering methods of research of safety of technical systems *Qualitative and quantitative approaches in methods of hazard assessment. Preliminary analysis of hazards. Methods of verification letter (CHECK-LIST) and "what will happen if ...?" ("WHAT - IF"). Tree bounce - DV (fault tree analysis - FTA). Event tree analysis (ETA). The decision tree.* *Literature: [15d]].* *Tasks at the IWS: Logical analysis. Control maps of processes.*	*2*
Classification of risks. Concepts of measuring the value of human life. Dose-effect dependencies *Classification of risks. Individual risk. Concepts of measuring the cost of human life. Dependences such as "dose-effect" and their use in the quantitative assessment of risk. Assessment of the level of risk. The sequence of calculation of risk levels using dependence "dose-effect". The concept and criteria of risk admissibility. Economic factors of risk acceptability.* *Literature: [6d].* *Tasks at the IWS: The psychological aspects of human environmental safety. The relationship between the disciplines "Life Safety" and "Environmental Safety". Medical and hygienic risk [6d].*	*2*
Environmental safety of the regions of Ukraine: comparative estimates *International integral indicators of environmental safety. Integrated risk assessments for the environmental safety of the regions of Ukraine. Natural factors of background risk. Risks to human life and health. Environmental risks . Risks of man-made*	*2*

nature. Matrix method of assessing the level of environmental safety according to L. Leopold. Harrington function. *Literature: [3d, 5, 2d].* *Tasks at the IWS: To assess the risk of damage to life and human health. Assessment of the risk of material losses [3d, 5, 2d].*	
Habitat impact on demographics of regions with developed infrastructure *Industry of Ukraine. Pollution of the environment. Demographic processes. Fertility factor. Cluster analysis of the health situation in Ukraine.* *Literature: [5d, 1d, 2d].* *Tasks at the IWS: Medical and hygienic monitoring. Zoning of environmental conditions according to environmental criteria (characteristics of zones of ecological norm, environmental risk, environmental crisis, environmental disaster) [1d, 2d, 5d].*	*2*
Total	*18*

Seminars

In the system of professional training of students, seminar classes occupy 66 % of the classroom load. Being an addition to the lecture course, they lay and form the basics of the Master qualification. The content of these classes and the methodology of their conduct should ensure the development of creative activity of the individual. They develop scientific thinking and the ability to use special terminology, allow you to test knowledge, in connection with which this type of work acts as an important means of operational feedback. Therefore, seminars should perform not only cognitive and educational functions, but also contribute to the growth of students as creative workers in the field of ecology.

The main tasks of the series of seminars:

- help students systematize, consolidate and deepen knowledge of a theoretical nature in the cycle of environmental disciplines;

- teach students techniques for solving practical problems, promote mastering the skills and abilities to identify the type of situation and assess the level of danger, and on the basis of analyzing the processed information, come to their own informed conclusions;

- teach them to work with scientific and reference literature, documentation and schemes;

- to form the ability to learn independently, that is, to master the methods, methods and techniques of self-study, self-development and self-control.

№	*The name of the topic of the lesson and the list of main questions (list of didactic support, references to literature and tasks to the IWS)*	*Number of hours*
1	*Mapping the distribution of hazards in populated areas of Ukraine. Ecological and geographical analysis and evaluation of the territory.* *Literature: [5д, 16д].* *Tasks on the IWS. Limit-permissible environmental load.*	*7*
2	*Fault tree analysis – FTA.* *Literature: [15д]* *Tasks on the IWS. Probabilistic and statistical methods of risk analysis. Category of statistical method.*	*7*
3	*Decision tree. Logical analysis.* *Literature: [15д]* *Tasks on the IWS. Probabilistic and statistical methods of risk analysis.*	*7*

	Probability-heuristic method category.	
4	*Integrated assessments of the risk of ecological security of the regions of Ukraine for 10 years* *Literature: [3, 5]* *Tasks on the IWS. Establishing influence coefficients for the assessment of environmental safety of regions.*	*7*
5	*Institutions for determining international integral indicators of environmental safety* *Literature: [13]* *Tasks on the IWS. The role of world universities in determining the integral indicators of environmental safety for assessing the environmental safety of regions.*	*6*
	Modular control test	*2*
	Total	*36*

Independent work of student

Independent work of students takes 60% of the time of studying the component, it also includes preparation for the exam. The main task of students' independent work is to acquire scientific knowledge in the field of environmental protection, which was not included in the list of lecture questions, by personally searching for information, forming an active interest in a creative approach in educational work. In the process of independent work within the framework of the credit module, the student must learn to deeply analyze the problem of greening of production and, based on calculations, come to his own well-founded conclusions.

No	*Name of the topic submitted for self-study*	*Number of hours*
Section 1. GENERAL PROVISIONS OF THE DISCIPLINE		
1	*World experience of environmental policy in a market and centralized planned economy. Environmental technologies and the environment. The most important sources of international environmental law. The concept of sustainable development of civilization, the main directions of sustainable development. "The Rio Declaration." Club of Rome, its purpose, structure, functions, role in the international arena.* *Literature: [2d, 11d].* *Common goals to be achieved to solve environmental problems (research of global energy and biogeochemical cycles, substantiation of observation systems for assessing global changes, analysis of global changes in biodiversity, development of theoretical and methodological foundations for understanding environmental changes, analysis and support of international efforts).* ***Literature:** [12d, 13d].*	*11*
***Section 2.** EMERGENCIES*		
2	*Criteria for assessing the ecological state of the ecosystem, public health. Types of ecosystems (natural, equilibrium, crisis, critical, catastrophic, collapse).* *Literature**:** [13d]].*	*11*

	Technology crises of the 70s of the twentieth century. and ways and mechanism of exit from it. Types of engineering miscalculations in Ukraine and other countries that have led to the most negative impact on the geopolitical environment. ***Literature:** [2d, 3d].* *Transformation of some types of emergencies into others. Unconventional threats. New "ecological" diseases. Geopathic zones. The threat of placement in Ukraine of environmentally hazardous industries and technologies.* *Literature: [8d, 15d].*	
Section 3. METHODS OF RISK ASSESSMENT		
3	*The density of accidents and ways to reduce the risk of undesirable technical situations.* *Literature: [2d, 14d].* *Economic aspect of environmental safety. Organizational and managerial aspect of environmental safety. Technological aspects of environmental safety. Legal aspects of environmental safety. Scientific aspects of environmental safety. Humanitarian aspect of environmental.* *Literature: [1d, 2d, 14d, 12d].* *Batelle Methods and a combination of map analysis (G-technologies).* *Literature: [4d].* *Logical analysis. Control maps of processes. Tables of states and emergency combinations* *Literature: [15d].* *The task at the IWS is the psychological aspects of human environmental safety [4d]. The relationship between the disciplines "Life Safety" and "Environmental Safety" [7d]. Medical and hygienic risk [6d].* *Assessment of the risk of damage to life and human health. Assessment of the risk of material losses.* *Literature: [3d, 5, 2d].*	*12*
Section 4. FEATURES OF TECHNOGENESIS IN UKRAINE		
4	*"Critical" object and "critical" situation, differences and similarities between them. Classes of hazards of the main pollutants according to the degree of impact on the human body.* *Literature: [15d].* *Social and economic consequences of the Chernobyl accident.* *Literature: [10d].* *Irrational use of natural resources as a factor that threatens environmental safety. Trade in quotas as a method of regulating the consumption of natural resources.* *Literature: [15d].* *The main directions of solving the global raw material crisis.* *Literature: [15d].* *Environmental problems of transport highways.* *Literature: [5].*	*12*

	Medical and hygienic monitoring. Zoning of environmental conditions according to environmental criteria (characteristics of zones of ecological norm, environmental risk, ecological crisis, environmental disaster). *Literature: [1d, 2d, 5d].* *The model of ecologically predetermined famine - the degradation impact on the environment of the exponentially growing population - an experiment on the island of St. Matthew. The model of ecocide is the flowering and degradation of civilization with an exponential increase in the number of the human population and its sudden depopulation on Easter Island (Rapa Nui) due to the depletion of the territory's resources. The history of civilization and the state of the environment of Easter Island: analysis of human behavior from the standpoint of environmental safety and application for the future of humanity and planet Earth.* *Literature: [13d].* *Ecologically safe development. History of development of socio-economic systems. Cycles of structuring. Industrial and technological stages. Program of action for safe development.* *Literature: [2d].*	
5	*Execution of HWT*	*10*
6	*Preparation for MCT*	*5*
8	***Total hours***	*36*

Individual work

According to the curriculum, the student must complete an individual task in the form of a homework test. Individual work simultaneously performs several educational functions. First, the HWT highlights in a more concrete form those issues that were briefly considered by the teacher; secondly, the student acquires the skills of working with modern scientific literature and the ability to analyze a certain problem; thirdly, presenting his scientific work in class in front of his colleagues, the author of the HWT learns to make scientific reports and defend his point of view in a discussion in which the students themselves take part. HWT should be based on processing sources of basic and auxiliary literature, web-resources. In addition, it is recommended to use monographs, special articles, textbooks for university students and periodicals as auxiliary literature.

Control works

The purpose of the tests is to consolidate and verify theoretical knowledge from the credit module, students to acquire practical skills of independent problem solving.

One modular control work (MCR) is performed. Each student receives an individual assignment to which written answers must be provided and sent. The control work is carried out after studying the last topic and is devoted to the influence of the habitat on the demographic indicators of regions with developed infrastructure.

Politics and control

6. Policy of component

Rules for attending classes and behavior in classes

Students are obliged to take an active part in the educational process, not to be late for classes and not to miss them without a good reason, not to interfere with the teacher to conduct classes, not to be distracted by actions that are not related to the educational process.

Rules for assigning incentive and penalty points

encouraging points can be credited by the teacher only for the performance of creative works in the discipline or additional passage of online specialized courses with the receipt of the appropriate certificate:

https://ru.coursera.org/learn/climate-science

https://ru.coursera.org/learn/global-environmental-management

https://ru.coursera.org/learn/sustainability-social-ecological-systems

https://ru.coursera.org/learn/urban-nature

https://ru.coursera.org/learn/ecosystem-services

https://ru.coursera.org/learn/intro-indoor-air-quality

https://alison.com/courses/diploma-in-environmental-quality-monitoring-and-analysis/content

However, their amount cannot exceed 10 % of the rating scale.

Penalty points within the discipline are not provided.

Deadline and overlay policy

In case of debts in the discipline or any force majeure circumstances, students should contact the teacher through accessible (provided by the teacher) communication channels to solve problematic issues and coordinate the algorithm of actions for working out. If the student did not pass or will not appear at the MKR (without a good reason), his result is evaluated at 0 points. Recompilation of MKR results is not provided for.

Academic Integrity Policy

Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the absence of references when using printed and electronic materials, quotes, opinions of other authors. Invalid hints and write-offs when writing tests, conducting classes; passing the credit for another student; copying of materials protected by the copyright system without the permission of the author of the work.

The policies and principles of academic integrity are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"https://kpi.ua/code.

Policy of academic behavior and ethics

Students should be tolerant, respect the opinion of others, object to formulate in the correct form, constructively maintain feedback in the classroom.

The norms of ethical behavior of students and employees are defined in Section 2 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"https://kpi.ua/code.

7. Types of control and rating system for assessing learning outcomes (RCOs)

Distribution of educational time by types of classes and tasks in the component according to the curriculum

Semester	School time		Training hours				Control measures		
	Loans	akad.h	Lectz.	Pract.	L/r	IWS	MCT	HCW	Semester certification
2	4	120	18	36	--	66	1	1	test

The student's rating in the component consists of points that he receives for:

1. one control work
2. implementation of 5 practical works.
3. execution of HCW.

System of rating (weight) points and evaluation criteria:
1. Modular control.
Weight point – 30. Criteria for evaluation of control works

Mark	*Completeness of the answer*
27-30	*"excellent", Full answer (at least 90% of the necessary information)*
20-26	*"very good", incomplete disclosure of one of the questions or full answer with minor inaccuracies*
10-19	*"good", Incomplete disclosure of the question (at least 60% of the required information) and minor errors*
2-9	*"satisfactory", the answer is superficial, unspecified*
0-1	*Unsatisfactory work (does not meet the requirements for 3 points).*

2. Work in practical classes.
*Weight point – 10. The total number of points for work in seminar classes is 10*5=50 points.*

Criteria for assessing students' knowledge

Mark	*Completeness of the answer*
9-10	*Timely full implementation of the year, presentation of the results of the work, registration of p/r.*
4-8	*Disadvantages under paragraph 1. Timely implementation of p/r.*
1-3	*Minor deficiencies in paragraph 1. Untimely execution of p/r.*
0	*Non-fulfillment of p/r*

3. Subject to the implementation of the HCW, the maximum weight point is 20.
Criteria for evaluation of HCW

Mark	*Completeness of the answer*
18-20	*"excellent» creative approach to solving the problem, reflected own position*
12...17	*"good", reasonable disclosure of the problem with certain shortcomings*
5...11	*"satisfactory", the topic is disclosed incompletely*
0...4	*"unsatisfactory", the topic is not disclosed, the DKR is not counted*

Thus, the rating semester scale of the credit module is:

$$R_C=1*30+5*10+20=100 \text{ marks}$$

According to the results of educational work before the first certification the "ideal student" should score 40 points. At the first certification the student receives "enrolled" if his current rating is not less than 20 points.

According to the results of educational work before the second certification the "ideal student" should score 90 points. At the second certification, the student receives "enrolled" if his current rating is not less than 45 points.

The maximum amount of points is 100. To obtain a credit module score from the "automatic" module, you need to have a rating of at least 60 points.

Students who have a rating of less than 60 points at the end of the semester, as well as those who want to increase their grade in the ECTS system, perform scoring control work.

The starting score is points for DKR.

The task of the control work consists of open questions of different sections of the syllabus of the discipline .

– Evaluation system of the first two questions:

– "excellent", full answer (at least 90% of the necessary information) – 23-25 points;

– "very good", full answer (at least 85% of the necessary information) – 20-22 points;

– "good", a sufficiently complete answer (at least 75% of the necessary information or minor inaccuracies) – 15-19 points;

– "satisfactory", incomplete answer (at least 65% of the necessary information and some errors) – 9-14 points;

– "enough", full answer (at least 60% of the necessary information) – 4-8 points;

– "unsatisfactory", unsatisfactory answer – 3-0 points.

The system for evaluating the third question:

– "excellent", full answer (at least 90% of the necessary information) – 23-26 points;

– "very good", full answer (at least 85% of the necessary information) – 20-22 points;

– "good", a sufficiently complete answer (at least 75% of the necessary information or minor inaccuracies) – 15-19 points;

– "satisfactory", incomplete answer (at least 65% of the necessary information and some errors) – 9-14 points;

– "enough", full answer (at least 60% of the necessary information) – 4-8 points;

– "unsatisfactory", unsatisfactory answer – 3-0 points.

The amount of points for scoring control work and DKR is transferred to the scoring assessment according to the table.

Points $R=r_{HCW}+r$	*Score*
95...100	*Perfectly*
85...94	*Very good*
75...84	*Well*
65...74	*Satisfactory*
60...64	*Enough*
less than 60	*Disappointing*

8. Additional information from the component

Approximate list of HCW tasks

1. *Check-list method;*
2. *"What if?" (What - If);*
3. *Preliminary analysis of hazard (PHA Hazard and Analysis) (PHA);*
4. *Analysis of types of failures and consequences (FAILURE Mode and Effects Analysis) (FMEA));*
5. *Action Errors Analysis) (AEA));*
6. *Conceptual Hazard Analysis) (CHA));*
7. *Conceptual Safety Review) (CSR));*
8. *Human Hazard and Operability) (Human HAZOP));*
9. *Human Reliability Analysis) (HRA) and Human Errors or Interactions) (HEI));*
10. *Method of logical analysis;*
11. *Methods based on image recognition (cluster analysis);*
12. *Ranking (expert assessments);*
13. *Hazard Identification and Ranking Analysis) (HIRA));*
14. *. Failure Mode, Effects and Critical Analysis (FMECA);*
15. *Methodology of domino effects analysis;*
16. *Methods of potential risk determination and evaluation (Methods of potential risk determination and evaluation);*
17. *Human Reliability Quantification (HRQ);*
18. *Flow Maps;*
19. *Control cards;*
20. *Accident Sequences Precursor (ASP);*
21. *Event Tree Analysis (ETA);*
22. *Fault Tree Analysis (FTA);*
23. *Risk assessment of minimal paths from the initiating event to the main event (Short Cut Risk Assessment) (SCRA)*
24. *Decision Tree;*
25. *Probabilising risk assessment of potentially hazardous objects;*
26. *Method of expert evaluation;*
27. *Analogy method;*
28. *Method of ball evaluations;*
29. *Method of subjective probabilities of assessment of dangerous states;*
30. *Method of coordination of group ratings;*
31. *Hazard and Operability Study (HAZOP) method;*
32. *Maximum Credible Accident Analysis (MCAA);*
33. *Reliability Block Diagram (RBD);*
34. *Safety Analysis (SA);*
35. *Structural Reliability Analysis (SRA);*
36. *Full risk analysis - Optimum Risk Analysis (ORA) technique;*
37. *Method Organized Systematic Analysis of Risk (MOSAR);*
38. *Quantitative Risk Assessment (QRA).*

An approximate list of tasks for modular tests

1. *Explain the concept of "fertility coefficient". Specify the global trends in this issue.*
2. *Present the distribution of fertility rates in Ukraine.*
3. *Describe the ecological and geographical analysis and evaluation of the territory based on cartographic modeling.*
4. *Describe the demographic processes in Ukraine.*
5. *Carry out a cluster analysis of the medical and sanitary situation of Ukraine.*
6. *Explain the features of the ecological and hygienic impact of industrial facilities on the population.*

An approximate list of questions for the test

1. Describe the dependencies of the type "dose-effect" and indicate the possibility of their use in quantitative risk assessment.

2. Describe the ecological and geographical analysis and assessment of the territory on the basis of cartographic modeling.

3. Describe emergencies of socio-political nature.

4. Describe the concept and criteria of risk acceptance.

5. Describe emergencies of man-made nature.

6. Give the classification of emergencies.

7. Describe the economic risk factors.

8. Describe emergencies of environmental nature.

9. Describe military emergencies.

10. Explain the concept of "individual risk". Describe the main characteristics of individual risk.

11. Give the sequence of calculation of risk levels using the dose-effect relationship.

12. List the most important factors of accidents and catastrophes in Ukraine and abroad.

13. Introduce modern concepts of measuring the value of human life.

14. Conduct a cluster analysis of the health situation in Ukraine.

15. Give the characteristics of modern emergencies, accidents and catastrophes.

16. Give the characteristics of expected emergencies, accidents and catastrophes in the future.

17. Introduce a decision algorithm to ensure safety for the object of potential danger.

18. Give the classification of industrial facilities by degree of danger.

19. Explain the features of ecological and hygienic impact of industrial facilities on the population.

20. Describe the methodology of risk analysis.

21. Describe the demographic processes in Ukraine.

22. Compare technical, environmental, social, economic types of risks.

23. Explain Farmer's rule in setting tolerable risk limits.

24. Explain the concept of "fertility rate". Present the distribution of fertility rates in Ukraine.

25. List the social and psychological risk factors.

26. Describe particularly vulnerable areas, waters, objects.

27. Give the algorithm for risk assessment by the Monte Carlo method.

28. Describe the slow man-made impacts.

29. Give the classification of environmental factors.

30. Give the classification of hazardous substances and the maximum amounts of their use.

31. Explain the concept of "potential environmental risk". Describe the main characteristics of the potential environmental risk.

32. Describe dangerous objects on the territory of Ukraine.

33. Explain the importance of the environmental passport of the enterprise.

34. Describe the state register of potentially dangerous objects.

35. Compare the methods of risk assessment: the method of the checklist and the method "what will happen if…?".

36. Describe the qualitative and quantitative approaches in hazard assessment methods.

37. Describe international law in the field of environmental security.

38. Describe the state policy in the field of environmental safety.

39. Describe the international policy in the field of environmental security.

40. Give a classification of risks.

41. Describe the expert method as a method of risk assessment.

42. Describe the domestic law in the field of environmental safety.

43. Describe the method "Event Tree" as a method of risk assessment.

44. Describe the method of "Tree of failures" as a method of risk assessment.

45. Give the basic concepts and definitions of environmental safety.

46. Describe the decision tree method as a risk assessment method.

47. Give environmental laws and the main principles of environmental safety, the main features of environmental safety.

48. List the factors of man-made hazards.

49. Describe the method of maximum permissible values as a method of risk assessment.

50. Describe the hazards and sources of danger in the field of nature and ecology.

51. Describe man-made accidents and disasters.

52. Explain the concept of "Ashby criterion" as a method of risk assessment.

53. Give the main criteria of environmental safety.

54. Describe the technical and man-made systems.

55. Describe the method of mapping the distribution of risk levels.

56. Explain the concepts of "technical diagnostics", "equipment monitoring" and "risk management".

57. Give a risk management algorithm.

58. Introduce the main types of calculations, processes related to emergencies, accidents, catastrophes.

59. Describe the environmental problems of the regions of Ukraine.

60. Give an algorithm for determining risk levels using the analysis of "Failure Tree".

Work program of component (syllabus):

***Compiled** prof., Doctor of Technical Sciences, Shabliy T.O.*

***Approved** by the **Ecology and technology of plant polymers** (protocol No 17 from 29.05.2025)*

***Approved** by the CEF Methodical Commission (protocol No.11 of 27.05.2025)*