NATIONAL UNIVERSITY OF CIVIL DEFENCE OF UKRAINE

Fire safety

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(name of faculty/unit )

automatic security systems and information technologies

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(name of departments )

## SYLLABUS OF THE EDUCATIONAL DISCIPLINE

Automatic control and instruments for measuring environmental parameters

(name of academic discipline)

mandatory professional

(compulsory general or compulsory professional or elective)

according to the educational and professional program of radiation and chemical protection

(name of educational program)

preparationbachelor's degree

(name of educational degree)

in the field of knowledge 18 "Production and technologies"

(code and name of the field of knowledge)

by specialty 183 " Technologies of environmental protection "

(code and specialty name)

Recommended by the department

ASBIT for the 2023 - 2024 academic year.

Minutes from " 30 " August 202 of the 3rd year No. 1

The syllabus is developed in accordance with the Workbook programs of the academic discipline "Automatic control and instruments for measuring environmental parameters"

(name of academic discipline)

2023 year

**General information about the discipline**

Abstract of the discipline

The development of automated process control and management systems contributes to increasing labor productivity and the level of public safety. Monitoring the state of environmental safety at the current stage of development is largely determined by the level of management. Without the necessary means of automatic diagnosis of the condition and automatic management of it, it is significantly more difficult to ensure the safety of the population and territories. The subject of study of the educational discipline " Automatic control and devices for measuring environmental parameters " is issues related to the research and operation of modern automated systems for monitoring the state of the environment, systems for detecting, locating and eliminating emergency situations and their consequences, conducting an analysis of the conformity of automatic control means and monitoring, the requirements of national and international standards.

This course provides theoretical and practical mastery of the principles of structure, composition, operation and features of operation of environmental control systems with the aim of assimilating higher education students with theoretical knowledge and acquiring practical skills necessary for solving problems related to the structure and operation of means of automatic control used in the field of technogenic and environmental safety.

Information about scientific and pedagogical employee(s)

|  |  |
| --- | --- |
| general information | Antoshkin Oleksiy Anatoliyovych , teacher of the Department of Automatic Safety Systems and Information Technologies of the Faculty of Fire Safety, candidate of technical sciences, associate professor |
| Contact Information | Kharkiv, st. Chernyshevska, 94, office No. 329. The working phone number is 707-34-35. |
| E-mail | antoshkin @ nuczu . edu . u.a |
| Scientific interests | * mathematical modeling of security systems; * optimization of the composition and operation of automatic fire protection and surveillance systems. |
| Professional abilities | * professional knowledge and experience of working with electronic computing equipment; * professional knowledge and considerable experience in determining and evaluating the parameters of automatic fire protection systems of objects and monitoring the state of the environment. |
| Scientific activity with an educational component | * Seryak O.I., Antoshkin O.A. Investigation of the characteristics of the electrostatic field for the deposition of fire-extinguishing aerosol // Problems and prospects of ensuring civil protection: materials of the international scientific and practical conference of young scientists. Kharkiv: NUCDU, 2021. - p. 178. <http://repositsc.nuczu.edu.ua/handle/123456789/13076>; * Seryak O.I., Antoshkin O.A. Possibilities for acceleration of dust deposition using an electrostatic field // "Occupational safety: Education and practice", "Problems and prospects for the development of occupational safety": Collection. of science Proceedings of the All-Ukrainian scientific and practical conference of teachers and specialists-practitioners and the 11th All -Ukrainian scientific and practical conference of cadets, students, graduate students and adjuncts - Lviv: LSU BZD, 2021. - p. 166-167. [http://repositsc.nuczu.edu.ua/bitstream/123456789/13066/1/Seryak%20iz%20zbirky.pdf](http://repositsc.nuczu.edu.ua/bitstream/123456789/13066/1/%D0%A1%D1%94%D1%80%D1%8F%D0%BA%20%D1%96%D0%B7%20%D0%B7%D0%B1%D1%96%D1%80%D0%BA%D0%B8.pdf) ; * Antoshkin O.A., Lytvyak O.M, Malyarov M.V. Experimental study of the characteristics of the installation for the deposition of fire-extinguishing aerosol // Problems of fire protection. – 2020. Kharkiv, NUCDU – No. 48. - pp. 9-16. <http://repositsc.nuczu.edu.ua/handle/123456789/11834>; * Google Scholar: <https://scholar.google.com.ua/citations?user=RyehLl8AAAAJ&hl=ru> * ORCID ID: 0000-0003-2481-2030; * SCOPUS: <https://www.scopus.com/authid/detail.uri?authorId=57200544021>. |

Time and place of discipline classes .

Auditory classes on the academic discipline are held according to the approved schedule. All laboratory (practical) classes must be held in specialized laboratories (cabinets No. 324, 325, 326), equipped with stands with modern fire protection systems. The electronic version of the schedule is posted on the University's website ( <http://rozklad.nuczu.edu.ua/timeTable/group>).

Consultations on the academic discipline are held during the semester every Thursday from 4:00 p.m. to 5:00 p.m. in offices No. 324, 325, 326 and in remote format. In case of additional need of the applicant for consultation, the time is agreed with the teacher.

**The purpose** of studying the discipline: assimilation by students of higher education of theoretical knowledge and acquisition of practical skills necessary for solving problems related to the development, application and operation of automatic control and management tools used in various systems for monitoring the state of the environment, including means and devices that ensure control of the safe flow of technological processes, early detection of emergency situations in fire and explosive industries, as well as means of automatic prevention of emergency situations.

The knowledge acquired during the study of the discipline "Automatic control and devices for measuring environmental parameters" is necessary for the applicant during the performance and defense of qualification works, as well as in professional activities when assessing the technical condition of systems for ensuring the safety of people, enterprises and public facilities.

**Description of the academic discipline**

|  |  |  |
| --- | --- | --- |
| Name  indicators | Form of education | |
| daytime | extramural (distance) |
| **Discipline status** | mandatory professional |  |
| **A year of training** | 2023-2024 |  |
| **Semester** | 6 |  |
|  |  |  |
| **Scope of discipline:** |  |  |
| - in ECTS loans | 4 |  |
| - the number of modules | 2 |  |
| - total number of hours | 120 |  |
|  |  |  |
| **Time allocation according to the curriculum:** | | |
| - lectures (hours) | 22 |  |
| - practical classes (hours) | 38 |  |
| - seminar classes (hours) | - |  |
| - laboratory classes (hours) | - |  |
| – course project (work) (hours) | - |  |
| - other types of classes (hours) | - |  |
| - independent work (hours) | 60 |  |
| - individual tasks (research) (hours) | - |  |
| - final control ( differential assessment , exam) | differential calculation |  |

**Prerequisites for studying the discipline**

The knowledge obtained during the study of the courses: "Higher mathematics", "Physics", "Basics of information technologies" provide a basis for understanding and contribute to the assimilation of the principles of building automatic control systems and devices for measuring environmental parameters , methods of measuring temperature, pressure, level, costs and others

**Learning outcomes and competence in the discipline**

According to the radiation and chemical protection educational program, the study of the educational discipline " **Technogenetic and ecological safety"** should ensure:

- achievement of the following learning outcomes by students of higher education:

|  |  |
| --- | --- |
| Program learning outcomes | PRN |
| * to be able to use information technologies and communication networks for environmental protection tasks; | PR 03 |
| * to be able to apply the knowledge of control and assessment of the state of pollution and industrial emissions, from the analysis of the dynamics of their changes depending on the conditions and technologies of cleaning environmental components; | PR 10 |
| * to be able to apply the basic principles of safe, resource-efficient and environmentally friendly technologies in the management of environmental protection activities, including through environmental management systems in accordance with international standards ; | PR 13 |
| Disciplinary learning outcomes | *abbreviation* |
| The ability to use modern software products to ensure the process of monitoring the state of the environment. | DRN 01 |
| Knowledge of the principles of the structure and operation of devices for monitoring the state of the environment. | DRN 02 |
| Possession of the skills of the construction of circuits of automatic systems for monitoring the state of the environment. | DRN 03 |
| The ability to assess the quality of the system for monitoring the state of the environment. | DRN 04 |

- formation of the following competencies in higher education students :

|  |  |
| --- | --- |
| Software competencies (general and professional) | ZK, PC |
| * ability to prevent environmental pollution and crisis phenomena and processes; | SK10 |
| * the ability to manage (placement and disposal) waste; | SK16 |
| * the ability to ensure environmental safety; | SK17 |
| * The ability to assess the impact of industrial objects and other objects of economic activity on the environment. | SK18 |
| Expected competencies in the discipline | abbreviation |
| * with the ability to determine functional relationships between individual elements of environmental control systems. | OKD 01 |
| * the ability to make informed decisions regarding the structure and composition of environmental control systems. | OKD 02 |

**Program of educational discipline**

**Subjects of the academic discipline:**

Module 1. Principles of construction and operation of means of measurement and control of environmental parameters .

Topic 1.1. General information about means of measurement and control of environmental parameters.

Topic 1.2. Design and operation of devices for measuring and controlling environmental parameters.

Module 2. Principles of the structure of environmental monitoring systems

Topic 2.1. Measurement errors

Topic 2.2. ACS environmental parameters

**Distribution of disciplines in hours by forms of organization of the educational process and types of educational classes :**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Names of modules and topics** | **Daytime form** | | | | | |
| Number of hours | | | | | |
| everything | including | | | | |
| lectures | practical (seminar) classes | laboratory  classes (other types of classes) | independent work | modular control work |
| **6th semester** | | | | | | |
| **Module 1 . Principles of construction and operation of means of measurement and control of environmental parameters** | | | | | | |
| **Topic 1.1.**  General information about means of measurement and control of environmental parameters | 14 | 4 | - | - | 10 |  |
| **Topic 1.2.**  Design and operation of devices for measuring and controlling environmental parameters | 63 | 14 | 24 | - | 25 |  |
|  |  |  |  |  |  |  |
| **Together by module 1** | 77 | 18 | 24 | - | 35 |  |
| **6th semester** | | | | | | |
| **Module 2 . Principles of the structure of environmental control systems** | | | | | | |
| **Topic 2.1.**  Measurement errors | 16 | 2 | 4 | - | 10 |  |
| **Topic 2.2.**  ACS environmental parameters | 27 | 2 | 10 | - | 15 |  |
|  |  |  |  |  |  |  |
| **Together by module 2** | 43 | 4 | 14 | - | 25 |  |
| **Together** | 120 | 22 | 38 | - | 60 |  |

**Topics of practical classes**

|  |  |  |
| --- | --- | --- |
| No  s/p | Topic name | Number  hours |
|  | Design and operation of means for measuring temperature. | 4 |
|  | Design and operation of pressure measuring devices. | 4 |
|  | Design and operation of means for measuring level and costs. | 4 |
|  | Design and operation of electronic devices for monitoring technological parameters. | 4 |
|  | Design and operation of means for analyzing the composition of substances. | 4 |
|  | Study of the state of the environment (SPS). | 4 |
|  | Methods of determining measurement errors. | 4 |
|  | Construction of functional automation schemes. | 4 |
|  | ACS parameters of the state monitoring process. | 2 |
|  | Automatic executive devices in technological process control systems. Design, technical characteristics and operation. | 4 |
|  | Together | 3 8 |

**Approximate subject of individual** **tasks**

1. Determination of the value of various types of errors.
2. Construction of functional automation schemes.

**Evaluation of educational achievements** **students of higher education**

**Evaluation tools**

The means of assessment and methods of demonstrating learning results are: differential credit at the end of the semester, individual calculation tasks in practical classes during the semester. Each student of higher education completes 2 individual written tasks during the semester.

Evaluation of training results is carried out according to the cumulative point-rating system, the main purpose of which is regular and comprehensive evaluation of the results of training activities and the formation of competencies.

All practical types of control of achievements of applicants by educational components, is carried out on a 100-point scale.

Other types of educational work (test control, additional types of classes, availability of reporting materials) are evaluated using a 100-point scale, and it also includes a general account of the accumulation of points.

**Evaluation criteria**

**Forms of current and final control**

The current control of the learning outcomes of the students is carried out in oral or written form individual express survey ( control ) , which is performed during classroom classes in accordance with the thematic plan and according to the option set by the teacher. It takes no more than 15 minutes at the beginning and at the end of the lesson. At the beginning of the lesson, theoretical questions are checked during an express survey ( control ) , at the end of the lesson, practical questions learned during the lesson are checked. Also, current control is carried out in the form of individual calculation and calculation-graphic tasks. Applicants of higher education must demonstrate the skills of independent work when solving a task.

The final control is carried out in the form of a differential assessment.

**The distribution and accumulation of points , which the winners receive, for species educational classes and discipline control measures**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Kinds educational classes | | Number  educational classes | The maximum score for kind educational session | Total maximum number of points  by types of educational activities |
| **I. Current control** | | | | |
| Module 1 | lectures | 9 | 2 | 18 |
| practical training | 6 | 7 | 42 |
| laboratory work | - | - | - |
| according to the results of control (modular) works (modular control) | - | - | - |
| Together for module 1 | | | | 60 |
| Module 2 | lectures | 2 | 2 | 4 |
| practical training | 4 | 7 | 28 |
| laboratory work | - | - | - |
| according to the results of control (modular) works (modular control)\* |  |  |  |
| Together for module 2 | | | | 32 |
| Together for current control | | | | 9 2 |
| **II. Individual tasks (research)** | | | | 8 |
| **III . Final control** | | | | - |
| Together for all kinds educational activities and control measures | | | | 100 |

**Current control.**

Criteria for the current evaluation of the knowledge of applicants for lectures:

2 points – the student of higher education participates in the discussion of the lecture material, answers additional questions.

1 point – the student of higher education is present at the lecture, takes notes.

0 points – the student of higher education is absent from the lecture.

Criteria for the current evaluation of the knowledge of the students in the practical session :

7 points - the answer to the question is given without errors in its entirety, a high technique of performing all components is demonstrated .

5-6 points – the answer to the question has a single insignificant flaw.

2-4 points – the answer to the question demonstrates the ability to apply theoretical knowledge, but the answer contains more than one significant error or two or three minor ones.

1 point - half of the proposed questions are answered.

0 points – the answer to the question is missing or incorrect.

**Individual tasks.**

Evaluation criteria of individual tasks .

*Individual tasks* (scientific and research) are performed during the semester by participating in the work of the scientific circle of the department, preparing theses and reports at the conference, articles for scientific collections, participation in conducting scientific and research works, etc.

**List of theoretical questions for preparation for differential assessment:**

1. Concept of measurement
2. Measurement methods
3. Measurement errors
4. Accuracy class meter
5. Errors of the measuring chain
6. Mechanical sensors:
7. Pneumatic sensors
8. Electric sensors
9. Photoelectric converters FEP
10. Mathematical description of primary converters
11. Intermediate converters
12. Measuring control devices
13. Monitoring measuring devices
14. Mathematical description of the double-action hydraulic IM.
15. Technological process as an object of management
16. Classification of technological processes
17. Tasks of TP management
18. A typical solution for automation of TP
19. Structure diagram of ATS TP
20. Multidimensional and multi-cascade ACS TP
21. Peculiarities of calculation of multidimensional ACS
22. Functional diagrams of ACS TP
23. Rules for conventional designation of technological equipment
24. Rules for notation of communications
25. Conditional designations of devices on the FSA
26. Expanded FSA
27. ACS liquid level
28. ACS by pressure in the technological apparatus
29. ACS by liquid flow
30. ACS by gas consumption
31. ACS by cost ratio (concentration)
32. Automatic control system of heat exchange devices
33. ACS of furnaces
34. Tasks and structure of ASPPZ
35. SP classification
36. Basic physical principles of the structure of sensitive elements of the SP
37. SP connection diagrams
38. Classification of PPKP
39. Principles of PPKP structure
40. Requirements for fire alarm zones
41. Types of SO and UE

**The policy of teaching the academic discipline**

1. Conscientious implementation of the schedule of classes in the academic discipline (students of higher education who are late for class are not allowed to class).
2. Active participation in the discussion of educational issues, preliminary preparation for practical classes, high-quality and timely performance of tasks and obligatory performance of independent tasks given by the teacher.
3. The use of mobile devices during class is allowed only with the permission of the teacher and only for educational purposes.
4. A student of higher education can review the level of his grades and accumulated points with the help of a journal, record of educational classes of the educational group, which is freely available.
5. It is allowed to redo any express control in case of receiving an unsatisfactory assessment.
6. An increase in the current grade is allowed within 10 days after the class.

**RECOMMENDED SOURCES OF INFORMATION**

**L literature**

1. Educational and professional program "Technogenetic-ecological safety" in specialty 183 "Environmental protection technologies" training at the first (bachelor's) level of higher education in the field of knowledge 18 "Production and technologies".
2. Automation to prevent explosions and fires. O.A. Derevyanko, S.M. Bondarenko, O.A. Antoshkin, M.M. Murin, O.M. Mohylnikov - Kharkiv: ACDU, 2006. - 278 p.
3. Fire and security alarm systems. Bondarenko S.M., Hristych V.V., Derevyanko O.A., Antoshkin O.A. Synopsis of lectures. Kharkiv: Ukrainian State University, 2008. - 136 p.
4. Control and measuring devices with the basics of metrology: a course of lectures / O. S. Sadovyi. - Mykolaiv: MNAU, 2016. - 84 p. URL: <http://dspace.mnau.edu.ua/jspui/bitstream/123456789/2275/1/Kontrolno-vymiryuvalni_prylady_osnovamy_metrolohiyi.pdf>
5. Heat engineering measurements and devices: teaching. manual / A.F. Kurilov, V.M. Kozin. – Sumy: Sumy State University, 2015. – 189 p. URL: <https://core.ac.uk/download/pdf/324243027.pdf>
6. Course of lectures "Mathematical modeling and optimization of security systems" // Composers: O.A. Antoshkin, S.M. Bondarenko, O.A. Derevyanko, O.M. Lytvyak, M.M. Murin, V.V. Hristych – Kharkiv: NUCDU, 2021 <http://repositsc.nuczu.edu.ua/handle/123456789/13121>

**Information resources**

1. Website of ASBIT Department URL: [http :// www . asbestos \_ nuczu \_ edu . u.a](http://www.asbit.nuczu.edu.ua)
2. Antoshkin O.A., Lytvyak O.M, Malyarov M.V. Experimental study of the characteristics of the installation for the deposition of fire-extinguishing aerosol // Problems of fire protection. – 2020. Kharkiv, NUCDU – No. 48. - pp. 9-16. URL: <http://repositsc.nuczu.edu.ua/handle/123456789/11834>
3. Antoshkin O.A., Lytvyak O.M, Halytsa M.V. Experimental study of the influence of the electrostatic field on the deposition rate of fire-extinguishing aerosol // Problems of fire safety. – 2018. Kharkiv, NUCDU – No. 43. - pp. 9-13. URL: <http://repositsc.nuczu.edu.ua/handle/123456789/7408>

Developer(s):

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