Silabus
educational component of the EC
(conventional designation of EC in the educational programme (EP))

Automated experiment management system

Name of the discipline:	**Automated experiment management system**
Level of higher education:	**first (educational and scientific)**
Course page in Moodle:	*https://dl.khadi.kharkov.ua/course/view.php?id=1238*
Scope of the educational component	**3 credits (90 hours)**
Form of final control	**Credit**
Consultations:	**on schedule**
Name of the department:	**Department of Automation and Computer-Integrated Technologies**
Language of instruction:	**Ukrainian**
Course leader:	**Oleksandr Kononykhin, Associate Professor, PhD in Engineering**
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Summary of the educational component:
The aim is to form a system of knowledge of the tasks, principles and methods of experiment control systems in higher education students
Subject*:* theoretical and methodological foundations, methodological provisions of scientific areas of modelling and optimisation of experiment control systems at the modern level.
The main objectives of the discipline are:
- mastery of methods of measurement evaluation, processing and analysis, methods of experiment planning using computational mathematics.
- mastery of the basic methods of analysing and identifying risks, threats and hazards in the workplace and apply them in the development of
- understanding of the scientific and mathematical principles necessary for solving engineering problems in the field of automation and computer-integrated technologies.

Competences acquired by the applicant:
General competencies:
Ability to apply knowledge in practical situations.
Ability to communicate in the state language both orally and in writing.
Skills in the use of information and communication technologies.
Special (professional) competencies:
Ability to apply knowledge of mathematics to the extent necessary to use mathematical methods for the analysis and synthesis of automation systems.
Ability to apply knowledge of physics, electrical engineering, electronics and microprocessor technology to the extent necessary to understand processes in automation systems and computer-integrated technologies.
Ability to apply the methods of system analysis, mathematical modelling, identification and numerical methods to develop mathematical models of individual elements and automation systems as a whole, to analyse the quality of their functioning using the latest computer technologies.

PC-9. Ability to freely use modern computer and information technologies to solve professional problems, program and use applied and specialised computer-integrated environments to solve automation problems.

Learning outcomes:

Knowledge of linear and vector algebra, differential and integral calculus, functions of many variables, functional series, differential equations for functions of one and many variables, operational calculus, theory of functions of complex variable, probability theory and mathematical statistics, theory of random processes to the extent necessary to use mathematical apparatus and methods in the field of automation.

Be able to apply modern information technologies and have the skills to develop algorithms and computer programs using high-level languages and object-oriented programming technologies, create databases and use Internet resources.

Understand the essence of the processes occurring in automation objects in the fields of instrumentation and automation of construction, road machinery and equipment, and be able to analyse automation objects and justify the choice of structure, algorithms and control schemes based on the results of the study of their properties

To be able to apply methods of system analysis, modelling, identification and numerical methods to develop mathematical and simulation models of individual elements and automation systems as a whole, to analyse the quality of their functioning using the latest computer technologies.

Be able to use a variety of specialised software to solve typical engineering problems in the field of automation, including mathematical modelling, computer-aided design, database management, computer graphics methods.

Learning outcomes in accordance with the study programme:

To create highly reliable automation systems with a high level of functional and information security of software and hardware.

To apply specialised conceptual knowledge, including modern scientific achievements, as well as critical understanding of modern problems in the field of automation and computer-integrated technologies to solve complex problems of professional activity.

To develop computer-integrated control systems for complex technological and organisational and technical objects, applying a systematic approach, taking into account non-technical components of the assessment of automation objects.

Adhere to the norms of academic integrity, know the basic legal norms for the protection of intellectual property, commercialisation of research, inventive and design activities.

ELO 12. Collect the necessary information using scientific and technical literature, databases and other sources, analyse and evaluate it.

Thematic plan

Topic No.	Name of the topic (LC, PL, IL)	Number of hours	
		face-to-face	correspondence
1	LC Organising and conducting an experimental study	2	
	Determination of the error of the experiment	2	
	IL Features of scientific research. Preparation and planning of research and development	10	15
2	LC Theory of experimental design	2	

	PL Detection of gross errors	2	
	IL Extreme experiment	10	15
3	LC Conducting an experimental study.	4	
	PL Comparison of variances and means	4	
	IL Drawing up and filling in a laboratory journal. Programme of experimental research, purpose and methods of research. One-factor experiment	10	15
4	LC Determining the error of the experiment	4	
	PL Least squares method	4	
	IL The total variance and standard error of the individual determination. Student's distribution system.	8	15
5	LC Least squares method	2	
	PL Correlation analysis.	2	
	IL Determining the parameters of a parabolic equation. Equation method for a nonlinear function	7	15
6	LC Correlation analysis.	2	
	PL Planning scientific experiments in the search for optimal conditions	2	
	IL Equations and regression lines, correlation coefficient. Calculation and graphical work	5 18	15
Together	LC	16	
	PR (LR, NW)	16	
	IL	58	90

Individual research assignment (if available):

Teaching methods:
- verbal method (lecture, class discussion, explanation, story);
- practical method (practical classes, business and role-playing games, brainstorming);
- visual method (method of illustrations, method of demonstrations);
- work with literature (scientific literature; regulatory literature; search for information on the task);
- independent work;

Forms and methods of assessment
- final control (credit)
- oral control (conversation)
- test control
- practical examination (defence of practical works)
- Methods of self-monitoring and self-assessment **Assessment** system **and requirements:**

Current performance

1 The current academic performance of students for the performance of academic types of work in classrooms and for the performance of independent work is assessed using a four-point grading scale with the subsequent conversion to a 100-point scale. When assessing current performance, all types of work provided by the curriculum are taken into account.

1.1 Lecture classes are assessed by determining the quality of performance of specific tasks.

1.2 Practical classes are assessed by the quality of the control or individual task, performance and design of practical work.

1.3 Laboratory classes are assessed by the quality of laboratory reports.

1.4 Seminar classes are assessed by the quality of the individual assignment/report.

2 Assessment of the current performance of higher education students is carried out at each practical lesson (laboratory or seminar) on a four-point scale ("5", "4", "F", "2") and is recorded in the academic record book.

- "excellent": the applicant has mastered the theoretical material flawlessly, demonstrates in-depth knowledge of the relevant topic or discipline, and the main provisions;

- "good": the applicant has mastered the theoretical material well, knows the main aspects of the primary sources and recommended literature, presents it in an argumentative manner; has practical skills, expresses his/her views on certain problems, but makes certain inaccuracies and errors in the logic of the presentation of theoretical content or in the analysis of practical content;

- "satisfactory": the applicant has basically mastered the theoretical knowledge of the subject or discipline, is familiar with the primary sources and recommended literature, but gives unconvincing answers, confuses concepts, is uncertain about answering additional questions, does not have stable knowledge; when answering practical questions, shows inaccurate knowledge, is unable to evaluate facts and phenomena, to relate them to the future profession;

- "unsatisfactory": the applicant has not mastered the educational material of the topic (discipline), does not know scientific facts, definitions, is almost not familiar with primary sources and recommended literature, lacks scientific thinking, and has not developed practical skills.

3 The final grade for the current activity is recognised as the arithmetic mean of the grades for each class, individual work, and current tests according to the formula:

$$K^{nomoч} = \frac{K1 + K2 + ... + Kn}{n},$$

where $K^{nomoч}$ is the final assessment of success based on the results of the current control;

$K1, K2, ..., Kn$ - Assessment of the success of the n current control measure;

n - number of current control measures.

The scores are converted into points according to the conversion scale (Table 1).

Table 1 - Conversion of the average score for current activities to a multi-point **scale**

4-point scale	100-point scale	4-point scale	100-point scale	4-point scale	100-point scale	4-point scale	100-point scale
5	100	4,45	89	3,90	78	3,35	67
4,95	99	4,4	88	3,85	77	3,3	66
4,9	98	4,35	87	3,80	76	3,25	65
4,85	97	4,3	86	3,75	75	3,2	64
4,8	96	4,25	85	3,7	74	3,15	63
4,75	95	4,20	84	3,65	73	3,1	62
4,7	94	4,15	83	3,60	72	3,05	61
4,65	93	4,10	82	3,55	71	3	60
4,6	92	4,05	81	3,5	70	from 1.78 to 2.99	from 35 to 59
						reassembly	
4,55	91	4,00	80	3,45	69	from 0 to 1.77	from 0 to 34

4,5	90	3,95	79	3,4	68	re-examination

Final assessment

1 A higher education student receives a credit at the last class in the discipline based on the results of the current assessment. The average grade for the current activity is converted into points on a 100-point scale, according to the conversion table (Table 1).

Higher education students who have a current average grade in the discipline below "3" (60 points) in the last class can improve their current grade by taking tests in the discipline.

The assessment of applicants' knowledge through testing is carried out on a scale:

- "Excellent": at least 90% of correct answers;
- "Very good": 82% to 89% of correct answers;
- "Good": 74% to 81% of correct answers;
- Satisfactory: 67% to 73% of correct answers;
- "Satisfactory enough": 60% to 66% of correct answers;
- "Unsatisfactory": less than 60% of correct answers.

2 A prerequisite for receiving credit is:

- making up all missed classes;
- the average current grade in the discipline is not lower than "3" (60 points).

3 Additional points are awarded for individual independent work and participation in scientific events.

3.1 Additional points are added to the sum of points gained by the higher education student for the current academic activity (for disciplines for which the final form of control is a test), or to the final grade in the discipline for which the final form of control is an examination.

3.2 The number of additional points awarded for different types of individual tasks depends on their scope and significance:

- prize-winning places in the discipline at the international/national competition of student research papers - 20 points;
- prize-winning places in the discipline at national competitions - 20 points;
- participation in the international / all-Ukrainian competition of scientific student works - 15 points
- participation in international/national scientific conferences of students and young scientists - 12 points;
- participation in all-Ukrainian competitions in the discipline - 10 points
- participation in competitions and scientific conferences of KhNADU in the discipline - 5 points;
- completion of individual research (educational and research) tasks of increased complexity - 5 points**.**

3.3 The number of additional points cannot exceed 20 points.

4 The learning outcome is assessed *(select the appropriate one)*:

- on a two-point scale (passed/not passed) according to Table 2;
- on a 100-point scale (for differentiated grading) according to Table 3.

The total score, including additional points, cannot exceed 100 points.

Table 2 - Scale for converting points to the national grading system

On a 100-point scale	According to the national scale
from 60 points to 100 points	enrolled
less than 60 points	unaccounted for

Table 3 - Scale for assessing students' knowledge based on the results of the final control in the discipline

Score in points	Score on the national scale		ECTS grades	
	examination	offset	Assessment.	Criteria.
90-100	**Excellent**	**Enrolled**	**A**	The theoretical content of the course has been mastered in full, without gaps, the necessary practical skills to work with the material have been formed, all the learning tasks provided for in the curriculum have been completed, the quality of their performance has been assessed with a number of points close to the maximum
80-89	**Good.**	**Enrolled**	**B**	The theoretical content of the course has been mastered in full, without gaps, the necessary practical skills to work with the material have been basically formed, all the learning tasks provided for in the curriculum have been completed, the quality of most of them has been assessed with a number of points close to the maximum
75-79			**C**	The theoretical content of the course is mastered in full, without gaps, some practical skills of working with the material mastered are insufficiently developed, all the learning tasks provided for by the curriculum have been completed, the quality of any of them is not assessed with the minimum number of points, some types of tasks are completed with errors
67-74	**Satisfactory**		**D**	The theoretical content of the course is partially mastered, but the gaps are not significant, the necessary practical skills to work with the material mastered are basically formed, most of the learning tasks provided for in the curriculum have been completed, some of the completed tasks may contain errors
60-66			**E**	The theoretical content of the course is partially mastered, some practical skills have not been developed, many of the learning tasks provided for in the curriculum have not been completed, or the quality of some of them is assessed with a score close to the minimum.

Score in points	Score on the national scale		ECTS grades	
	examination	offset	Assessment.	Criteria.
35-59	**Unsatisf actory**	**Not cred ited**	**FX**	The theoretical content of the course is partially mastered, the necessary practical skills have not been formed, most of the assignments provided by the curriculum have not been completed, or the quality of their performance is assessed with a score close to the minimum; with additional independent work on the course material, it is possible to improve the quality of the assignments (with the possibility of retaking)
0-34	**Unaccep table**		**F**	The theoretical content of the course is not mastered, the necessary practical skills are not formed, all completed assignments contain gross errors, additional independent work on the course material will not lead to any significant improvement in the quality of the assignments (with a mandatory repeated course)

Course policy:

- The course involves teamwork, and the classroom environment is friendly, creative, and open to constructive criticism;
- mastering the discipline requires mandatory attendance at lectures and practical classes, as well as independent work;
- independent work involves the study of individual topics of the discipline, which are submitted in accordance with the programme for independent study, or have been considered briefly;
- all tasks envisaged by the programme must be completed within the set timeframe;
- if a higher education student is absent from classes for a valid reason, he/she presents the completed assignments during independent preparation and consultation with the teacher;
- the term paper must be defended no later than one week before the start of the examination session ***(if available)*;**
- while studying the course, higher education students must adhere to the rules of academic integrity set out in the following documents: "Rules of Academic Integrity of Participants in the Educational Process of KhNADU" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_dobroch_1.pdf), "Academic Integrity. Checking the text of academic, scientific and qualification works for plagiarism" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_85_1_01.pdf), "Moral and ethical code of participants of the educational process of KhNADU (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_MEK_1.pdf).
- if the fact of plagiarism is detected, the applicant receives 0 points for the assignment and must repeat the tasks provided for in the silent study;

- cheating during tests and exams is prohibited (including using mobile devices). Mobile devices may be used only during online testing.

Recommended reading: *(literature no later than 10 years old, except for 1 fundamental classical textbook or monograph)*

1. Fundamentals of scientific research. Managing editorial team I.M.Glushchenko.-Kyiv: Higher school. Main publishing house , 2013. 158 p.
2. Planning of the experiment in technological research./ Vinarsky M.S., Lurie M.V.- Kyiv: Technika, 2015. 168 p.
3. Mathematical processing of the experimental results. Rumshinskiy L.Z. - Moscow: Nauka, 2017. - 192 p.
4. Ray W. Technological Process Management Methods - M. Mir, 1988 - 868 p.
5. Handbook for the designer of automated production process control systems (Ed. by G.L. Snyalyansky) - Moscow: Mashinostroenie. 2013 - 528 c.
6.. Schneider M. The World Nuclear Industry Status Report 2016 / Mycle Schneider, Antony Froggatt, Julie Hazemann, Tadahiro Katsuta, M.V. Ramana. - Paris, London, Tokyo. - 2016 .- 278p / Additional **sources:**
1. distance learning course:
https://dl.khadi.kharkov.ua/course/view.php?id=1238

Developer(s)

educational course syllabus _____ O. Kononykhin

Department Chair _____ O. Hurko