Syllabus educational component of the Ministry of Education

System analysis

Subjects:	System analysis
Level of higher	first (undergraduate)
education:	
Course page in	https://dl2022.khadi-kh.com/course/view.php?id=1224
Moodle:	
The scope of	4 credits (120 hours)
education	
Component:	
The form of the	test
summary control:	
Consultations:	on schedule
Name of the	Automation and computer-integrated technologies
department:	
Teaching language:	Ukrainian
Course leader:	Nefedov Leonid, Doctor of Science, professor
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Brief content of the educational component:

The goal is the formation of students' system thinking, the theoretical and practical basis of system research in the analysis of problems and decision-making in the field of professional activity for use in future professional activity.

The subject of the discipline is the principles and regularities inherent in automation and computer-integrated technologies in all fields of activity, as well as models, methods, tools and technologies for the analysis and synthesis of complex objects.

The main tasks of studying the academic discipline are: formation of students' system of knowledge, skills and ideas about system analysis in the field of automation and computer-integrated technologies.

Prerequisites for studying the educational component: studying the course requires systematic and thorough knowledge of related courses "Numerical methods and computer simulations", "Metrology, technological measurements and devices", "Modeling and optimization of control systems", "Information systems and complexes", "Intelligent automation and partner systems", as well as purposeful work on the study of special literature, active work at lectures, practical classes. Больше информации: brief

Competencies acquired by the acquirer:

Ability to conduct research at the appropriate level;

Ability to generate new ideas (creativity);

Ability to work in an international context;

Ability to search, process and analyze information from various sources;

Ability to apply knowledge of mathematics, to the extent necessary for the use of mathematical methods for the analysis and synthesis of automation systems; The ability to apply methods of

system analysis, mathematical modeling, identification and numerical methods to develop mathematical models of individual elements and automation systems as a whole, to analyze the quality of their functioning using the latest computer technologies; The ability to freely use modern computer and information technologies to solve professional tasks, to program and use applied and specialized computer-integrated environments to solve automation problems.

Learning outcomes according to the educational program:

Know 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 a complex variable, probability theory and mathematical statistics, theory of random processes to the extent necessary for use mathematical apparatus and methods in the field of automation. Be able to apply the methods of system analysis, modeling, identification and numerical methods to develop mathematical and simulation models of individual elements and automation systems as a whole, to analyze the quality of their functioning using the latest computer technologies.

Be able to use a variety of specialized software for solving typical engineering tasks in the field of automation, in particular, mathematical modeling, automated design, database management, computer graphics methods.

		Number		
Topic	Name of topics (LC, LW, PW, SC, IW)			Literature
No		ocular	extramu-	
			ral	
1	2	3	4	5
	LC 1. The history of the development of systemic ideas.	2	1	
	PW 1. Selection of the best version of the device under	2	1	
1	development.			1.1-1.3
	IW 1. Methods of solving linear programming	8	7	
	problems.			
	LC 2. The system as an object of research.	2	1	
2	PW 2. Graphical method of solving linear programming	2	1	1.1-1.3
	problems.			
	IW 2. Dual problems of linear programming.	8	7	

Table 1 – Thematic plan

The end of the table 1.

1	2	3	4	5
	LC 3. The system as an object of research (continued).	2	1	
3	PW 3. Solving problems of linear programming using Microsoft Excel.	2	1	1.1-1.3
	IW 3. Transport problems of linear programming.	8	7	
	LC 4. Initial steps of system analysis.	2	1	
4	PW 4. Solution of the transport problem by means of MS Excel.	2	1	1.1-1.3
	IW 4. Transport problems of linear programming.	8	7	
	LC 5. Modeling in system analysis.	2	1	
5	PW 5. Expert decision-making methods.	2	1	1.1-1.3
	IW 5. Expert methods.	8	7	
	LC 6. Systemological analysis of the decision-making	2	1	
6	procedure.			1.1-1.3
	PW 6. The Delphi method.	2		
	IW 6. Expert methods.	7	7	
	LC 7. Formation of generalized multi-criteria assessments and substantiation of models for choosing	2	1	
7	compromise solutions.			1.1-1.3
	PW 7. Decision-making in the administration of	2	1	
	complex technical projects.	7	7	
	LC 8 Models and methods of making multi-criteria	,	,	
0	decisions under conditions of stochastic uncertainty.	2	1	1 1 1 2
8	PWP 8. Multi-criteria car selection.	2	1	1.1-1.3
	IW 8. Multi-criteria optimization problems.	7	7	
	LC 9. Methods of expert decision-making.	2	1	
9	PW 9. Making decisions in conditions of uncertainty.	2	1	1-3
	IW 9. Expert methods.	7	7	
	LC 10. Inventory management models.	2	1	
10	PW 10. The method of analysis of hierarchies T. Saati.	2	1	1.1-1.3
	IW 10. Expert methods.	7	7	
11	IW 11. Implementation of CGW (CW)	5	30	1.1-1.3
In just	t one semester	120	120	
ALL k	oy discipline	120	120	

Approximate topics of individual and/or group classes: CGW (CW):

- 1. Graphical method of solving linear programming problems.
- 2. Methods of solving linear programming problems.
- 3. Dual problems of linear programming.
- 4. Transport problems of linear programming
- 5. Expert methods.
- 6. Multi-criteria optimization problems.

Teaching methods:

1) verbal:

1.1 traditional: lectures, explanations, stories, etc.;

1.2 interactive (non-traditional): problem lectures, discussions, etc.;

2) visual: method of illustrations, method of demonstrations, presentations.

3) practical:

3.1 traditional: practical classes;

3.2 interactive (non-traditional): business and role-playing games, trainings, seminarsdiscussions, "round table", brainstorming method, case method.

Evaluation system and requirements: Current performance

1 The current success of applicants for the performance of educational types of work in training sessions and for the performance of independent work tasks is evaluated using a four-point rating scale with subsequent transfer to a 100-point scale. During the evaluation of the current academic performance, all types of work provided by the educational program are taken into account.

1.1 Lecture classes are evaluated by determining the quality of performance of specified tasks.

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

1.3 Laboratory classes are evaluated by the quality of reports on the performance of laboratory work.

1.4 Seminar classes are evaluated by the quality of individual assignment/abstract.

2 The current performance of higher education applicants is assessed at each practical session (laboratory or seminar) on a four-point scale ("5", "4", "3", "2") and entered in the journal of academic performance.

- "excellent": the winner mastered the theoretical material flawlessly, demonstrates deep knowledge of the relevant topic or academic discipline, the main provisions;

- "good": the applicant has mastered the theoretical material well, has the main aspects from primary sources and recommended literature, presents it in a reasoned manner; has practical skills, expresses his thoughts on certain problems, but certain inaccuracies and errors are assumed in the logic of the presentation of theoretical content or in the analysis of practical ones;

- "satisfactory": the applicant has basically mastered the theoretical knowledge of the educational topic or discipline, orients himself in primary sources and recommended literature, but answers unconvincingly, confuses concepts, answers additional questions uncertainly, does not have stable knowledge; when answering questions of a practical nature, reveals inaccuracy in knowledge, does not know how to evaluate facts and phenomena, connect them with the future profession;

- "unsatisfactory": the applicant has not mastered the educational material of the topic (discipline), does not know scientific facts, definitions, hardly orients himself in primary sources and recommended literature, lacks scientific thinking, practical skills are not formed.

3 The final score for the current activity is recognized as the arithmetic mean sum of points for each lesson, for individual work, current control works according to the formula:

$$K^{current} = \frac{K1 + K2 + \dots + Kn}{n},$$

where *K*^{current} – the final assessment of success based on the results of current control; K1, K2, ..., Kn – evaluation of the success of the nth measure of current control; n – the number of measures of current control.

Estimates are converted into points according to the conversion scale (table 2).

							Policester
4-point	100-	4-point	100-	4-point	100-	4-point	100-
scale	point	scale	point	scale	point	scale	point
	scale		scale		scale		scale
5,00	100	4,45	89	3,90	78	3,35	67
4,95	99	4,40	88	3,85	77	3,30	66
4,90	98	4,35	87	3,80	76	3,25	65
4,85	97	4,30	86	3,75	75	3,20	64
4,80	96	4,25	85	3,70	74	3,15	63
4,75	95	4,20	84	3,65	73	3,10	62
4,70	94	4,15	83	3,60	72	3,05	61
4,65	93	4,10	82	3,55	71	3,00	60
4.60	02	4.05	81	3 50	70	From 1,78 to 2,99	From 35 to 59
4,00	92	4,03	01	3,30	70	Reass	embly
4,55	91	4,00	80	3,45	69	From 0 to 1,77	From 0 to 34
4,50	90	3,95	79	3,40	68	Re-exar	nination

Table 2 – Recalculation of the average grade for the current activity into a multi-point scale

Final assessment

1 A student of higher education receives a credit in the last lesson in the discipline based on the results of the current assessment. The average score for the current activity is converted into points on a 100-point scale, according to the conversion table (table 2).

Applicants for higher education who have a current grade point average in the discipline lower than "3" (60 points) can increase their current grade by taking tests in the discipline in the last session.

Assessment of the knowledge of applicants through testing is carried out according to the following scale:

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

2 The condition for obtaining credit is:

- making up for all missed classes;

- the average current grade in the discipline is not lower than "3" (60 points).

3 For performing individual independent work and participation in scientific events, additional points are awarded to the winners.

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

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

- prizes in the discipline at the international / all-Ukrainian competition of scientific student works - 20 points;

- prize places in the discipline at the All-Ukrainian Olympiads - 20 points;

- participation in the international / all-Ukrainian competition of scientific student works - 15 points - participation in international / all-Ukrainian scientific conferences of students and young scientists - 12 points;

- participation in all-Ukrainian Olympiads in the discipline - 10 points

- participation in Olympiads and scientific conferences of the Khnadu in the discipline - 5 points;

- performance of individual scientific and research (educational and research) tasks of increased complexity - 5 points.

3.3 The number of additional points cannot exceed 20 points.

4 The learning result is evaluated (select is required):

- on a two-point scale (passed/failed) according to table 2;

- on a 100-point scale (for differentiated assessment) according to table 3.

The final grade together with additional points cannot exceed 100 points.

Table 3 – Scale for	[•] transferring	points to the	national	evaluation	system
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On a 100-point scale	On a national scale
from 60 points to 100 points	counted
less than 60 points	not counted

Rating in	Evaluation by national			Evaluation according to the ECTS scale
points	scale		Rating	Criteria
	examination	test		
1	2	3	4	5
90-100	Perfectly	Counted	A	The theoretical content of the course has been mastered in its entirety, without gaps, the necessary practical skills for working with the mastered material have been formed, all educational tasks provided for in the training program have been completed, the quality of their performance has been assessed with a number of points close to the maximum
80-89 75-79	Good	ounted	B C	The theoretical content of the course has been mastered in its entirety, without gaps, the necessary practical skills for working with the mastered material have mainly been formed, all educational tasks provided for by the training program have been completed, the quality of most of them has been assessed with a number of points close to the maximum The theoretical content of the course has been mastered in its entirety, without gaps, some practical skills of working with the mastered material have not been formed enough, all educational tasks provided for by the training program have been completed, the quality of none of them has been assessed with a minimum number of points, some types of tasks have been completed with errors
67-74	factorily		D	The theoretical content of the course is partially mastered, but the gaps are not of a significant nature, the necessary practical skills for working with the mastered material are basically formed, most of the educational tasks provided by the training program have been completed, some of the completed tasks may contain errors
00-00	Satisf		Ľ	been partially mastered, some practical work skills have not been formed, many educational tasks provided by the training program have not been completed, or the quality of some of them has been assessed with a number of points close to the minimum.

 Table 4 - The scale for evaluating the knowledge of students based on the results of the final control of the academic discipline

1	2	3	4	5
35-59	Unsatisfactorily	Vot counted	FX	The theoretical content of the course has been partially mastered, the necessary practical work skills have not been formed, most of the prescribed training programs of educational tasks have not been completed, or the quality of their implementation has been assessed with a number of points close to the minimum; with additional independent work on the course material, it is possible to improve the quality of the performance of educational tasks (with the possibility of retaking)
0-34	Unacceptable	F -1	F	The theoretical content of the course has not been mastered, the necessary practical work skills have not been formed, all completed educational tasks contain gross errors, additional independent work on the course material will not lead to any significant improvement in the quality of the performance of educational tasks (with a mandatory repeat course).

Course policy:

- the course involves working in a team, the environment in the classroom is friendly, creative, open to constructive criticism;

- mastering the discipline involves mandatory attendance of lectures and practical classes, course work, as well as independent work;

- independent work involves the study of individual topics of the academic discipline, which are presented in accordance with the program for independent study, or were considered briefly;

- all tasks provided by the program must be completed within the set time;

- if the student of higher education is absent from classes for a good reason, he presents the completed tasks during independent preparation and consultation of the teacher;

- the coursework must be protected no later than a week before the beginning of the examination session;

- while studying the course, students of higher education must adhere to the rules of academic integrity set forth in the following documents: "Rules of academic integrity of participants the educational process the Khnadu" in of (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 (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_85_1_01.pdf), plagiarism" Moral and ethical code of participants in the educational process of the Khnadu" (https://www .khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_MEK_1.pdf).

- in case of detection of plagiarism, the applicant receives 0 points for the task and must repeat the tasks provided for in the syllabus; - writing off during tests and exams is prohibited (including using mobile devices). Mobile devices are allowed to be used only during online testing.

1. Basic literature

1.1. Zgurovsky M.Z., Pankratova N.D. Fundamentals of system analysis. Textbook. - K.: Published. BHV Group, 2017. – 544 p.

1.2. Phil N.Y. Methodical instructions for the implementation of practical work in the discipline "System Analysis" for students of the specialty 151 "Automation and computerintegrated technologies". - Kharkiv: Khnadu, 2020. - 64 p.

1.3. Katrenko A.V. System analysis, Textbook. – Lviv: Novy svit, 2019. – 396 p.

1.4. Ladanyuk A.P. Fundamentals of system analysis. Tutorial. - Vinnytsia: Nova kniga, 2019. – 176 p.

1.5. Ponomarenko O.I., Ponomarenko V.O. System methods in economics, management and business, Education. manual. - K.: Lybid, 2020. - 239 p.

1.6. Chorney N.B., Chorney R.K. Theory of systems and system analysis, Education. manual. - K.: MAUP, 2020. – 256 p.

1.7. O.A. Stopakevich Systems theory and system analysis. - K.: ISDO, 2017. –200 p.

2. Supporting literature

2.1. Lyamets V.Y., Tevyashev A.D. System analysis. Introductory course. - Kharkiv: Khnure, 2018. – 448 p.

2.2. Zgurovsky M.Z., Pankratova N.D. System analysis. Problems, methodology, applications. - K.: Nauk. dumka, 2019. – 726 p.

2.3. Stopakevich A.A. Complex systems: analysis, synthesis, management. - Odessa: KRED, 2018. – 277 p.

3. Information resources

3.1. Vernadsky National Library of Ukraine [Electronic resource: access mode: www.nbuv.gov.ua].

3.2. Synopsis of lectures on the discipline "Systems analysis" for full-time and part-time students majoring in 151 Automation and computer-integrated technologies /course/view.php?id=968.

3.3. Methodical instructions for the implementation of practical work in the discipline "Systems analysis" for full-time and part-time students in the specialty 151 - Automation and computer-integrated technologies.// Khnadu located on the educational portal of //http://dl.khadi.kharkov .ua/course/view.php?id=968.

The developer of the syllabus of the educational discipline

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