Silabus
selective educational component
Intelligent information systems

Name of the discipline:	**Intelligent information systems**
Level of higher education:	**first (bachelor's)**
Course page in Moodle:	**https://dl.khadi.kharkov.ua/course/view.php?id=2779**
The volume of the educational component	**3 credits (90 hours)**
Form of final control	**Offset**
Consultations:	**on schedule**
Name of the department:	**ACIT department**
Language of instruction:	**Ukrainian**
Course leader:	**Zaporozhetsev Serhii Yuriiovych, PhD, Associate Professor**
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Summary of the educational component:

The purpose of studying the educational component is to form a system of theoretical and practical knowledge and skills in the field of creation and functioning of intelligent automation and intelligent information systems.

Subject*:* pedagogically adapted system of concepts about intelligent information systems, development methods and features of their application.

The main tasks of studying the discipline are:

- substantiation and presentation of theoretical and methodological foundations of building intelligent information systems and artificial intelligence;

– studying the principles and technology of building intelligent information systems and their application in control systems;

- formation of skills in choosing machine learning models for different classes of tasks;

– formation of skills in the implementation of intelligent information systems in specialized software environments;

– development of skills to analyze the results of creating intelligent information systems.

Prerequisites for studying the educational component:

Higher mathematics.

Physics.

Probability theory.

Algorithmization and programming or computer science.

Competencies acquired by the applicant:
General competencies:

Ability to apply knowledge in practical situations.

Skills in the use of information and communication technologies.

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

Ability to work in a team.

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 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 technology.

Ability to use the latest technologies in the field of automation and computer-integrated technologies to solve professional problems, in particular, the design of multi-level control systems, data collection and archiving to form a database of process parameters and their visualization using human-machine interface tools.

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

Learning outcomes in accordance with the educational program:

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.

Be able to apply 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 technology.

Be able to design multi-level control and data acquisition systems for the formation of a database of process parameters and their visualization using human-machine interface tools, using the latest computer-integrated technologies.

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

Thematic plan

no. of topics	Name of topics (LC, LR, PR, NW, SR)	Number of hours	
		face-to-face	correspondence
1	2	3	4
1	LC. Introduction to intelligent information systems. The concept of artificial intelligence.	2	
	OBJECTIVE. Determination of the level of intelligence of complex systems.	2	
	SR. Software and hardware platforms of intelligent systems	10	
2	LC. Stages of development of intelligent systems. Models of knowledge representation. Expert systems and their structure.	4	
	PR. Technologies of designing expert systems based on different models.	4	
	SR. Semantic networks and their use in expert systems. Frame model of knowledge representation.	16	

1	2	3	4
3	LC. Basic concepts of fuzzy logic. Fuzzy logical conclusions. The order of development of fuzzy expert systems	6	
	PR. Development of fuzzy expert system in MATLAB FUZZY LOGIC TOOLBOX	4	
	SR. Decision support systems. Typical architecture and principles of construction. Methods and models of data processing in decision support systems.	16	
4	LC. Artificial neural networks, their classification and properties.	4	
	PR. Creation and research of different types of neural networks	6	
	SR. Hybrid neural networks. Neuro-fuzzy networks. Study of genetic algorithms in systems with artificial intelligence. Application of neural networks in problems of natural language processing and machine vision.	16	
Together	LC	**16**	
	PR	**16**	
	SR	**58**	

Individual educational and research task: not provided.

Teaching methods:
1) verbal: 1.1 traditional: lectures, explanations, storytelling, etc;
2) visual: illustration method, demonstration method;
3) practical: 3.1 traditional: practical classes; experiential learning based on computer experiments.

Evaluation system and requirements:

Current academic performance
1 The current performance of applicants for the performance of educational activities in the classroom 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 progress, all types of work provided by the curriculum are taken into account.
1.1 Lecture classes are evaluated by determining the quality of specific tasks.
1.2 Practical classes are evaluated by the quality of the control or individual task, performance and design of practical work.
2 Evaluation of the current progress of higher education students is carried out at each practical lesson on a four-point scale ("5", "4", "C", "2") and recorded in the academic record book.
- "excellent": the applicant has flawlessly mastered the theoretical material, demonstrates deep knowledge of the relevant topic or discipline, the main provisions;
- "good": the applicant has mastered the theoretical material well, knows the main aspects of the primary sources and recommended literature, reasonably presents it; has practical skills, expresses his thoughts 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 oriented in the primary sources and recommended literature, but unconvincingly answers, confuses concepts, hesitates to answer additional questions, does not have stable knowledge; answering questions of a practical nature, shows inaccuracy in 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 oriented in

primary sources and recommended literature, there is no scientific thinking, practical skills are not formed.

3 The final score for the current activity is recognized as the arithmetic mean of points for each class, for individual work, current control works 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 the current activity into 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 evaluation

1 A higher education student receives a credit at the last class of 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 applicants who have a current average grade in the discipline below "3" (60 points) in the last class can increase their current score by taking tests in the discipline.

Assessment of knowledge of applicants by testing is carried out on a 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 receiving credit is:
- working off 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 applicant for higher education for the current educational activity (for disciplines, the final form of control for which is a test), or to the final grade in the discipline, the final form of control for which is an exam.

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

- prizes in the discipline at the international / all-Ukrainian competition of scientific student works - 20 points;
- prize places in the discipline at the 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 national competitions in the discipline - 10 points
- participation in Olympiads and scientific conferences of KhNADU in the discipline - 5 points;
- performance 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 on a two-point scale (passed/not passed) according to Table 2;

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

Table 2 - Scale of points conversion to the national evaluation system

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

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

Score in points	Assessment on the national scale		Evaluation on the ECTS scale	
			Evaluation	Criteria.
	examination	offset		
90-100	That's great.	Enrolled	**A**	The theoretical content of the course is mastered completely, without gaps, the necessary practical skills of working with the mastered material are formed, all the training tasks provided by the training program are completed, the quality of their implementation is estimated by the number of points close to the maximum

Score in points	Assessment on the national scale		Evaluation on the ECTS scale	
	examination	offset	Evaluation	Criteria.
80-89	Okay.	Enrolled	**B**	The theoretical content of the course is mastered completely, without gaps, the necessary practical skills of working with the mastered material are basically formed, all the training tasks provided by the training program are completed, the quality of most of them is estimated by the number of points close to the maximum
75-79			**C**	The theoretical content of the course is fully mastered, without gaps, some practical skills of working with the mastered material are insufficiently formed, all the training tasks provided by the curriculum are completed, the quality of any of them is not assessed by the minimum number of points, some types of tasks are performed 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 of working with the mastered material are basically formed, most of the training tasks provided by the curriculum are 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 formed, many of the training tasks provided by the curriculum have not been completed, or the quality of some of them is estimated by the number of points close to the minimum.
35-59	Unsatisfactory	Not enrolled	**FX**	The theoretical content of the course is partially mastered, the necessary practical skills have not been formed, most of the learning tasks provided by the curriculum have not been completed, or the quality of their implementation is estimated by the number of points close to the minimum; with additional independent work on the course material, it is possible to improve the quality of learning tasks (with the possibility of repeating)

Score in points	Assessment on the national scale		Evaluation on the ECTS scale	
	examination	offset	Evaluation	Criteria.
0-34	Unacceptable.		**F**	The theoretical content of the course has not been mastered, the necessary practical skills have not been formed, all completed training tasks contain gross errors, additional independent work on the course material will not lead to any significant improvement in the quality of training tasks (with a mandatory repeated course)

Policy of the course:

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

- mastering the discipline involves mandatory attendance of 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 program for independent study, or were considered briefly;

- all tasks provided by the program must be completed in due time;

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

- 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 of the educational process of KNADU" (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 papers for plagiarism" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_85_1_01.pdf), "Moral and ethical code of participants in the educational process of KNADU (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_MEK_1.pdf).

- in case of detection of the fact of plagiarism, the applicant receives 0 points for the task and must repeat the tasks provided in the silabus;

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

Recommended literature:

1.1 Bulgakova O. S. Methods and systems of artificial intelligence: theory and practice : textbook / O. S. Bulgakova, V. V. Zosimov, V. O. Pozdeyev ; Mykolaiv National University named after V. O. Sukhomlynsky - Kherson: Aldi-Plus, 2020. 353 p.

1.2 Savchenko A.S. Methods and systems of artificial intelligence: textbook / A.S. Savchenko, O.O. Sinelnikov - K.: NAU, 2017. 176 p.

1.3 Sharov S.V. Intelligent information systems: textbook / S.V. Sharov, D.V. Lubko, V.V. Osadchiy - Melitopol: B. Khmelnytsky MDPU Publishing House, 2015. 144 p.

1.4 Intelligent automation systems: monograph / Avrunin O. G., Vladov S. I., Petchenko M. V., Semenets V. V., Tatarinov V. V., Telnova G. V., Filatov V. O., Shmelev Y. M., Shushlyapina N. O. - Kremenchuk: NOVABUK Publishing House, 2021. - 322 p.

Additional

2.1 Subbotin S.O. Representation and processing of knowledge in artificial intelligence and decision support systems: Study guide / S.O. Subbotin. - Zaporizhzhia: ZNTU, 2008. - 341 c.

2.2 Oliynyk A.O. Data mining: textbook / A.O. Oliynyk, S.O. Subbotin, O.O. Oliynyk - Zaporizhzhya: ZNTU, 2012. -271 p.

2.3 Fundamentals of designing intelligent systems: textbook / A.S. Dovbysh - Sumy: Sumy State University Publishing House, 2009.- 171 p.

2.4Zaychenko Y.V. Fundamentals of designing intelligent systems. Study guide. K: Publishing House "Slovo", 2004. - 352 p. 119 p.

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