KHMELNYTSKYI NATIONAL UNIVERSITY

APPROVED

Dean of the Faculty of Information Technology

Tetiana HOVORUSHCHENKO

Signature, Name, I.A.S.T.

01 09 2025

WORK PROGRAM OF THE EDUCATION COMPONENT

Human-machine interaction

Name of the discipline

Field of Study	F Information Technology
Specialty	F2 «Software Engineering»
Level Higher education	First (bachelor's) Level
Educational and Professional Program	Software Engineering
Course Load:	5 ECTS credits
Course Code	CPT.15
The language of instruction:	English
Discipline status:	Compulsory (professional training)
Faculty	Faculty of Information Technology
Department –	Department of Software Engineering

Form of study	Year	Semester	Total credits		Number of hours						Course project*	Course work	Semester Control Form	
					Contact hours					Independent work, incl. Idividual Task				
			ECTS Credits	Hours	Total	Lectures	Laboratory works	Practical classes	Seminar classes				Pass/fail test	Exam
D	3	5	5	150	66	32	34			84				+
Total DFN			5	150	66	32	34			84				1

The work program is based on the educational and professional program "Software Engineering" within the specialty "Software Engineering"

Progarm's author _____ Yurii FORKUN

Signature — Academic degree, academic title, Name, SURNAME

Approved at the meeting of the Department of ___ Software Engineering

Name

Minutes of dated No.1 August 28, 2025

Head of the Department of Software Engineering _____ Leonid BEDRATYUK

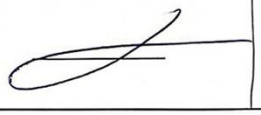
Name — Signature — Name, SURNAME

The work programme was reviewed and approved by the Academic Council of the Faculty of Information Technologies

Chair of the Academic Council _____ Tetiana HOVORUSHCHENKO

Khmelnytskyi 2025

LETTER OF APPROVAL

Position	Department Name	Signature	First Name, LAST NAME
Head of Department DSc, Prof.	Software Engineering		Leonid BEDRATIUK
Programme Guarantor DSc, Prof.	Software Engineering		Leonid BEDRATIUK

3. EXPLANATORY NOTE

The discipline "Human-Machine Interaction" is one of the professional disciplines and occupies a leading place in the training of applicants for the first (bachelor's) level of higher education, full-time (hereinafter referred to as full-time) form of higher education, who study under the educational and professional program "Software Engineering" within the specialty 121 "Software Engineering".

Prerequisites: English (MGT.04), Ukrainian language((MGT.13)), foreign language((MGT.14)).

Postrequisites: Software architecture and design (MPT.01), Design and technological practice (MPT.14); Qualification work(MPT.16).

In accordance with the educational programme, the course contributes to the development of:

competencies: Ability to solve complex, specialised tasks or practical problems in software engineering, characterised by complexity and uncertainty of conditions, using information technology theories and methods. (IC); bility to participate in software design, including modelling (formal description) of its structure, behaviour, and operational processes. (PC02); Ability to formulate and ensure software quality requirements following client requirements, technical specifications, and standards (PC04).

programme learning outcomes: To analyse, purposefully search for, and select the necessary information, reference resources, and knowledge for solving professional tasks, considering modern scientific and technical achievements. (PLO01); be able to develop a human-machine interface (PLO08)

Purpose of the course. Formation of the personality of a specialist capable of performing typical and complex tasks of automation and implementation of computer-integrated technologies by programming human-machine interaction.

Subject of the course. Human-machine interaction and methods and tools for programming real-time systems.

Course objectives. Formation of practical skills in the development of human-machine interfaces and human-machine interaction, using appropriate development environments and application packages.

Learning outcomes. A student who has successfully completed the study of the discipline must: skillfully use the conceptual apparatus of human-machine interaction to develop systems of human-machine interaction; determine what properties certain objects have along with the functions and operations specified for them; characterize and classify discrete objects; build discrete objects of human-machine interaction that satisfy predetermined properties; be able to use the apparatus of human-machine interaction for modeling of the subject area of machine systems; software and hardware for building systems of human-machine interaction.

4. Structure of the course credits

Name of the topic (topic)	Number of hours allotted for:		
	Lecture	Laboratory work	SRS
Topic 1. Fundamentals of human-machine systems and their interaction. History of human-machine interaction.	2		5
Topic 2. Architecture of human-machine interaction systems Interaction models: from mechanical to electronic.	2		5
Topic 3. Human-machine interface and its components. Ergonomics in human-machine interaction.	2		5
Topic 4. Interface design principles.	2		5
Topic 5. Basic software of human-machine systems.	2	4	5
Topic 6. Characteristics of human-machine systems and systems. Basics of working with sound and graphics in interfaces.	2	4	5
Topic 7. Features of signal processing in human-machine systems. I/O technologies in interaction systems.	2	4	5
Topic 8. The use of machine learning in interaction systems. Methods for recognizing and interpreting human behavior.	2		6
Topic 9. Human-machine interfaces. Console programming of human-machine systems.	2		6
Topic 10. Visual programming of human-machine interfaces and human-machine systems.	2	4	5
Topic 11. Programming of human-machine and human-machine interfaces using graphical language	2	4	6
Topic 12. Development of adaptive interfaces.	2	4	5
Topic 13.Use of machine learning in interaction systems. Use of artificial intelligence to support human-machine interaction.	2	4	6
Topic 14. Security and privacy in human-machine interaction systems.	2	2	5
Topic 15. Evaluation and testing of interaction systems.	2	4	5
Topic 16.Ethical issues in human-machine interaction. Innovations and trends in human-machine interaction. The future of human-machine interaction	2		5
Total:	**32**	**34**	**84**

5. PROGRAM OF THE DISCIPLINE

5.1. Content of the lecture course

№ Lecture	List of Lecture Topics and Annotations	Number of hours
1	Fundamentals of human-machine systems and their interaction. History of human-machine interaction.	2
2	Architecture of modern human-machine systems. Hard and soft real-time systems. Queue. Abend. Memory management.	2
3	Human-machine interface in modern real-time systems. Real-time data support. Organization of access to data.	2
4	Interface design principles.	2
5	Basic software of human-machine systems.	2
6	Characteristics of human-machine systems and systems. Basics of working with sound and graphics in interfaces.	2
7	Features of signal processing in human-machine systems. I/O technologies in interaction systems.	2
8	The use of machine learning in interaction systems. Methods for recognizing and interpreting human behavior.	2
9	Human-machine interfaces. Console programming of systems of human-machine systems.	2
10	Visual programming of human-machine interfaces and human-machine systems.	2
11	Programming of human-machine and human-machine interfaces using graphical language	2
12	Development of adaptive interfaces.	2
13	The use of machine learning in interaction systems. The use of artificial intelligence to support human-machine interaction.	2
14	Security and privacy in human-machine interaction systems	2
15	Evaluation and testing of interaction systems.	2
16	Ethical issues in human-machine interaction. Innovations and trends in human-machine interaction. The Future of Human-Machine Interaction	2
	Total	**32**

5.2. Content of laboratory works

№	List of topics of laboratory work, their annotations	Pours
1	Fundamentals of programming in the Arduino IDE environment. Learning how to work with discrete input and output signals	4
2	Organization of reading signals from sensors	4
3	Implementation of software control of DC collector motor.	4
4	Study of servo drives and implementation of the cyclogram	4
5	Study of the operation of a remote control manipulator	4
6	Implementation of blocking the operation of the manipulator when obstacle is detected	4
7	Software development of a robotic site.	4
8	Using computer vision when operating a robot.	6
	Total	**34**

5.3 Content of independent work of *full-time* students

Independent work of students of all forms of education consists in the systematic study of program material from appropriate sources of information, preparation for the implementation and defense of laboratory work, testing. In addition, students have at their disposal a page of the academic discipline in the Modular Learning Environment, where the Work Program of the discipline and the necessary documents for its educational and methodological support are posted.

Week №	Type of independent work	hours
1	Elaboration of lecture material. Preparation for laboratory work No. 1.	5
2	Elaboration of lecture material. Processing the results of laboratory work No. 1.	5
3	Elaboration of lecture material. Preparation for laboratory work No. 2.	5
4	Elaboration of lecture material. Elaboration of the results of laboratory work No. 2.	5
5	Elaboration of lecture material. Preparation for laboratory work No. 3.	5
6	Elaboration of lecture material. Elaboration of the results of laboratory work No. 3. Preparation for test control.	5
7	Elaboration of lecture material. Preparation for laboratory work No. 4.	5
8	Elaboration of lecture material. Elaboration of the results of laboratory work No. 4.	5
9	Elaboration of lecture material. Preparation for laboratory work No. 5.	5
10	Elaboration of lecture material. Elaboration of the results of laboratory work No. 5.	5
11	Elaboration of lecture material. Preparation for laboratory work No. 6.	5
12	Elaboration of lecture material. Elaboration of the results of laboratory work No. 6. Preparation for the test.	5
13	Elaboration of lecture material. Preparation for laboratory work No. 7.	5
14	Elaboration of lecture material. Elaboration of the results of laboratory work No. 7.	5
15	Elaboration of lecture material. Preparation for laboratory work No. 8.	4
16	Elaboration of lecture material.	5
17	Elaboration of lecture material. Elaboration of the results of laboratory work No. 8. Preparation for the final control measure.	5
	Total	**84**

6. Technologies and teaching methods

The learning process in the discipline is based on the use of traditional and modern methods. In particular, lectures are conducted by verbal methods, and laboratory classes are conducted by practical and visual methods using information technologies and modern means of their implementation and are aimed at acquiring practical skills in the implementation of human-machine interfaces and their programming and are aimed at mastering the basic concepts of machine interfaces and using tools for their programming and development.

7. Methods of assessment

Current control is carried out during classroom laboratory classes, as well as on the days of control measures established by the work program and schedule of the educational process, including the use of the Modular Learning Environment. The following methods of current control are used:

– evaluation of the results of laboratory work defense

– test control of the assimilation of theoretical and practical material on the topic;

Current control is carried out during classroom laboratory classes, as well as on the days of control measures established by the work program and schedule of the educational process, including the use of the Modular Learning Environment. The following methods of current control are used:

– oral interview before admission to the laboratory lesson;

– evaluation of the results of laboratory work defense

– test control of the assimilation of theoretical material on the topic.

When deriving the final semester grade, the results of both current control and final control, which is carried out from all the material of the discipline according to tickets previously developed and approved at the meeting of the department, are taken into account. A higher education applicant who has scored in any type of educational work the amount of points lower than 60 percent of the maximum score is not allowed to semester control until he completes the amount of work provided for by the Work Program. A higher education applicant who has scored a positive weighted average score (60 percent or more of the maximum score) in all types of current control and has not passed the exam is considered to have academic debt. Elimination of academic debt from semester control is carried out during the examination session or according to the schedule established by the dean's office in accordance with the "Regulations on control and evaluation of the learning outcomes of higher education applicants at KhNU".

8. Course policy

The policy of the academic discipline is generally determined by the system of requirements for the applicant for higher education, which are provided for by the current provisions of the University on the organization and educational and methodological support of the educational process. In particular, passing a safety briefing; Attendance at discipline classes is mandatory. For objective reasons (confirmed by documents), theoretical training in agreement with the lecturer can take place online. Successful mastery of the discipline and the formation of professional competencies and program learning outcomes implies the need to prepare for a laboratory lesson (study of theoretical material on the topic of work, preliminary preparation of the work protocol, preparation for an oral interview for admission to the lesson (given in the Methodological Recommendations for Laboratory Classes)), actively work in the classroom, prepare a high-quality report (in accordance with the topic, task and purpose), defend the results of the work performed, participate in discussions on the constructive decisions made when performing laboratory work by applicants, etc.

Applicants for higher education must comply with the established deadlines for the implementation of all types of educational work in accordance with the work program of the academic discipline. The term of defense of laboratory work is considered timely if the student defended it at the next lesson after completing the work). The student is obliged to work out the missed laboratory lesson within the deadline set by the teacher, but no later than two weeks before the end of theoretical classes in the semester.

The student's assimilation of theoretical material in the discipline is evaluated according to the results of evaluation of laboratory work, testing and performance of tests and test controls. The implementation of the course project ends with its submission for verification, the content and requirements for the implementation of which are regulated by the relevant methodological recommendations.

In case of violation of the academic integrity policy in any types of academic work, the applicant for higher education receives an unsatisfactory grade and must repeat the tasks on the relevant topic (type of work) provided for by the work program. Any forms of violation of academic integrity ***are not allowed.***

Within the framework of the study of the academic discipline, applicants for higher education are provided with the recognition and enrollment of learning outcomes acquired through non-formal education, which are posted on accessible platforms that contribute to the formation of competencies and deepening of learning outcomes determined by the work program of the discipline, or provide the study of the relevant topic and/or the type of work on the program of the academic discipline (more details in the Regulations on the procedure for recognizing and enrolling the learning outcomes of higher education applicants at KhNU).

9. Assessment of students' learning outcomes during the semester

Assessment of academic achievements of a higher education applicant is carried out in accordance with the "Regulations on Control and Evaluation of Learning Outcomes of Higher Education Applicants at KhNU". During the current

assessment of the work performed by the applicant from each structural unit and the results obtained by him, the teacher assigns him a certain number of points from the Work Program for this type of work. At the same time, each structural unit of educational work can be credited if the applicant has scored at least 60 percent (the minimum level for a positive assessment) of the maximum possible amount of points assigned to the structural unit.

When evaluating the learning outcomes of higher education applicants in any type of educational work (structural unit), it is recommended to use the following generalized criteria:

Table – Criteria for assessing the educational achievements of a higher education applicant

Grade and Level of Achievement of Intended Learning Outcomes and Competences	General Description of Assessment Criteria
Excellent (high)	The student has deeply and fully mastered the course content, confidently navigates it, and skilfully uses the conceptual framework; demonstrates the ability to connect theory with practice, solve practical problems, and clearly express and justify their reasoning. An excellent grade implies a logical presentation of the answer in the language of instruction (oral or written), high-quality formatting of the work, and proficiency in using specialised tools, instruments, or application software. The student demonstrates confidence when answering reformulated questions, is capable of making detailed and summarised conclusions, and shows practical skills in solving professional tasks. The answer may contain two or three minor inaccuracies.
Good (Average)	The student has shown full understanding of the course content, possesses the conceptual framework, and navigates the material well; applies theoretical knowledge consciously to solve practical tasks. The answer is generally well-articulated, although some minor inaccuracies or vague formulations of rules or principles may occur. The student's answer is based on independent thinking. Two or three minor mistakes are acceptable.
Satisfactory (sufficient)	The student demonstrates knowledge of the basic course material sufficient for continued learning and practical activity in the profession; is able to complete the practical tasks foreseen by the programme. The answer is usually based on reproductive thinking. The student has limited knowledge of the structure of the discipline, makes inaccuracies and significant errors in the answer, and hesitates when answering reformulated questions. Nevertheless, they possess basic skills to complete simple practical tasks that meet the minimum assessment criteria and, under the lecturer's guidance, can correct their mistakes.
Unsatisfactory (insufficient)	The student demonstrates fragmented, unstructured knowledge, cannot distinguish between main and secondary ideas, makes conceptual errors, misinterprets definitions, presents material in a chaotic and unconfident manner, and cannot apply knowledge to solve practical problems. An unsatisfactory grade is typically given to a student who is unable to continue learning the subject without additional study.

Based on the results of the current control, the final semester grade is assigned.

Structuring of the Course by Types of Academic Work and Assessment of Student Learning Outcomes

In-Class Work								**Assessment Activities**		**Assessment Activities**	
Laboratory work No:								Test Control:		Exam	Total
1	2	3	4	5	6	7	8	T 1	T 2		
Number of points per type of academic work (min–max)											
3-5	3-5	3-5	3-5	3-5	3-5	3-5	3-5	6-10	6-10	24-40	**60-100***
24-40								**12-20**		**24-40**	

Notes: * For the number of points scored in any type of academic work in the discipline below the established minimum, the applicant receives an unsatisfactory grade and must retake it within the period set by the teacher (dean). The institutional assessment is established in accordance with the table " **Correspondence between the Institutional Grading Scale and the ECTS Grading Scale".**

Assessment of Laboratory Work Defence Results

Laboratory work performed and designed in accordance with the requirements established by the Methodological Recommendations is comprehensively evaluated by the teacher during its defense, taking into account the following criteria: independence and correctness of performance; completeness of the answer and knowledge of the work methodology; the presence of screenshots, diagrams and compliance with the requirements for the design of figures, etc.

The result of the performance and defense of each laboratory work by the applicant for higher education is evaluated in accordance with the table of Criteria for evaluating the educational achievements of the applicant for higher education.

If the applicant reveals a level of knowledge lower than 60 percent of the maximum score established by the Work Program for each structural unit, laboratory work ***is not credited to him,*** and in order to defend it, he must study in more detail the material on the topic of the work, the method of its implementation, correct gross mistakes and re-defend it at the time appointed by the teacher.

Assessment of Test-Based Control Results

Each of the tests provided for by the Work Program consists of 10 test tasks, each of which is equivalent.

According to the table of structuring the types of work for test control, the applicant, depending on the number of correct answers, can receive from 3 to 5 points.

Distribution of points depending on the number of correct answers to test items:

The test duration is 30 minutes. students complete the test online in the modular learning environment. if a failing grade is received, the test must be retaken before the next scheduled assessment.

Number of correct answers	0-5	6	7	8	9	10
Percentage of correct answers	**0-59**	**60**	**70**	**80**	**90**	**100**
Number of points received	0	3		4	5	

The final semester grade according to the institutional grading scale and the ECTS grading scale is determined automatically after the lecturer enters the assessment results in points for all types of academic work into the electronic gradebook. The correspondence between the institutional grading scale and the ECTS grading scale is provided in the table "Correspondence" below.

Assessment of the Final Semester Control (Exam)

The educational program provides for the final semester control in the discipline in the form of an exam, the task of which is a systematic and objective assessment of both theoretical and practical training of the applicant in the academic discipline. The exam is taken according to tickets previously developed and approved at the meeting of the department. In accordance with this, the exam ticket offers a combination of questions of both theoretical (including in test form) and practical.

Table – Assessment of Final Semester Examination Results *for full-time students (40 points allocated for final control)*

Types of tasks	**For each individual type of task**		
	Minimum (sufficient) score (satisfactory)	**Potential positive scores*** **(GPA) (good)**	**Maximum (high) score (excellent)**
Theoretical question No. 1	3	4	5
Theoretical question No. 2	3	4	5
Practical task (problem 18 points)	18	24	30
Total:	**24**		**40**

Note. A passing score for the exam, different from the minimum (24 points) and the maximum (40 points), falls within the range of 25–39 points and is calculated as the sum of points for all structural elements (tasks) of the exam.

For each individual type of task in the final semester assessment, the assessment criteria for student learning outcomes provided above (see **Table – Assessment Criteria for Student Learning Outcomes**) are applied.

The final semester grade according to the institutional grading scale and the ECTS grading scale is determined automatically after the lecturer enters the assessment results in points for all types of academic work into the electronic gradebook. The correspondence between the institutional grading scale and the ECTS grading scale is shown below in the **Correspondence Table**.

The final examination grade is recorded if the total number of points accumulated by the student in the course as a result of ongoing assessment falls within the range of 60 to 100 points. In this case, a grade of *Excellent/Good/Satisfactory* is assigned according to the institutional scale, and a letter grade is assigned according to the ECTS scale, corresponding to the total number of points earned by the student as specified in the **Correspondence Table**.

Table – Correspondence between the Institutional Grading Scale and the ECTS Grading Scale

<table>
<tr><th rowspan="2">ECTS Grade</th><th rowspan="2">Rating Scale of Points</th><th colspan="2">Institutional Grade(Level of Achievement of the Intended Learning Outcomes in the Course)</th></tr>
<tr><th>Pass/ Fail</th><th>Exam / Graded Credit</th></tr>
<tr><td>A</td><td>90-100</td><td rowspan="5">Pass</td><td>Excellent – a high level of achievement of the intended learning outcomes in the course, indicating the learner’s full readiness for further study and/or professional activity in the field.</td></tr>
<tr><td>B</td><td>83-89</td><td rowspan="4">Good – an average (maximally sufficient) level of achievement of the intended learning outcomes in the course and readiness for further study and/or professional activity in the field.

Satisfactory – the student has demonstrated a minimally sufficient level of achievement of the learning outcomes required for further study and/or professional activity in the field.</td></tr>
<tr><td>C</td><td>73-82</td></tr>
<tr><td>D</td><td>66-72</td></tr>
<tr><td>E</td><td>60-65</td></tr>
<tr><td>FX</td><td>40-59</td><td rowspan="2">Uncredited</td><td>Fail – several intended learning outcomes in the course have not been achieved. The level of acquired learning outcomes is insufficient for further study and/or professional activity in the field.</td></tr>
<tr><td>F</td><td>0-39</td><td>Fail – no learning outcomes have been achieved.</td></tr>
</table>

10. Self-assessment questions on learning outcomes

1. Basic principles of human-machine interaction
2. Modern approaches to human-machine interaction.
3. Examples of typical real-time systems.
4. Basic requirements for human-machine interaction systems.
5. Hard and soft real-time systems
6. Process as a unit of decomposition in systems of human-machine interaction.
7. Process states. Transition between states. Operations on processes.
8. Data structures and process priorities.
9. Fundamentals of real-time system architecture.
10. Queue.
11. Abend.
12. Memory management.
13. Process management.
14. Input and output blocks.
15. Process driver.
16. The general scheme of passing I/O requests.
17. Logical channels of the process.
18. Software architecture of human-machine interaction systems.
19. Features of software debugging of human-machine interaction systems
20. Methods of software development of modern systems of human-machine interaction.
21. Modeling.
22. Main characteristics of real-time systems
23. Sync.
24. Delay. Deadline.
25. Latency.
26. Jitter
27. Features of taking into account the time characteristics of human-machine interaction systems in software development.
28. Equation of balances.
29. Interface.
30. Human-machine interface.
31. Classification of human-machine interfaces.
32. Features of the human-machine interface of modern real-time systems.
33. Communication and support for real-time data.
34. Organization of access to data.
35. Fundamentals of development of modern software for human-machine interaction systems.

36. Programming languages.
37. Development environments.
38. Visual programming tools.
39. Methods of visual programming of human-machine interaction systems.
40. Interfaces and controls.
41. Properties of objects.
42. Algorithms and procedures.
43. Hardware and software implementation of human-machine interaction systems.
44. Graphic programming language.
45. Modeling
46. Specialized means of graphic language for software development of human-machine interaction systems.

11. Educational and methodological support

The educational process in the discipline is fully and in sufficient quantity provided with the necessary educational and methodological literature. . In particular, the teachers of the department prepared and published the following works:

Human-Machine Interaction: Methodical Instructions for Laboratory Work for Students under the Educational and Professional Program 121 Software Engineering / Yu.V. Forkun. – Khmelnytskyi: KhNU, 2023.

12. Material, technical and software of the discipline

Information and computer support: PC, tablet, smartphone or other mobile device, projector. Software: Microsoft Office programs or similar, Internet access, work with presentations, Visual Studio or analogues, tools for working with UML diagrams. Arduino device, plwts for circuit coding, electronic components. Software for virtual work with Arduino boards and electronic components (browser and local versions)

The study of the discipline does not require the use of special application software, except for commonly used programs and operating systems.

13. Recommended literature

Primary

1. Martynyuk V., Forkun Y., Forkun I., Novak T. Architecture of solar panel intelligent monitoring systemby means of industrial controller. «Measuring and computing devices in technological processes», 2020, issue 1. P. 46-50
2. Kuznetsova Y. A., Kirilenko O. G., Luchcheva O. V. Human-Machine Interaction: Teaching. Manual. From the execution of the lab. Works. Kharkiv: Nats. Aerospace. Univ. M. E. Zhukovsky "Khark. aviation. Inst-T", 2020. 90 p. (in Russian).
3. Harder D.W. A practical introduction to real-time systems for undergraduate engineering. University of Waterloo, 2023. 744p.
4. Paseka, M. S. Human-Machine Interface: Lecture Notes. Ivano-Frankivsk: IFNTUNG, 2021. 194 p. (in Russian).
5. Pampenko I.G. Lecture Notes on the Discipline "Human-Machine Interface". Odesa, 2021. 38 p. (in Russian).
6. Kartashov V.V. Manual of lectures on the discipline "Automated control systems of technological processes". Ternopil: Ivan Pulyuy TNTU Publ., 2021, 49 p.
7. Pankiv, Y. V. Software and technical complexes of automation: laboratory workshop Ivano-Frankivsk: IFNTUNG, 2022. 103 p. (in Russian).

1. **Supplementary**Stepanets O.V. Programming in Automated Process Control Systems: Methodological Guidelines for Laboratory Work "Simulation Modeling of the Control System" of NTUU "KPI" students of the direction of training "Automation and Computer-Integrated Technologies" K. KPI, 2021. 28 p. (in Russian).
2. Pampenko I.G. Methodical Instructions for Practical Work in the Discipline "Human-Machine Interface" for the Training of Junior Specialists in the Specialty 121 "Software Engineering". Odesa, 2021. 88 p. (in Russian).

11. Information resources:

1. Modular learning environment. URL: https://msn.khmnu.edu.ua/course/view.php?id=8641
2. Electronic library of the university. URL: http://lib.khmnu.edu.ua/asp/php_f/p1age_lib.php
3. Repository of KhNU. URL: http://elar.khmnu.edu.ua/home/

Human-machine interaction

Type of Educational Component	Compulsory
Level of Higher Education	First (*bachelor's*) level
Language of instruction	Ukrainian
Semester	Fifth
Number of ECTS credits assigned	5,0
Forms of Study the Course is Designed For	Full-time (daytime)

Learning outcomes. A student who has successfully completed the study of the discipline must: skillfully use the conceptual apparatus of human-machine interaction to develop systems of human-machine interaction; determine what properties certain objects have along with the functions and operations specified for them; characterize and classify discrete objects; build discrete objects of human-machine interaction that satisfy predetermined properties; be able to use the apparatus of human-machine interaction for modeling subject area of machine systems; software and hardware for building systems of human-machine interaction.

Course Content. Fundamentals of human-machine systems and their interaction. History of human-machine interaction. Architecture of human-machine interaction systems Interaction models: from mechanical to electronic. Human-machine interface and its components. Ergonomics in human-machine interaction. Interface design principles.Basic software of human-machine systems. Characteristics of human-machine systems and systems. Basics of working with sound and graphics in interfaces. Features of signal processing in human-machine systems. I/O technologies in interaction systems. The use of machine learning in interaction systems. Methods for recognizing and interpreting human behavior. Human-machine interfaces. Console programming of systems of human-machine systems. Visual programming of human-machine interfaces and human-machine systems. Programming of human-machine and human-machine interfaces using graphical language. Development of adaptive interfaces. The use of machine learning in interaction systems. The use of artificial intelligence to support human-machine interaction. Security and privacy in human-machine interaction systems. Evaluation and testing of interaction systems. Ethical issues in human-machine interaction. Innovations and trends in human-machine interaction. The future of human-machine interaction.

Prerequisites: English, Ukrainian language, foreign language.

Correquisites: architecture and design of software, design and technological practice; Qualification work.

Planned Learning Activities.: The minimum volume of classes in one ECTS credit of the academic discipline for the first (bachelor's) level of higher education in full-time education is 10 hours per 1 ECTS credit.

Forms (Methods) of Instruction: lectures (using visualization methods, problem-based and interactive learning, motivational techniques**,** information and communication technologies**);** laboratory classes (using information technology methods and modern integrated programming environments, master classes); independent work (processing of theoretical material, preparation for the implementation and defense of laboratory work, current and final control) using information and computer technologies and distance learning technologies.

Forms of assessment of learning outcomes: oral survey before admission to the laboratory lesson; evaluation of the results of laboratory work defense; test control of the assimilation of theoretical and practical material.

Type of semester control: exam – 5th semester.

Learning Resources:

1. Martynyuk V., Forkun Y., Forkun I., Novak T. Architecture of solar panel intelligent monitoring systemby means of industrial controller. «Measuring and computing devices in technological processes», 2020, issue 1. P. 46-50
2. Kuznetsova Y. A., Kirilenko O. G., Luchcheva O. V. Human-Machine Interaction: Teaching. Manual. From the execution of the lab. Works. Kharkiv: Nats. Aerospace. Univ. M. E. Zhukovsky "Khark. aviation. Inst-T", 2020. 90 p. (in Russian).
3. Harder D.W. A practical introduction to real-time systems for undergraduate engineering. University of Waterloo, 2023. 744p.
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