Syllabus
educational component of VC

Technical means of automation

Subject:	**Technical means of automation**
Level of higher education:	**first (undergraduate)**
Course page in Moodle:	*https://dl2022.khadi-kh.com/course/view.php?id=1624*
The scope of the educational component	**3 credits (90 hours)**
Final control form	**test**
Consultations:	**on schedule**
Name of the department:	**Department of Automation and Computer-Integrated Technologies**
Language of teaching:	**Ukrainian, English**
Head of the course:	**Pluhina Tetyana, Ph.D., associate professor**
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Brief content of the educational component:

The goal is to develop research skills in the field of technical means and automation systems, design of new automation systems, practical skills and the ability to apply basic methods and approaches for the development of automated systems.

Subject: a pedagogically adapted system of concepts about technical means of automation and methods of designing automated systems based on them.

The main tasks of studying an academic discipline are:

- substantiation of the development and foundations of the construction of automated systems;
- analysis and synthesis of automatic control systems of technical objects;
- formation of directions for improvement and development of technical means of automation;
- formation of design and development skills of automated systems.

Prerequisites for studying the educational component: mathematics, physics, electrical engineering and electromechanics, algorithmization and programming

Competencies acquired by the acquirer:
General competences:
✓ Ability to apply knowledge in practical situations.
✓ Ability to communicate in the state language both orally and in writing.
✓ Skills in using information and communication technologies.

Special (professional) competences:
✓ 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;
✓ The ability to justify the choice of technical means of automation based on an understanding of the principles of their operation, analysis of their properties, purpose and

technical characteristics, taking into account the requirements for the automation system and operating conditions; adjust technical means of automation and control systems;
✓ The ability to justify the choice of a technical structure and to be able to develop application software for microprocessor control systems based on local automation tools, industrial logic controllers and programmable logic matrices and signal processors;
✓ The ability to design automation systems taking into account the requirements of relevant regulatory documents and international standards.

Learning outcomes according to the educational program:

✓ Know physics, electrical engineering, electronics and circuit engineering, microprocessor technology at the level necessary for solving typical tasks and automation problems;
✓ To understand the essence of the processes that take place in the objects of automation of technological processes and to be able to analyze the objects of automation and justify the choice of their structure, algorithms and control schemes based on the results of studies of their properties;
✓ Be able to apply knowledge about the basic principles and methods of measuring physical quantities and basic technological parameters to justify the choice of measuring instruments and evaluate their metrological characteristics;
✓ Know the principles of operation of automation technical means and be able to justify their choice based on the analysis of their properties, purpose and technical characteristics, taking into account the requirements for automation systems and operating conditions; have skills in setting up technical means of automation and control systems;
✓ To be able to increase the degree of automation and robotization of construction, road machines and equipment, taking into account the world-level scientific and engineering achievements in the field of development and operation of automated machine-building systems, including the Internet of Things technologies, and Industry 4.0.

Table 1 - Thematic plan

Topic No	Name of topics (lecture (Lec), practical work (PW), homework (HW))	Number of hours
1	2	3
1	Lec. Classification of elements of automation systems	2
	PW. Study of the main characteristics of automation elements	2
	HW. Characteristics of elements	8
2	Lec Classification and purpose of sensors	4
	PW. Sensor research	4
	HW. Methods of calculating parameters of the temperature control system	10
3	Lec Amplifiers	2
	PW. Study of amplifiers	2
	HW. Methods of calculating the converting elements of the ACS	8
4	Lec. Purpose and classification of switching elements	2
	PW. Design of the control system of the flow-transport line on the contact elements of automation	2
	HW. Distributed control systems	8
5	Lec. Contactless switching elements. Advantages and disadvantages.	2

	PW. Design of the control system of the flow-transport line on non-contact automation elements.	2
	HW. Programmable logic controllers	8
6	Lec. Classification and purpose of executive devices	2
	PW. Research of control systems with a combined drive.	2
	HW. Complex systems, management hierarchy	8
7	Lec. Objects of automation. Stepper motor.	2
	PW. Design of modern automation objects.	2
	HW. Modern means of automation	8
Together	Lec.	16
	PW.	16
	HW.	58
		90

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
3) practical: 3.1 traditional: practical classes, seminars;
3.2 interactive (non-traditional): business and role-playing games, trainings, seminars-discussions, "round table", brainstorming 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", "Z", "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 way; 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**:**

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

$K^{поточ}$ – final assessment of success based on the results of current control;

$K1, K2, ..., Kn$ – assessment of the success of the current control measure;

n – number of ongoing control measures.

Assessments are converted into points according to the calculation scale (table 2).

Таблиця 2 – Recalculation of the average grade 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	repeated study	

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 1).

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 a 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 the Olympiads and scientific conferences of the National Academy of Sciences 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

On a 100-point scale	On a national scale
from 60 to 100 points	counted
less than 60 points	not counted

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

Score in points	Evaluation on a national scale		Evaluation according to the ECTS scale	
	examination	test	Rating	Criteria
90-100	**Perfectly**	**Enrolled**	**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	**Fine**	**Enrolled**	**B**	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
75-79			**C**	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	**Satisfactorily**		**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

Score in points	Evaluation on a national scale		Evaluation according to the ECTS scale	
	examination	test	Rating	Criteria
60–66			**E**	The theoretical content of the course has 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.
35–59	**Unsatisfactorily**	**Not 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**	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, 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 (indicated if available);
- 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 in the educational process of the Khnadu" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_dobroch_1.p

df), "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 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.

Recommended literature:

1. Methods of modern management theory: a textbook / A.P. Ladanyuk, N.M. Lutsa, V.D. Kishenko and others. - Kyiv: Lira publishing house - K, 2018. - 368 p.
2. Vorobyova O.M. Technical means of automation: education. manual / Vorobyova O.M., Fleita Yu.V. – Odesa: ONAZ named after O.S. Popova, 2018. – 208 p.
3. Milykh V.I. Electrical engineering, electronics and microprocessor technology. Publisher: Karavela, 2018. - 688 p. ISBN: 978-966-8019-85-7.
4. Microprocessor and microcontroller systems: textbook. Part 1. Microprocessor systems [Electronic resource] / A. O. Novatskyi. – Electronic text data. – Kyiv: KPI named after Igor Sikorskyi, Polytechnic Publishing House, 2020. - 361 p.
5. Bondarenko I.M., Borodin O.V., Karnaushenko V.P. Microprocessor control and management systems: Education. a guide for students of higher education institutions. - Kharkiv: Khnure. - 2020. - 244 p.
6. Dudyuk D.L., Mazepa S.S. Flexible automated production and robotic complexes. Education village Rec. MES - K: Lira-K, 2019. - 278 p.
7. Savytsky V. K., Fedoryshyn R. M. Technical means of automation: Training manual. Lviv: Publishing House of Lviv Polytechnic, 2018. 292 p.
8. Lyashenko O. Modeling and research of electronic devices: Education. manual. / O. Lyashenko, O. Martyniuk. – Lutsk: Eastern Europe. national University named after Lesi Ukrainka, 2013. – 217 p.

Additional sources:

1. distance course: *https://dl2022.khadi-kh.com/course/view.php?id=1624*
2. Machines as objects of automation [Electronic resource]. Access mode: https://www.youtube.com/watch?v=Ev1wa0wRpqk&t=43s.
3. An example of executive mechanisms [Electronic resource]. Access mode: https://www.youtube.com/watch?v=ZjCXuA3t8kI
4. Human-machine interfaces [Electronic resource]: synopsis of lectures for students. direction 050202 "Automation and computer-integrated technologies" den. and extracurricular forms of education / comp. V. M. Kushkov. - K.: NUKHT. 2018. - 100 p. – Access mode: http://library.nuft.edu.ua/ebook/file/100.08.pdf

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