Syllabus
selective component of VC
(notation EC in the educational program (EP))
Information technologies in vehicle control

Discipline name:	**Information technologies in vehicle control**
Level of higher education:	**second (master's degree)**
Course page in Moodle:	**https://dl2022.khadi-kh.com/course/view.php?id=1476**
The scope of the educational component	**4 credits (120 hours)**
Final control form	**Test**
Consultations:	**on schedule**
Name of the department:	**department of computer technologies and mechatronics**
Language of teaching:	**English**
Head of the course:	**Nikonov Oleg, Doctor of Technical Sciences, professor**
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Brief content of the educational component:
The goal is the formation of competencies necessary for the analysis, selection and application of information technologies in the management of motor vehicles.

Subject: a pedagogically adapted system of concepts about the principles of construction and the structure of information technologies in the management of motor vehicles and the peculiarities of their application.

The main tasks of studying the academic discipline are:
- formation of knowledge regarding the theoretical and methodological foundations of information technologies in driving motor vehicles;
- formation of knowledge about the principles, laws and technology of building the structure of information technologies in the management of motor vehicles;
- formation of skills in the creation and use of information technologies in driving motor vehicles;
- formation of skills in the analysis of information technologies in the management of motor vehicles, their optimization and computer modeling.

Competencies acquired by the acquirer:

*General competences***:**

Ability to conduct research at an appropriate level.
Ability to abstract thinking, analysis and synthesis.
Ability to write and speak in Ukrainian and foreign languages.

Special (professional) competences:

The ability to apply modeling and optimization methods to research and increase the efficiency of information technologies in the management of motor vehicles;

Ability to apply specialized software and digital technologies to solve complex tasks and problems of automation and computer-integrated technologies.

The ability to develop the functional, technical and information structure of computer-integrated management systems of organizational and technological complexes with the use of network and information technologies, software and technical control complexes.

Learning outcomes:

Apply modern approaches and methods of modeling and optimization for research and creation of effective information technologies in the management of motor vehicles.

To develop the functional, organizational, technical and information structure of automation systems with complex technological and organizational and technical objects, to develop software and technical control complexes using network and information technologies.

Develop and use specialized software and digital technologies to create automation systems for complex organizational and technical objects, professionally own special software tools.

Thematic plan

№ topics	Name of topics (Lc, Pw, Ss)	Number of hours	
		ocular	extramural
1	Lc 1 Interactive visualization of systems and components of motor vehicles using augmented reality technology	2	
	Pw 1 Study of systems and nodes of motor vehicles using augmented reality technology	2	
	Ss Technology of augmented reality. Interactive visualization	11	
2	Lc 2 The concept of convergence of technologies of augmented reality and artificial intelligence for vehicles	2	
	Pw Research on the convergence of technologies of augmented reality and artificial intelligence for vehicles	2	
	Ss Convergence of augmented reality and artificial intelligence technologies	11	
3	Lc 3 Operating systems of car on-board computers	2	
	Pw Study of operating systems of car on-board computers	2	
	Ss Built-in operating systems of car on-board computers	11	
4	Lc 4 Adaptive lighting systems. Matrix and laser headlights	2	
	Pw Research of adaptive lighting systems	2	
	Ss Matrix and laser headlights	11	
5	Lc 5 Information and communication technology for intelligent control of ground unmanned multi-purpose vehicles	2	
	Pw Research of information and communication technologies of intelligent control of ground unmanned multi-purpose vehicles	2	
	Ss Ground unmanned multi-purpose vehicles	11	
6	Lc 6 Self-driving cars: levels of driving automation	2	
	Pw Study of driving automation levels	2	
	Ss Unmanned cars: automation of control processes	11	
7	Lc 7 Unmanned vehicles: technical vision	2	
	Pw Research of technical vision systems	2	

	Ss Unmanned cars: technical vision, algorithms, models	11	
8	Lc 8 Unmanned vehicles: cyber security	2	
	Pw Car cyber security research	2	
	Ss Unmanned cars: cyber security, structure, models	11	
Total	Lections	16	
	Practical works	16	
	Self-study	88	

Individual educational and research task (if available): not provided.

Teaching methods:

1) verbal: 1.1 traditional: explanation, story, conversation, etc;

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

2) visual: the method of illustrations, the method of demonstrations;

3) practical: 3.1 traditional: practical classes;

      3.2 interactive (non-traditional): business and role-playing games, trainings, 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", "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:

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

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

$K1, K2, ..., Kn$ – evaluation of success n measure of current control;

n – number of ongoing control measures.

Grades are converted into points according to the calculation scale (table 1).

Table 1 – 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 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 2 – The scale for transferring points to the national evaluation system

On a 100-point scale	On a national scale
from 60 points to 100 points	passed
less than 60 points	fail

Table 3 – 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	
	exam	test	Estimation	Criteria
90-100	Excellent	Passed	**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

Score in points	Evaluation on a national scale		Evaluation according to the ECTS scale	
	exam	test	Estimation	Criteria
80–89	Good	Passed	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	Good	Passed	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	Passed	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
60–66	Satisfactorily	Passed	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 evaluated with a number of points close to the minimum.
35–59	Unsatisfactorily	Not passed	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)

Score in points	Evaluation on a national scale		Evaluation according to the ECTS scale	
	exam	test	Estimation	Criteria
0–34	Fail		**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.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 the Khnadu (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_MEK_1.pdf).
– in case of detection of plagiarism, the winner receives 0 points for the task and must re-perform 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. Greengard S. Virtual Reality. Cambridge: MIT Press Essential, 2019. – 240 p.
2. Burns L.D., Shulgan C. Autonomy: The Quest to Build the Driverless Car − And How It Will Reshape Our World, Ecco Press, 2019. – 368 p.
3. Nagrath I.J., Gopal M. Control Systems Engineering. 6th edition. New age international publishers, 2017. – 912 p.
4. Nikonov O., Kyrychenko I., Shuliakov V., Fastovec V. Parametric synthesis of a

dynamic object control system with nonlinear characteristics // The Third International Workshop on Computer Modeling and Intelligent Systems (CMIS-2020). Zaporizhzhia, Ukraine, April 27 - May 1, 2020, CEUR-WS.org, online. P. 91-101.

5. Uspensky B., Avramov K., Liubarskyi B., Andrieiev Yu., Nikonov O. Nonlinear torsional vibrations of electromechanical coupling of diesel engine gear system and electric generator // Journal of Sound and Vibration. – 2019. – Vol.460. – 114877.

6. Uspensky B., Avramov K., Nikonov O. Nonlinear modes of piecewise linear systems forced vibrations close to superharmonic resonances // Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science. – 2019. – Vol.233. – Issue 23-24. – P. 7489-7497.

Additional sources:
1. Distance course:
https://dl2022.khadi-kh.com/course/view.php?id=1476

Developer (developers)
the syllabus of the academic discipline _____   _____Nikonov Oleg_____
                                          signature   Full name

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