**Syllabus**
**selective component of VC**
**Synergetics in road transport**

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| **Subjects:** | **Synergetics in road transport** |
| **Level of higher education:** | **second (master's)** |
| **Course page in Moodle:** | **https://dl2022.khadi.kharkov.ua/course/view.php?id=3009** |
| **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 of the National Academy of Sciences** |
| **Teaching language:** | **English** |
| **Course leader:** | **Oleh Pavlovich Aleksiev, doctor of technical sciences, professor** |
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**Brief content of the educational component:**

**The purpose of studying an academic discipline**is to provide students with knowledge and skillsconsists in obtaining knowledge, ideas and competences fromSynergetics of road transport (SAT) in the future activity of a business analyst in the motor vehicle and road industry (qualification 3131.3. Analyst of computer systems according to the ST_KHNADU code).

**Subject:** a system of concepts about laws on the problems of intellectualization of car electronic systems and monitoring of the state and conditions of movement of transport vehicles in order to provide domestic land transport systems with a new qualitative level and significantly increase their technical characteristics, improve the conditions for providing transport services to the population of cities and regions of Ukraine.

**The main tasks of studying the educational discipline of SAT are:**

the ability to generalize, analyze, perceive information, set a goal and choose ways to achieve it;

the ability to conduct research, a flexible way of thinking, understanding and solving problems, a critical attitude to established scientific concepts;

the ability to apply analytical methods of analysis, mathematical modeling and perform physical and mathematical experiments to solve engineering problems;

the ability to formulate technical tasks, develop and use automation tools in the design and technological preparation of production;

readiness to use appropriate software for conducting research, to visualize the results of calculations and experiments, to determine the methodology of finding a technical solution using optimization methods, to understand and skillfully use mathematical and numerical methods.

**Competencies acquired by the acquirer:**

***General competences*:**

Ability to conduct research at an appropriate level.

Ability to generate new ideas (creativity).

Ability to abstract thinking, analysis and synthesis.

***Special (professional) competences:***

The ability to integrate knowledge from other fields, apply a systematic approach and take into account non-technical aspects when solving engineering problems and conducting scientific research.

The ability to apply modern technologies of scientific research of processes, equipment, means and systems of automation, control, diagnostics, testing and management of complex organizational and technical objects and systems.

The ability to present the results of research activities, prepare scientific publications, participate in scientific discussions at scientific conferences, symposia, and carry out pedagogical activities in educational institutions.

The ability to create, improve and apply quantitative mathematical, scientific and technical methods and computer software tools, to apply a systematic approach to solving engineering problems of industrial engineering, in particular, in conditions of technical uncertainty

**Learning outcomes:**

Apply modern approaches and methods of modeling and optimization to research and create effective systems based on a systemic approach, taking into account the non-technical components of the evaluation of automation objects.

Achieving skills and knowledge to prove the need to implement a cognitive approach to the creation of new special automotive computer systems (ACS) at the WEB 1, 2, 3, 4 level from ordinary information sites to Industry 4 level industrial portals in the motor vehicle and road industry.

**Thematic plan**

| Topic No | Name of topics (LK, LR, PR, SZ, SR) | Number of hours | |
|---|---|---|---|
| | | ocular | extramural |
| **1** | **Lecture #1:**Fundamentals of ATS in transport applications | **4** | |
| | **Practical lesson 1:**Definition of sections of NMB SAT. NMB SAT software platform. | **4** | |
| | **Tasks for independent work 1** | **22** | |
| **2** | **Lecture #2:**Mechatronics of transport systems and machines | **4** | |
| | **Practical lesson 2:**SAT and ZHC AKS. Instrumental means of computerization of road machines | **4** | |
| | **Assignment for independent work 2** | **22** | |
| **3** | **Lecture #3:**Telematics of transport systems and machines | **4** | |
| | **Practical lesson 3:**Network technologies. Clouds and GRID | **4** | |
| | **Assignment for independent work 3.** | **22** | |
| **4** | **Lecture #4:**Cloud Computing in transport | **4** | |

| | | | |
|---|---|---|---|
| | **Practical lesson 4:**JSC's competitive ability. Evaluation of the effectiveness of Cloud Computing at JSC | **4** | |
| | **Assignment for independent work 4** | **22** | |
| **Together** | **Lectures** | **16** | |
| | **Practices** | **16** | |
| | **Independent work** | **88** | |

**Teaching methods:**
verbal method (lecture, educational discussion, explanation, story);
practical method (practical classes, business and role-playing games, brainstorming method);
visual method (illustration method, demonstration method);
work with literature (scientific literature; regulatory literature; information search by task);
video method in combination with the latest information technologies and computer training tools (experimental training based on computer experiments)
independent work;
**Assessment forms and methods**
final control (credit)
oral control (conversation)
test control
practical examination (protection of practical works,)
methods of self-control and self-assessment

**Evaluation system and requirements:**
**Current performance**
**1**The current success rate of applicants for the performance of educational types of work in training sessions and for the performance of independent work tasks is evaluated usingfour-pointrating scale with subsequent transfer to a 100-point scale. Current performance is taken into account during evaluationall types of work provided by the curriculumprogram
**1.1**Lecture classes are evaluated by determining the quality of performance of the specified onestasks
**1.2**Practical classes are evaluated by the quality of performance of a control or individual task, performance and design of practical work.
**2**Evaluation of the current performance of higher education applicants is carried out at each practical session on a four-point scale("5", "4", "Z", "2")and are enteredinaccounting journalacademicsuccess

–"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, possesses 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** Final scorebycurrent activity is recognized as an arithmetic averagesumpoints for each lesson, for individual work, current control worksby the formula:

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

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

Assessments 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 points scale | 4-ball scale | 100 points scale | 4-ball scale | 100 points scale | 4-ball scale | 100 points 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": 82% to 89% correct answers;
–"Good": from 74% to 81% of correct answers;
–"Satisfactory": from 67% to 73% of correct answers;
–"Fair enough": 60% to 66% 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 participating in scientific events, winners are

awarded additional points.

**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 test), 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 research (educational research) tasks of increased complexity- 5 points**.**

**3.3**The number of additional points cannot exceed 20 points.

**4**The learning result is evaluated on a two-point scale (passed/failed) according to table 2; 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 | counted |
| less than 60 points | not counted |

**Table 3**– The scale for evaluating the knowledge of the 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 | |
|---|---|---|---|---|
| | | | Rating | Criteria |
| | examination | test | | |
| **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** | **Okay** | **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 |

| Score in points | Evaluation on a national scale | | Evaluation according to the ECTS scale | |
|---|---|---|---|---|
| | | | Rating | Criteria |
| | examination | test | | |
| **75-79** | | | **WITH** | 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 |
| **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) |

| Score in points | Evaluation on a national scale | | Evaluation according to the ECTS scale | |
|---|---|---|---|---|
| | | | Rating | Criteria |
| | examination | test | | |
| **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;

- 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 National Academy of Sciences (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. Alexiev V.O. Mechatronics, telematics, synergetics in transport applications / V.O. Alexiev, O.P. Alexiev, O.Ya. Nikonov. - Kharkiv: Khnadu, 2012. 212 p.

1.2. Alexiev V.O. Application of GRID technology in the transport university. - Kharkiv: Khnadu, 2009. - 208 p.

1.3.Alexiev V. O. V. O., Volkov V. P., Kalmykov V. I. Mechatronics of vehicles and systems. - Kharkiv: Khnadu, 2004. - 159 p.

**2. Supporting literature**

2.1. Asherov A.T. Preparation, examination and defense of theses. - Kharkiv: UIPA, 2002. - 135 p.

2.2. ISO/IEC 12207:2008 Information technology. System and software engineering. Software life cycle processes.

2.3. Aleksiev O.P., Alexiev V.O. Introduction to system engineering of flexible computerized systems in transport - Kharkiv: RVV Khnadu, 2010. - 84 p.

2.4 Alexiev V.O.Automotive synergy of transport machines and systems Alexiev, V.O.. Alexiev, O.P. Neronov S.M., . – Kharkiv: KHNADU, 2022. p. (other printed materials - electronic version of the terminological dictionary - the working version of 2022 at the stage of the author's addition and clarification of some definitions according to the specialty 122 KN-computer sciences).

**3. Information resources**

3.1. https://www.cio.com/article/2439504/business-intelligence/business-intelligence-definition-and-solutions.html (Business intelligence (BI) leverages software and services to transform data into actionable intelligence that informs an organization's strategic and tactical business decisions).

3.2. https://ikt.khadi.kharkov.ua/ (transfer road portal).

**Syllabus developer**:
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