UKRAINIAN STATE UNIVERSITY

RAILWAY TRANSPORT

SYLLABUS

DESIGN OF AUTOMATED SYSTEM

Level of higher education – **first (bachelor's)**
Field of knowledge – **15 "Automation and instrumentation"**
Specialty – **151 "Automation and computer-integrated technologies"**
Educational program – **"Automation and computer-integrated technologies"**
Time and audience of classes – according to the class schedule
http://rasp.kart.edu.ua

TEAM OF TEACHERS

Lecturer, head of practical classes:
Ananieva Olga (Doctor of Technical Sciences, Professor)
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Consultations: 14.00-15.00 Tuesday-Thursday
Location of the department: Kharkiv, Maidan Feyerbacha, 7, building 1, auditorium 1.222.

Information resources:

1. http://metod.kart.edu.ua/
2. http://194.44.152.155/elib/local/1962.pdf
3. http://pm.fmi.org.ua/files/5b052bb2e603c2.62262691.pdf
4. http://er.nau.edu.ua/bitstream/NAU/24750/
   https://science.kpi.ua/uk/node/19

COURSE COMPETENCES

The course aims to form and develop such competencies of students.

Standard

GC3 Skills of using information and communication technologies GK4 Ability to conduct research at the appropriate level;

GC5 Ability to develop and manage projects;

GC7 Ability to work autonomously and in a team GK8 Ability to abstract thinking, analysis and synthesis of OPP;

GC11 Knowledge and understanding of the subject area and understanding of professional activity, ability to apply knowledge in practical actions;

GC12 Ability to learn and master modern knowledge;

GC13 The ability to identify, pose and solve problems GK14 Skills in using automation technologies;

FC1 Compliance in professional activity with the requirements of regulatory and legislative acts of Ukraine, the Rules for the technical operation of railways of Ukraine, instructions and recommendations for the operation, repair and maintenance of railway transport facilities, which is the subject of the educational program "Organization of control of train traffic control systems" (OP OK SKRP);

FC2 The ability to distinguish objects of railway transport and their components, in particular train traffic control systems, to determine requirements for their design, parameters and characteristics;

FC4 The ability to develop and implement technological processes, technological equipment and technological equipment, means of automation and mechanization in the production, operation, repair and maintenance of railway transport facilities, their systems and elements, which are the subject of study of OP OK SKRP;

FC5 The ability to develop, draw up and introduce into production documentation on the technological processes of construction, operation, repair and maintenance of railway transport facilities, in particular train traffic control systems, their systems and other instructions, rules and methods;

FC6 The ability to develop, taking into account safe conditions of use, strength, aesthetic and economic parameters, technical tasks and technical conditions for the

design of railway transport objects, its systems and individual elements, which are the subject of study of OP OK SKRP; draw up plans for the placement of equipment, technical equipment and organization of workplaces; calculate equipment loading and product quality indicators;

FC11 The ability to use modern software tools for the development of design and construction and technological documentation for the creation, operation, repair and maintenance of railway transport facilities, their systems and elements;

RN 1 To carry out professional activities in social interaction based on humanistic and ethical principles;

RN 4 To carry out professional activities using information technologies, "Information databases", navigation systems, Internet resources and modern software tools;

RN 5 Use the principles of formation of labor resources; identify reserves for improving the work efficiency of railway transport employees, in particular for train traffic control systems;

RN 9 To be able to apply international and national standards and practices in professional activities;

RN 12 Know the main provisions of regulatory and legislative acts of Ukraine in the field of railway transport, the Rules for the technical operation of railways of Ukraine, instructions and recommendations for the operation, repair and maintenance of train traffic control systems as objects of railway transport;

RN 13 To identify objects of railway transport, their systems, elements, characteristics and parameters, which are the subject of study of OP OK SKRP;

RN 14 To determine the parameters of railway transport objects, which are the subject of study of OP OK SKRP, by conducting a measurement experiment with an evaluation of its results;

RN 15 Know the main technological operations, technological equipment, technological equipment, means of automation and mechanization used in the operation, repair and maintenance of railway transport facilities, which is the subject of study of OP OK SKRP;

RN 16 To have the basics of developing and implementing into production documentation regarding the certainty of technological processes of construction,

operation, repair and maintenance of railway transport facilities, in particular train traffic control systems, and other instructions, rules and methods;

RN 17 Know the peculiarities and be able to develop technical tasks and technical conditions for the design of railway transport objects, its systems and individual elements, which is the subject of study of the educational OP OK SKRP; draw up plans for placing equipment, technical equipment and workplace organization, calculate equipment loading and product quality indicators;

RN 22 To develop design and construction and technological documentation for the creation, operation, repair and maintenance of railway transport facilities, in particular train traffic control systems, using specialized modern software tools;

RN 24 Be able to calculate the technical, economic and operational indicators of railway transport facilities, their systems and elements, in particular, train control systems;

RN 27 To be able to develop technical tasks according to the customer's requirements while providing consulting services and implement technical solutions for the development, design and implementation of train traffic control systems of various purposes, implemented on an arbitrary element base (microprocessor, relay-microprocessor, relay, etc.);

RN 28 Be able to work with the main systems of automated design (CAD, CAE) with their application in the preparation of design and technical and/or operational documentation for means of train traffic control systems in the provision of service and consulting services (EPlan, AutoCAD, etc.);

RN 29 Be able to configure and support the application software of computer-integrated train traffic control systems of various purposes;

WHY SHOULD YOU CHOOSE THIS COURSE?

If you are interested in issues of design and management, where the processes of making effective decisions based on the received information are special - this is exactly what you need! Only one thing is expected from the applicants of higher education - the desire to study! By conscientiously studying this course, you will become an expert in modern computer design methods, and the team of teachers during your studies will be able to provide you with any kind of advisory help from the course of the academic discipline in person or by e-mail at the specified consultation time. The program of the academic discipline consists of the following content modules:

1. Basic concepts and design stages.
2. Life cycle of automation systems.
3. Design sequence of automation systems, composition and content of project documentation.
4. Basic principles of building automation systems.
5. Selection of technical means when designing an automation scheme.
6. Design of local automation tools.
7. Design of automation and automation systems.
8. Design of power supply systems.
9. Designing an automation system using software logic controllers.

180 hours / 6 ECTS credits are allocated to the study of the academic discipline.

COURSE OVERVIEW AND OUTLINE

In today's world, project work takes place every day – new automation systems are created and existing automation systems are modernized. This type of activity requires a wide range of skills from a specialist. An engineer must not only know the principles of construction of railway automation systems, but also be able to work with regulatory documentation, orient himself in industry instructions.

The educational course of the discipline "Design of automated systems" (PSS) will prepare students for independent design work and will help to bring knowledge in the field of design to a new level.

Planned learning outcomes

A student who has successfully completed the "PAS" course will master the following skills:

- Development of technical requirements and tasks;

- Development of design and technical documentation;

- Development of structural and functional schemes of railway automation systems depending on the requirements for reliability and functional safety;

- Design of power supply systems for automation and telemechanics devices;

- Determination of parameters of executive devices and sensors of automation and automation systems;

The purpose of teaching the educational discipline "Design of automated systems" is to prepare students for independent engineering activities in the field of designing railway automation and telemechanics systems and to study the basic design principles and norms and standards of technical documentation.

The task of studying the discipline "Design of automated systems" is to provide special skills and knowledge sufficient to perform tasks and duties (works) of a certain level of professional activity, which are related to the design of automation devices and means.

Information for independent study

№	Topic name
1	Functions of automatic control systems of ASUZHT
2	Informational functions of ASUZHT
3	Technical support of ASUZHT
4	ASUZHT software
5	Information provision of ASUZHT
6	General technical requirements for ASAZHT
7	Characteristics of sections of the technical task
8	Description of schemes used in the design of automation systems
9	Principles of building sensors of railway automation devices

PLAN OF LECTURES AND PRACTICAL LESSONS

Week	Number of hours	The topic of the lecture	Number of hours	Topic of practical, seminar and laboratory classes
1	2	Lecture No. 1. Basic concepts and stages of designing railway automation and automation systems. Basic concepts of life cycles of automation systems and automation.		
2	2	Lecture No. 2. The main requirements for the processes of design, testing, trial operation and introduction into permanent operation.	2	PR-1 Life cycle of automation systems.
3	2	Lecture No. 3. The composition of technical documentation and the sequence of their preparation.		
4	2	Lecture No. 4. Basic requirements for the content of technical documentation.	2	PR-2 Power supply systems of self-locking devices and EC, features of their design. Calculation of the power transmission line.
5	2	Lecture No. 5. Procedure for checking technical documentation		
6	2	Lecture No. 6. Determination of technical requirements for the system	2	PR-3 Composition and content of project documentation.
7	2	Lecture No. 7. Development of the general system structure and functional scheme. Development of structural diagrams of system nodes.		
8	2	Lecture No. 8. The main technical means used in railway automation and automation systems.	2	PR-4. Development and implementation of the automation scheme. Determination of the number and parameters of input and output signals depending on the selected executive devices and sensors of the floor equipment.
Modular control of knowledge				

9	2	Lecture No. 9. Determination of requirements for technical means. The choice of technical means depending on the requirements for technical means.		
10	2	Lecture No. 10. Basic principles of building microprocessor systems of railway automation.	2	PR-5 Selection of technical means when designing an automation scheme.
11	2	Lecture No. 11. Defining the structure and order of data exchange in the system.		
12	2	Lecture No. 12 Calculation of system input and output signal parameters and selection of information input/output modules.	2	PR-6 Design sequence of basic relay systems of railway automation and automation.
13	2	Lecture No. 13. Development of the configuration of the microprocessor system.		
14	2	Lecture No. 14. Requirements and standards for software. Stages of software design.	2	PR-7 Design sequence of basic microprocessor systems of railway automation and automation.
15	2	Lecture No. 15. Development of the structural diagram of the power supply system and definition of technical means power supply devices according to their technical indicators.	2	
Modular control of knowledge				

INFORMATION SUPPORT FOR THE INDEPENDENT WORK OF HIGHER EDUCATION ACQUIRES

Recommended reading Basic

1. Rules of technical operation of railways of Ukraine.

2. GSTU 32.0.08.001-97. The procedure for developing and putting products into production for the needs of railway transport in the system of the Ministry of Transport of Ukraine.

3. DSTU 4178-2003. Complexes of technical means of train control and regulation systems. Functional safety and reliability. Requirements and test methods.

4. Klymenko K.S. Methodical instructions for performing calculation and graphic work in the discipline "Fundamentals of designing automation systems" Kh.: UkrDAZT, 2013. - 21c.

5. Boynik,. A.B. [Text]: Methodical instructions for practical classes and independent work in the discipline "Fundamentals of designing automation systems" by A.B. Boynik, A.A. Prylypko– Kh.: UkrDAZT, 2015. – 26c

Auxiliary

1. Kazakov A.A. etc. Automated systems of interval regulation of train traffic. - M.: Transport, 1995. -320 p.

2. Instructions on signaling on railways of Ukraine.

3. DSTU 3626 97. Basic software and technical complexes of the local level for distributed automated control systems of technological processes. General requirements.

4. DSTU 4151 2003. Complexes of technical means of train control and regulation systems. Electromagnetic compatibility. Requirements and test methods.

5. Methodology for proving the functional safety of microelectronic complexes of train control and regulation systems // State Administration of Railway Transport of Ukraine; Kyiv. - 2002.

6. Rules for acceptance into operation of completed construction objects of railway automation and telemechanics (CSB devices). - Kyiv. 2006. - 35 p. (ЦСШ-0040)

7. Instructions on the procedure for conducting operational and acceptance tests of experimental samples of signaling, centralization and blocking devices. - Kyiv. 2003. - 14 p. (ЦСШ-0026)

REQUIREMENTS OF THE TEACHER

The study of the educational discipline "Design of automated systems" requires:

- performance of tasks according to the curriculum (individual tasks, independent work, etc.);
- preparation for practical classes;
- work with information sources.

Preparation for practical classes involves: familiarization with the program of the academic discipline, questions that are presented in classes on the corresponding topic; study of methodical material. The solution of practical tasks must meet the requirements (have all the necessary components) put forward for the solution of the corresponding task, testify to its independence (demonstrate signs of independence of the applicant's performance of such work), absence of signs of repetition and plagiarism.

At the practical classes, the presence of students of higher education is mandatory, and their participation in the discussion of all issues of the topic is also important. Missed classes must be made up. The same applies to students who did not complete the task or showed a lack of knowledge on the main issues of the topic.

PROCEDURE FOR ASSESSMENT OF LEARNING RESULTS

Control methods: oral survey, ongoing control, modular control (tests), final testing, assessment. When evaluating learning outcomes, be guided by the Regulation on control and evaluation of the quality of students' knowledge at UkrDUZT (http://kart.edu.ua/images/stories/akademiya/documentu-vnz/polojennya-12-2015.pdf).

According to the Regulation on the introduction of the credit-module system of the organization of the educational process, a 100-point rating scale is used.

The principle of forming an assessment for the module as part of credit credits I and II on a 100-point scale is shown in the table, which shows the maximum number of points that a student can score for different types of study load.

Maximum number of points per module		
Modular control	Modular control (Tests)	Sum of points for the module
Up to 60	Up to 40	Up to 100
Current control		1 semester
Attending classes. Activity in classes (Lectures, practical).		18
Submission of practical works within the term 42		42
Sum up to 60		до 60

When filling out the credit and examination information and the credit book (individual study plan) of the student, the grade given on a 100-point scale must be transferred to the state scale (5, 4, 3,) and the ECTS scale (A, B, C, D, IS).

Determination of the name according to the state scale (estimate)	**Determination of the title according to the ECTS scale**	**On a 100-point scale**	**ECTS rating**
PERFECTLY – 5	**Excellent** – excellent performance with only a few minor errors	90-100	A
GOOD – 4	**Very good** – above average with a few faults	82-89	B
	Good – generally correct work with a certain number of gross errors	75-81	C
SATISFACTORY - 3	**Satisfactory -** not bad, but with a significant number of shortcomings	69-74	D
	Sufficient – performance meets minimum criteria	60-68	E
UNSATISFACTORY-2	**Unsatisfactory** – you need to work before getting a credit or exam (without re-studying the module)	35-59	FX
	Unsatisfactory – serious further work is required (re-study of the module)	<35	F

LEARNING RESULTS

As a result of studying the course "Designing railway automation systems", the student of higher education will:

1. Know the requirements of standards, regulatory documents and industry instructions related to technical diagnostic systems (STD), the basic principles of construction, algorithms of functioning; technical characteristics and features of operated and developing systems of technical diagnostics, possibilities of using microprocessor technology in systems of technical diagnostics.

2. To know the methods of technical diagnostics of ZA devices, methods and algorithms for finding faults; peculiarities of designing technical diagnostics systems, directions and trends, ways and prospects of STD development for the near and distant perspective, directions and trends, ways, as well as prospects for the development of methods and means of technical diagnostics of complex systems, algorithms for the functioning of both domestic and foreign perspective devices and STDs with wide application of a promising element base.

3. Be able to develop technical requirements or tasks; develop structural and functional schemes of systems depending on the requirements for reliability and functional safety; determine the parameters of executive devices and sensors of automation and automation systems; choose technical means (equipment of software and logical controllers) for automatic systems and automation of railway transport; determine the concept, strategy and principles of building relay and microprocessor systems of automation and automation of railway transport, choose and design power supply systems for various automation and telemechanics systems.

4. Determine the procedure for designing automation systems at the station and raceway, as well as independently compile design and technical documentation.

CODE OF ACADEMIC HONOR

The teaching team expects you to unconditionally comply with the Code of Academic Integrity. The code is available at the following link: http://kart.edu.ua/documentu-zvo-ua

In particular, compliance with the Code of Academic Integrity of UkrDUZT means that all work on exams and tests must be done individually. During independent work, students can consult with teachers and other students, but must solve tasks independently, guided by their own knowledge, abilities and skills. References to all resources and sources (for example, in reports, independent papers or presentations) should be clearly identified and properly formatted. In the case of joint work with other students on individual tasks, you must indicate the degree of their involvement in the work.

INTEGRATION OF STUDENTS WITH LIMITED OPPORTUNITIES

Higher education is a leading factor in raising social status, achieving spiritual and material independence and socialization of youth with limited functional capabilities and reflects the state of development of democratic processes and humanization of society.

To integrate students with disabilities into the educational process of the Ukrainian State University of Railway Transport, a distance learning system was created based on modern pedagogical, information, and telecommunication technologies.

Access to distance learning materials from this course can be found at the following link: http://do.kart.edu.ua/