UKRAINIAN STATE UNIVERSITY OF RAILWAY TRANSPORT

DEPARTMENT "AUTOMATION AND COMPUTER REMOTE CONTROL OF TRAIN TRAFFIC"

Recommendedat the meeting of the
Department of Automation and Computer
Remote Control of Train Traffic
protocol No.____dated "02" _02_ 2023

SYLLABUS

"STANDARDIZATION AND CERTIFICATION OF SYSTEMS ENSURING TRAIN TRAFFIC"

Semester and academic year

According to the educational program: automation and computer-integrated technologies - 2nd semester of 1st year of study

Second educational level (master's degree)

Branch of knowledge

15 Automation and instrumentation

Code and name of specialties:

151 Automation and computer-integrated technologies

Lectures, practical classes according to the schedule http://rasp.kart.edu.ua

Teaching team:

Lecturer and head of practical classes:

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Reception and consultation hours: according to the schedule of individual consultations posted on the information stand of the department

Location of the department: the city of Kharkiv, Maidan Feuerbach, 7, building 1, floor 2, auditorium 222.

Course web pages:

http://kart.edu.ua/vupysk-tekhn-ta-kol-ua/akit-ua

http://kart.edu.ua/v-shkil-ta-ych-ua/akit-ua

http://kart.edu.ua/v-shkil-ta-ych-ua/akszt-uahttp://kart.edu.ua/images/stories/novunu/25-10-2019/pol_pro_sil.pdf

1.Subject of discipline

The subject of the discipline "Standardization and certification of systems for ensuring the movement of trains" (SSZRP) is the basic requirements of standards for the field of railway automation, as well as methods and technical means for the certification of devices and systems of railway automation.

The object is standards and other regulatory documents in the field of railway automation systems.

Interdisciplinary connections. The CCZRP course is based on the knowledge gained by students during the study of the following disciplines: "Integrated information and control systems", "Innovative management and control systems", "Signal autoregulation systems".

The SSZRP course consists of lectures and practical classes (total volume – 4 credits (120 hours).

The discipline of SSZRP allows forming the following student competencies:

- integral competence;
- general competencies (CG);
- joint special (professional, subject) competences (FC);
- program learning outcomes (LP).

In addition, it allows to form additional student competencies:

1. Value-semantic competence - formation and expansion of the student's worldview in the field of product standardization and certification.

2. General cultural competence - understanding of historical and regional features that have developed in Ukraine and abroad in the field of railway automation and telemechanics.

3.Educational and cognitive competence - the formation of a student's interest in the state and prospects of development in the field of modern special measuring tools, mastery of measuring skills; the student's ability to form research goals with the aim of achieving them, the ability to find solutions in non-standard situations in the context of the development and operation of devices and systems of railway transport of Ukraine.

4. Information competence - the development of the student's skills for independent search, analysis, structuring and selection of special measurement methods and devices in railway automation devices with the help of modern information technologies.

5. Communicative competence - the development of the student's teamwork skills through the implementation of group projects in the field of designing modern special measuring tools, the ability to present one's own tools and methods of their use, and competently lead a discussion in the researched field.

6. Competence of personal self-improvement - elements of physical, spiritual and intellectual self-development, emotional self-regulation and self-support; maintaining a constant thirst for self-improvement and self-knowledge, by constantly searching for non-traditional approaches to the problem of improving special measuring tools.

2. Why should you choose this course?

Modern train traffic systems are based on microprocessor and computer technologies, and their reliable and safe operation is of great importance.

It is very important to develop modern management and control systems, but if they are not reliable and safe, it leads to loss of life, very large damage and unacceptable impact on the environment.

In order to effectively regulate the quality of products, their reliability and safety, standards are developed and used in the world. This is especially important for control systems of responsible processes, including systems for ensuring the movement of trains.

For the effective implementation and operation of modern digital technologies, students should know what certification is achieved according to the main indicators of the purpose, primarily in terms of reliability and functional safety. It is very important to do this at the stages of development, design, manufacture and operation of devices and systems. Standardization and certification have a special relevance for the quality and safety of electronic and programmable devices.

Students should know the basic requirements of the standards, be able to perform the certification of the train traffic system.

Unfortunately, we can cite some examples of low-quality work on standardization and certification in various industries and transport, which led to great losses and the death of many people.

1 Railway transport

1.1. Collision of two high-speed trains in Wenzhou province, China, 2011.

This is the first high-speed train accident in China.The reason is a false signal from the electronic devices for monitoring the availability of the track sections on which the train was, as a result of the blown fuse and the failure to turn on the necessary prohibition signal of the traffic light, due to which the second train crashed into it. 40 people died, 192 were injured, 12 of them seriously.This even affected people's trust in high-speed traffic, as a result of which its construction was temporarily suspended. The speed of high-speed trains was also significantly reduced.

1.2. The biggest railway disaster in the USSR

In 1989, near the city of Ufa, during the oncoming passage of two passenger trains No. 211 "Novosibirsk - Adler" and No. 212 "Adler - Novosibirsk", a very strong gas explosion occurred, which flowed into the valley from a pipeline that passed near the railway.

The reason for this was the fact that the gas leak control system was not implemented, the hope was on local residents who would provide information about it based on the smell of gas.

575 people died, including 181 children, 600 were injured, many of them very seriously.

1.3. "Railway disaster of the century"

At the Yelnikovo station of the Pidennaya Railway (at the USSR - Belgorod Branch), as a result of the installation of jumpers on the track relay by an electromechanic of the Central Railway Station, 1 fast train, 1 passenger train and a freight train collided with an explosive cargo.

2. Aviation

2.1. In October 2018 and March 2019, 2 modern Boeing 737 Max aircraft crashed in Indonesia and Ethiopia due to insufficient reliability of electronic systems and failures in their work.

189 and 346 people died, respectively.

After that, a worldwide ban on these planes came into effect, including the supply of 5 planes to Ukraine.

The material loss of the Boeing company from this amounted to 15.75 billion dollars, the revenues of this corporation decreased by more than a third, this led to the crisis of the global airline company.

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Boeing 737 MAX 8

2.2. The crash of the SSJ-100 plane at Sheremetyevo Airport, Moscow, May 2019.

The reason is the failure of electronics and radio communication due to lightning.The aircraft landed with full fuel tanks due to loss of radio communication and caught fire on landing.

41 people died.

2.3. Aviation event on an A-330 aircraft in October 2008, Australia

The reason is not only a hardware failure, but also an error in the data processing algorithm.

With great difficulty, the commander managed to land the plane at the reserve airfield.

119 people were injured, 12 of them seriously.

3. Sea transport

3.1. The "Doña Paz" passenger ferry disaster in the Philippines in 1987 after a collision with the "Vektor" tanker.

The reason is the human factor. There was no special navigation equipment and the simplest communication, not even radio communication, on the ferry and the tanker.

About 4 300 people died - this is the largest maritime disaster in the world in peacetime

3.2. The collision of the oil tanker Alnic MC with a US military destroyer near Singapore, which is associated with both human factors and errors in the design of the ship's electronic control system.

10 people died, 48 were injured.

As a result, it was decided to replace the new sensor control systems on the destroyers with the old mechanical ones.

4. Power supply systems

The biggest accident in the world in the power supply system.

In 2003, 263 power plants, including 10 nuclear power plants in the USA and Canada, were shut down in the USA due to tripping of relay protection and failures in the computer system. 55 million people remained without electricity in a large area of the USA and Canada.

Officially, the material damage from this amounted to 6 billion dollars.

Conclusion.

These examples clearly indicate the need to study the course "Standardization and certification of train traffic support systems" (SSZRP) and use it for engineering activities.

3. Review of the course

3.1 Purpose and tasks of the academic discipline

The main goal of the course is to prepare masters for creative participation in research, development, design, construction and operation of SSZRP, taking into account modern national and international standards.

After mastering the course, the master must:

Know:

 the requirements of national standards, normative documents and industry instructions regarding the reliability of the functioning of devices and systems of the ZRP;

 the principles of standardization, admission and ensuring the safety of functioning of operated and prospective systems of the ZRP, including computer and microprocessor equipment;

 peculiarities of the use of testing and measuring equipment in the study of product quality, its certification according to the main indicators of purpose;

 promising methods of standardization and certification of PPE systems;

 features of the design of ZRP systems taking into account the requirements of international standards.

Be able to:

 rationally choose the main indicators of purpose and the corresponding standards of ZRP systems and their functional nodes;

 to know the quantitative and qualitative requirements for the ZRP systems, their testing methods, increasing the reliability and safety of functioning;

 to organize certification tests according to the main indicators of the purpose of ZRP systems;

 rationally choose technical means for conducting certification tests of ZRP systems in accordance with national regulatory documents

 to develop and design the ZRP systems, including with the use of microprocessor technology, taking into account national normative documents.Have an idea:

 about ways to improve the requirements for the main indicators of the purpose of the ZRP systems;

 prospects for the development of systems of standardization and certification of products and services;

 about normative documents, requirements and methods of testing of the ZRP systems in different countries of the world.

The most important conditions for the implementation of modern high-quality systems for ensuring the movement of trains on main lines, industrial transport and subways (ZRP systems) are knowledge of national and international standards, as well as certification procedures, especially devices directly related to the safety of train movement. As a result, the discipline of the course "Standardization and certification of systems for ensuring the movement of trains" (SSZRP) is of great importance in the training of specialists in the development, design, manufacture and operation of technical means of automation of railway transport and other branches of industry.

The discipline "SSZRP" is an important link in the master's professional training. The discipline is related to the detailed study and research of issues of standardization and certification of products and services of technical means of ZRP systems.

The following are assigned to the study of the academic discipline:

- for the AKIT educational program, specialty 151 – 120 hours / 4 ECSTS credits.

3.2 The program of the academic discipline consists of the following content modules:

1. The essence of standardization and the main provisions of the State Standardization System of Ukraine
2. Standardization of the functional safety of train movement support systems
3. Standardization of electromagnetic compatibility of train traffic support systems
4. Certification and proof of functional safety of train movement support systems
5. Certification of electromagnetic compatibility of train movement support systems.

4 RECOMMENDED LITERATURE

The main one

1. Kustov V.F. Synopsis of lectures on the discipline "Standardization and certification of train traffic support systems (electronic version).

2. S. O. Pogasiy. Synopsis of lectures on the discipline "Standardization, certification, metrology" / S. O. Pogasiy, Yu.V. Krasnokutska; Hark. national Acad. urban farm - Kh.: KhNAMG, 2011. - 172 p.

3. Kustov V.F. "Fundamentals of the theory of reliability and functional safety of ensuring the movement of trains". Tutorial. Kharkiv. UkrDAZT. 2008, 156 p.

4. Kustov V.F. Methodical instructions for performing calculation and graphic and control work for the course "Standardization and certification of train traffic support systems". Kharkiv. UkrDAZT. 2019, (electronic version).

5. DSTU 4178-2003. Complexes of technical means of train control and regulation systems. Functional safety and reliability. Requirements and test methods. Effective from 01.07.2003.

6. DSTU EN 50126-1:2015 uk: Railway transport. Specification and demonstration of reliability, availability, safety and maintainability (RAMN). Part 1. Essential requirements and general process (EN 50126-1:1999, IDT). Valid from 2016-01-01.

7. DSTU EN 50129:2015 uk: Railway transport. Signaling and data processing communication systems.

8.EN 50126-1:2015: Rail transport. Specification and demonstration of reliability, availability, safety and maintainability (RAMN). Part 1. Basic requirements and general process.

9. EN 50128-2011. Railway transport - Software for railway control and protection systems.

10.EN 50129:2015: Rail transport. Signaling and data processing communication systems. Electronic security alarm systems.

11. Interstate standard MGS GOST 33893-2016 "Systems of railway automation and telemechanics at railway crossings. Security requirements and control methods". Entered into force on January 11, 2017.

12. Interstate standard MGS GOST 33894-2016 "Systems of railway automation and telemechanics at railway stations". Security requirements and control methods". Entered into force on January 11, 2017.

13. Interstate standard MGS GOST 33895-2016 "Systems of railway automation and telemechanics on railway lines. Security requirements and control methods". Entered into force on January 11, 2017.

14. Interstate standard MGS GOST 33896-2016 "Systems of dispatcher centralization and dispatcher control of train movement. Security requirements and control methods". Entered into force on January 11, 2017.

15. Interstate standard of Moscow State University GOST 33892—2016. "Systems of railway automation and telemechanics at sorting stations Safety requirements and control methods. Entered into force on January 11, 2017.

16. DSTU 4151-2003. Complexes of technical means of train control and regulation systems. Electromagnetic compatibility. Requirements and test methods. Valid from 01.01.2004.

17.DCTU EN 50121-1:2010 Railway transport. Electromagnetic compatibility. Part 1. General provisions (EN 50121-1:2006, IDT).

18. DSTU EN 50121-4:2018 (EN 50121-4:2016, IDT). Railway transport. Electromagnetic compatibility. Part 4. Emission and immunity of signaling and telecommunication equipment

19.EN 50121-4: 2016 "Rail transport. Electromagnetic compatibility. Part 4. Emission and immunity of signaling and telecommunication equipment"

20. Interstate standard MGS GOST 33436.4-1-2015. Compatibility of technical equipment of electromagnetic systems and equipment of railway transport Part 4-1 DEVICES AND EQUIPMENT OF RAILWAY AUTOMATION AND TELEMECHANICS. Requirements and test methods.

Additional

1. Methodology for proving the functional safety of train control and regulation complexes. Approved and put into effect by the order of the State Administration of Railway Transport of Ukraine dated August 17, 2001 No. 452-Ц. - 106 p.

2. Instructions on the procedure for conducting operational and acceptance tests of experimental samples of signaling, centralization and blocking devices. TSh 0026. Approved and put into effect by the order of the State Administration of Railway Transport of Ukraine dated August 17, 2001 No. 453-Ц. - 14 p.

3.EN 50121-2:2006. Electromagnetic compatibility in application to railways. Part 2. Emission of interference from the entire railway system into the environment.

4.EN 50121-3-1:2006. Electromagnetic compatibility in application to railways. Part 3-1. Rolling stock of railways. The train and the entire rolling stock.

5. EN 50121-5:2006.Electromagnetic compatibility in application to railways. Part 5. Emission and noise immunity of stationary installations and power supply equipment

5. Forms of final control of study success

Theoretical knowledge and practical skills are tested:

a) during ongoing control - in the process of a control survey and based on the results of solving test tasks in laboratory classes; when checking solutions to problems that were set for independent work; when checking laboratory work reports based on research results;

b) during intermediate control - according to the results of modular testing on a personal computer;

c) final - at the exam according to the discipline.

Means of diagnostics of learning success

The final study results are drawn up based on the results of current and test control during the semester in accordance with the regulation on control and assessment of the quality of students' knowledge at UkrDUZT

http://kart.edu.ua/images/stories/akademiya/documentu-vnz/polojennya-12-2015.pdf

6 INFORMATION VOLUME OF THE EDUCATIONAL DISCIPLINE

6.1 Distribution of lectures into modules, content modules

Module 1. Standardization of train traffic support systems

Topic 1. The essence of standardization

Basic concepts and definitions of standardization. Subject and object of standardization. Principles and purpose of standardization. Types of standardization. Standards and their types. The importance of standardization. International standardization organizations. Regional standardization organizations. National standardization organizations. Interstate systems of standards. Stages of development of international standards.

Topic 2. Main provisions of the State Standardization System of Ukraine

State policy in the field of standardization. Standardization bodies in Ukraine. State standardization system of Ukraine.Procedure for development and implementation of state standards and technical conditions.

Topic 3. Standardization of functional safety of train movement systems on the railways of Ukraine

Basic terms and definitions. Basic regulatory documents on the functional safety of information and control systems on the railways of Ukraine. Methods of normalizing indicators of reliability and functional safety of technological processes and systems.

Requirements of the national standard DSTU 4178 in terms of functional safety. General requirements for technical means performing security functions. Quantitative and qualitative requirements of functional safety. Nomenclature of functional safety indicators. Normative quantitative requirements of functional safety. Classification of technical means according to the levels of functional safety requirements.

Topic 4. Standardization of the reliability of systems for ensuring the movement of trains on the railways of Ukraine

Basic terms and definitions. . Basic regulatory documents on the reliability of information and control systems on the railways of Ukraine. Requirements of the national standard DSTU 4178 in terms of reliability. Quantitative reliability requirements.

Topic 5. Standardization of systems for ensuring the movement of trains on the railways of the countries of the European Union.

Requirements of the standards of the European Committee for Standardization in Electrical Engineering (SENELEC): EN 50126, EN 50128, EN 50129.

Topic 6. Interstate standards of train traffic support systems.

Requirements of interstate standards for train traffic support systems:

- systems of railway automation and telemechanics at railway stations. Security requirements and control methods.- systems of railway automation and telemechanics at railway crossings. Security requirements and control methods

- systems of dispatching centralization and dispatching control of train traffic. Security requirements and control methods.

- systems of railway automation and telemechanics at races. Security requirements and control methods.

Topic 7. Basic standards and regulatory documents regarding the electromagnetic compatibility of train traffic systems in Ukraine.

Requirements of the DSTU 4151 standard and normative documents on electromagnetic compatibility in the field of railway automation.

Topic 8. Standardization of electromagnetic compatibility on railways of other countries.

Requirements of EN-50121 (EN-50121-1) – (EN-50121-5) series standards. Harmonization of electromagnetic compatibility standards. EMC standards on railways of the Russian Federation and the CIS.

Module 2. Certification of train traffic support systems

Topic 9. Certification in the field of railway automation

The essence of certification. Definition of certification. Confirmation of compliance in legally regulated and non-regulated areas.

The structure of the certification body. Functions of the certification body. Requirements for certification bodies of products, works, and services. Procedure for certification of products, works, services. Peculiarities of the activity of testing centers and laboratories. The procedure for certification of products, works, and services. Certification schemes. Payment for certification services.

Topic 10. Peculiarities of certification and proof of functional safety of train movement support systems at the stage of calculating functional safety indicators.

Peculiarities of calculating indicators of functional safety of responsible devices and systems. Factors affecting the reliability of calculation results. Ways to improve the accuracy of calculation methods for determining functional safety.

Topic 11. Certification tests of hardware and software technological processes and systems for functional safety and reliability.

Terms. Methods of testing technical means for compliance with structural requirements of functional safety. Methods of testing technical means for compliance with structural requirements of functional safety.

Methods of testing technical equipment for functional safety in case of failures and damage to elements of their structure and external devices.Methods of testing technical equipment for functional safety and reliability in case of electromagnetic disturbances.

Requirements for the development of test methods and the compilation of a protocol of certification tests for the functional safety of systems for ensuring the movement of trains at the stages of bench tests and tests on simulation models.

Topic 12. Peculiarities of certification and proof of functional safety of train movement support systems at the stages of testing in operational conditions and formation of expert opinions.

Peculiarities of certification and proof of functional safety of train movement support systems at the stage of testing in operating conditions. Development of test methodology and requirements for drawing up a test protocol.

Peculiarities of certification and proof of functional safety of train movement support systems at the stage of formation of expert opinions. Requirements for experts. Peculiarities of drawing up expert opinions.

Disadvantages of proving the functional safety of train movement support systems at the stages of testing in operating conditions and forming expert opinions.

Topic 13. Confirmation of the functional safety of train movement support systems at the stages of experimental and permanent operation.

Methodology for confirming the functional safety of train movement systems at the stages of experimental and permanent operation.

Disadvantages of the stages of proof of functional safety at the stages of introduction into trial and permanent operation.

Methods of determining acceptable periods of diagnosis and monitoring of backup channels of responsible devices and systems of railway automation.

Topic 14.Peculiarities of certification of electromagnetic compatibility of train traffic support systems.

Development of the organization and methodology of certification tests for electromagnetic compatibility of train movement support systems.

Topic 15. Peculiarities of certification of electromagnetic compatibility of train movement support systems.

Conducting certification tests and drawing up a certification test protocol for electromagnetic compatibility of devices and systems for ensuring the movement of trains.

Topic 16. Ways to improve the quality of standardization and certification of products in the industry.

6.2 Practical classes

1 The essence of standardization. International, regional, national standardization organizations.

2 Requirements of the national standard DSTU 4178 in terms of functional safety and reliability.

3 Basic provisions and requirements of European and international standards in terms of functional safety and reliability.

4 Requirements of the national standard DSTU 4151 and international standards in terms of electromagnetic compatibility.

5 Certification of train traffic support systems. Procedure for certification of products, works, services. Purpose and functions of bodies and centers for certification of train traffic systems.

6 Peculiarities of certification and proof of functional safety of train traffic support systems.

7 Certification tests of hardware and software for technological processes and systems for electromagnetic compatibility

8 Peculiarities of certification and proof of functional safety of train movement support systems at the stages of testing in operational conditions and formation of expert opinions. Ways to improve the quality of standardization and certification of products in the industry.

6.3 Independent work

During independent work, knowledge of the discipline is learned and deepened by studying material from the recommended literature.

The time allocated for independent work also includes the performance of an individual task (RGR).

6.4 Individual tasks

Topic of the task (RGR) Type of the task

Study of the functional safety of the given RGR device

The student's educational load, allocated to independent and individual work, is:

– for full-time full-time education, 75 hours;

- for part-time full-time education, 106 hours.

7. PROCEDURE FOR ASSESSMENT OF LEARNING RESULTS

Theoretical knowledge and practical skills are tested:

a) during the current control - in the process of the control survey and based on the results of solving test tasks in practical classes; when checking solutions to problems that were set for independent work;

b) when conducting modular control - based on the results of performing test control tasks on a personal computer;

c) summatively - at exams according to the discipline; according to the results of the defense of the RGR.

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, a 100-point rating scale is used.

For the "Attendance of lectures and practical classes" component, 1 point is awarded for attending each lecture and practical class. Points for the component are canceled and are not awarded at all, if the student did not attend more than 50% of the classes in the module without valid reasons.

The "Independent work" component assesses the student's level of assimilation of sections and questions of the course, which are determined for independent study. The assessment is carried out by means of computer testing and oral interviews of students during practical classes and defense of RGR.

Current testing assesses the level of mastery of the material included in the corresponding module.The formation of the assessment for each module as part of credit on a 100-point scale is carried out in accordance with the expression

OM = OZ + OPR+OKR + OT,

where OZ is the sum of points for attending lectures and practical classes;

OПР - – the sum of points for assessment in practical classes;

OKR - the sum of points for the implementation and protection of the RGR

OT is the sum of points for the modular test control on a PC.

Points are awarded:

- on the 1st module (current success rate – 60 points, test control in MOODLE – 40 points):

The sum of points for 1 module Max. value

OZ - for attending lectures and practical classes; 16+8=24

OPR - for each excellent, good and satisfactory assessment in practical classes 36

OT - for modular test control on PC. 40

Total 100

- subject to attending lectures, 16 points are awarded for 8 lectures (2 points for each lecture);

- on the condition of attending 4 practical classes, in which there are no unsatisfactory grades, - 8 points are awarded (for each class - 2 points);;

- for each excellent, good and satisfactory assessment in practical classes, 9, 6 and 4 points are additionally awarded, respectively.

on the 2nd module:

- on the condition of attending 7 lectures, 14 points are awarded (for each lesson - 2 points);

- on the condition of attending 4 practical classes, 8 points are awarded (for each class - 2 points);

- for each excellent, good and satisfactory assessment in practical classes, 7, 5 and 3 points are additionally awarded, respectively.

- for completed and protected RGR calculation work - for excellent protection = 10 points; for good protection 7 points, for satisfactory protection = 5 points.

The sum of points for 2 modules Max.value

OZ - for attending lectures (14) and practical classes (8); 22 (14+8)

OPR - for each excellent, good and satisfactory grade in 4 practical classes 28 (7x4)

OKR - for completed calculation and graphic work of RGR 10

Total current success rate is 60

OT Modular test control on PC. 40

-Total 100

Additional points for the student's participation in scientific work, preparation of publications, works for scientific student competitions, participation in student Olympiads, activity in classes and consultations can be added to the listed components of the modular assessment.

A positive final grade can be issued if students have fully completed the curriculum, i.e. studied the theoretical part of the course, completed and defended the RGR.

The final grade is defined as the arithmetic mean of the grades of two credit modules.

The sum of points obtained in this way is brought to the attention of the students after the module control. Taking it into account, the corresponding evaluation of the module is added to the credit and examination list.

The examination grade is defined as the arithmetic mean of the grades of two credit modules. if it is less than 60 points or if the student disagrees with the sum of points received, it can be improved on the exam.

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

Determination of the name according to the state scale (approx

Determination of the title according to the state scale (evaluation) Determination of the title according to the ECTS scale According to the 100-point ECTS scale rating

EXCELLENT - 5 Excellent - excellent performance with only a small number of errors 90-100 A

GOOD - 4 Very good - above average with a few faults 82-89 B

Good - generally correct operation with some gross errors 75-81 C

SATISFACTORY - 3 Satisfactory - not bad, but with a significant number of shortcomings 69-74 D

Sufficient – performance meets the minimum criteria of 60-68 E

UNSATISFACTORY - 2 Unsatisfactory - need to work before getting a credit or exam (without repeating the module) 35-59 FX

Unsatisfactory - serious further work required (module restudy) <35 F

The number of points obtained based on the results of the current study gives the student the opportunity to increase the grade on the exam by one degree according to the state scale:

- from "good" (82-89 points) to "excellent" (90-100 points);
- from "satisfactory" (69-74 points) to "good" (75-89 points);
- from "unsatisfactory" (35-59 points) to "satisfactory" (60-74 points).

8 INFORMATION RESOURCES

8.1 Libraries and media libraries

1. NTB UkrDUZT (Kharkiv, Feuerbach Square, 7).
2. Media library of UkrUZT (Kharkiv, Feuerbacha Square, 7).
3. KhDNB named after V.G. Korolenko (Kharkiv, Korolenko Ave. 18).
4. Kharkiv Central Technical University (Kharkiv, Gagarina Avenue, 4).

8.2 Information resources on the Internet:

1.https://do.kart.edu.ua/
2.http://metod.kart.edu.ua/

Teaching team:

Viktor Fedorovych Kustov - lecturer on the course "Standardization and certification of train traffic support systems". Received the degree of Ph.D. in the specialty 05.22.20- "Operation and repair of means of transport" in 1987, associate professor since 1994.

Corresponding member of the Transport Academy of Ukraine (TAU).

Areas of scientific activity:

1. Development and implementation of microprocessor systems and devices of railway automation (project manager for the implementation of more than 100 state-of-the-art systems and

devices of the SCB, including relay-microprocessor and microprocessor systems for controlling arrows and signals, electronic systems for monitoring the freedom of track sections at stations and races on on the basis of counting the axles of rolling stock, microprocessor systems of crossing signaling and dispatching control over the movement of trains, as well as a microprocessor system of semi-automatic blocking based on a radio channel.

2. Research of reliability and safety of railway automation systems.The author of the main regulatory documents of the industry, including national standards for reliability and functional safety DSTU 4178, electromagnetic compatibility DSTU 4151, the industry "Methodology for proving the functional safety of microelectronic systems of control and regulation of train traffic", 3 international documents - Monument of the Organization cooperation of railways (on the reliability and electromagnetic compatibility of railway automation systems), which are approved by the experts of the Commission on the CSB of this organization.

Code of academic integrity

Violation of the Code of Academic Integrity of the Ukrainian State University of Railway Transport is a serious violation, even if it is unintentional. 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, skills and abilities. 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 should indicate the degree of their involvement in the work.Integration of students with disabilities

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 link: : http://do.kart.edu.ua/