Ukrainian State University of Railway Transport

Department "Automation and computer remote control of train traffic"

APPROVED
Minutes of the meeting of the department of automation and computer telecontrol of train traffic prot. No. 11 **from** "30" 08_2022

SYLLABUS

INNOVATIVE REMEDY AND CONTROL SYSTEMS Semester 2022/2023 **academic year**

Level of higher education:	**second**
Degree of higher education:	**master**
Specialty:	151 **Automation and** computer-integrated **technologies**
Educational program:	**Automation and** computer-integrated **technologies**
Amount:	5 **ECTS credits**
Number of modules:	2
Reporting:	**Exam** + **KP**

Time and audience of classes: According to the schedule - http://rasp.kart.edu.ua/

1. **Teaching team:**

Lecturer: Sosunov Oleksandr Oleksiyovych (candidate of technical sciences, associate professor), Contacts: *+38 (057) 730-10-22,* e-mail: sosunov63@kart.edu.ua

Reception and consultation hours: every Monday from 12.40-14.00

Placement of the department: City of Kharkiv, Maidan Feuerbach, 7, **building 1,** floor 2 , auditorium 222 . **Web page of the course:** http://do.kart.edu.ua/ **Additional information materials:** http://metod.kart.edu.ua

Kharkiv - 2021

The educational discipline "Innovative systems of remote control and control" (ISTK) aims to study the principles of construction, operation and design of microprocessor systems of dispatching control and control, as well as modern information complexes designed to intensify the technological process of transportation and increase its safety.

The modern level of development of computing equipment, characterized by their high speed, the availability of long-term information storage devices, high reliability even in household or office versions, a wide selection of information display tools, creates the prerequisites for building a new type of management and control systems capable of meeting the requirements of modern stage of development of industry and transport. The use of computer equipment in a complex with devices of automation and communication systems allows to automate the vast majority of functions of management and control of the technological process - train movement, and to ensure the possibility of exchanging information with already operating and prospective ACS of railway transport.

An equally important problem for ensuring the safe and continuous operation of the transport complex is the control of the condition of the rolling stock, in particular those components and aggregates that tend to break during operation. The widespread implementation of the above systems contributes to the intensification of the transportation process, the saving of all types of resources (rolling stock, electricity, fuel, etc.); timely, complete and high-quality execution of applications for transport services; reducing the duration of each stage of management; increasing the reliability and completeness of information used for planning operational work, as well as speeding up the planning process itself; reducing the number of employees due to the consolidation of management facilities and the elimination of intermediate links; improving the working conditions of operative workers.

The course aims to form and develop the following competencies of students: 1. Field-oriented competence (design and operation of telecontrol systems for train traffic, as well as systems of general technical purpose); 2. General cultural competence (understanding of cultural, historical and regional features that have developed in Ukraine and abroad in the field of providing and providing transport services, features and conditions of operation of management and control systems designed for the organization, optimization of the transport process, ensuring its safety, creation of comfortable conditions for passengers, customers, employees of railway transport); 3. Educational and cognitive competence (formation of the student's interest in the current state and prospects of the development of relay and microprocessor systems of automation, ways of their improvement; mastering of measurement skills; the student's ability to form research goals and, in order to achieve them, the ability to find ways out of non-standard situations in the context of the search for optimal design solutions). 4. Informational competence (development of the student's skills for independent search, analysis, structuring and selection of the necessary information for the development of structural, functional and electrical schematic diagrams of automation systems and devices with the help of modern information technologies) 5. Communicative competence (development of the student's teamwork skills through the implementation of group projects, the ability to present one's own project and competently lead a discussion in the researched field).

The main task of the discipline is to prepare students to participate in the development, design and operation of dispatch control systems, rolling stock diagnostics systems; preparation for successful mastery of other special disciplines based on the study of the principles of construction, operation and characteristics of the main elements and nodes of both classical dispatch control systems and systems and devices based on modern information technologies.

Why should you choose this course?

Over the course of several academic semesters, you studied railway automation systems of the lower hierarchical level: automatic and semi-automatic blocking on tracks, control systems for arrows and signals at stations, signal regulation systems, etc. It's time to familiarize yourself with systems in which self-locking and electrical centralization are only components of a single complex of transportation process management. Studying the ISTK discipline, you will be able to systematize already acquired knowledge and skills and acquire new ones, better understand the interrelationships between AB, **EC, DC systems , get the necessary information for studying control systems that will replace the existing ones. Considering that microprocessor control and control systems differ from each other to a lesser extent in terms of structure, elemental base, hardware component in comparison with systems with rigid logic of operation, you will create a reliable basis for further, including independent, study of** any **systems , self-improvement as a specialist in** any **field of technology.**

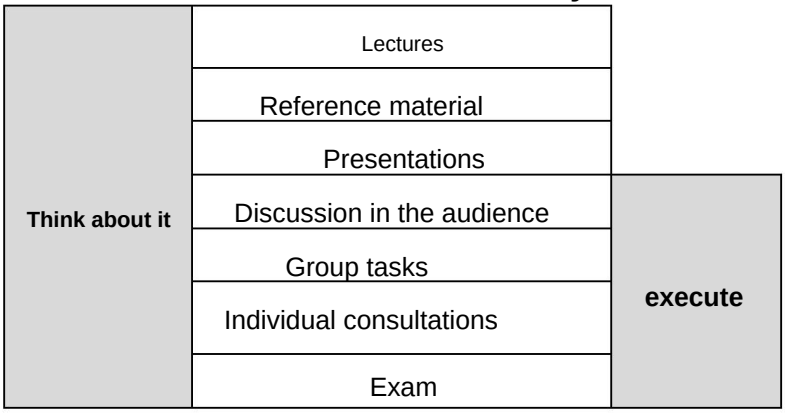
The teachers of the department are ready to help you with the most difficult aspects of the course by e-mail or in person - during working hours.

Course overview

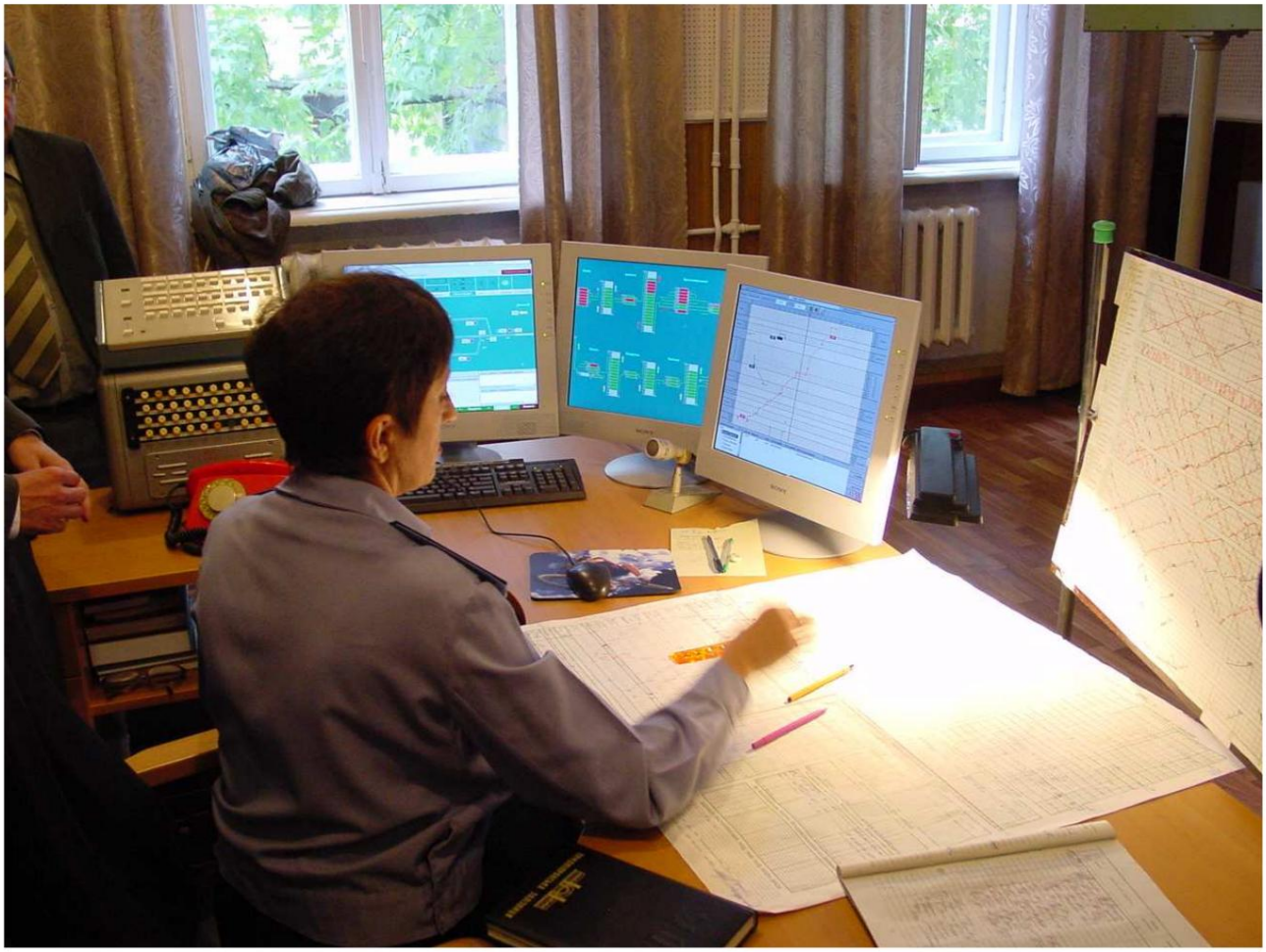
This course is studied from September to December, and gives students an understanding of the general theory of remote control and control systems for railway transport, the construction and principle of operation of microprocessor systems of dispatching centralization, algorithms for the functioning of complexes of linear points and the central post during the formation, transmission and implementation of control commands, registration and displaying control information about the state of objects, the possibility of using microprocessor technology in any **practical applications, trends, ways and perspectives of the development of telec**

The course includes one lecture per week, one practical and one laboratory session per two weeks. It is accompanied by text material, presentations, group and individual tasks. Students will have the opportunity to apply the acquired knowledge and solve practical tasks during discussions in the classroom and during the course project on the equipment of the railway station with microprocessor dispatching centralization devices.

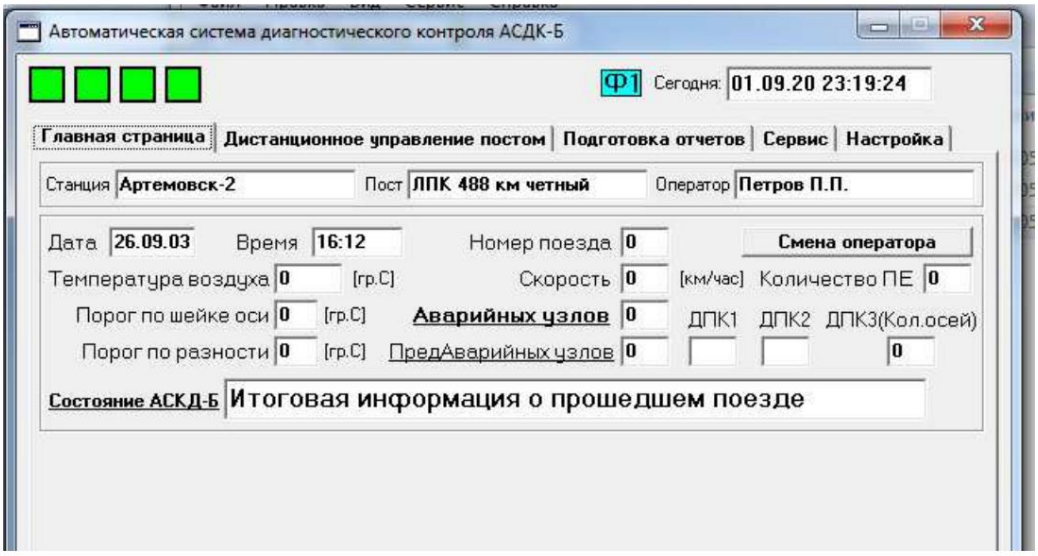
Innovative remote control and control systems / course outline

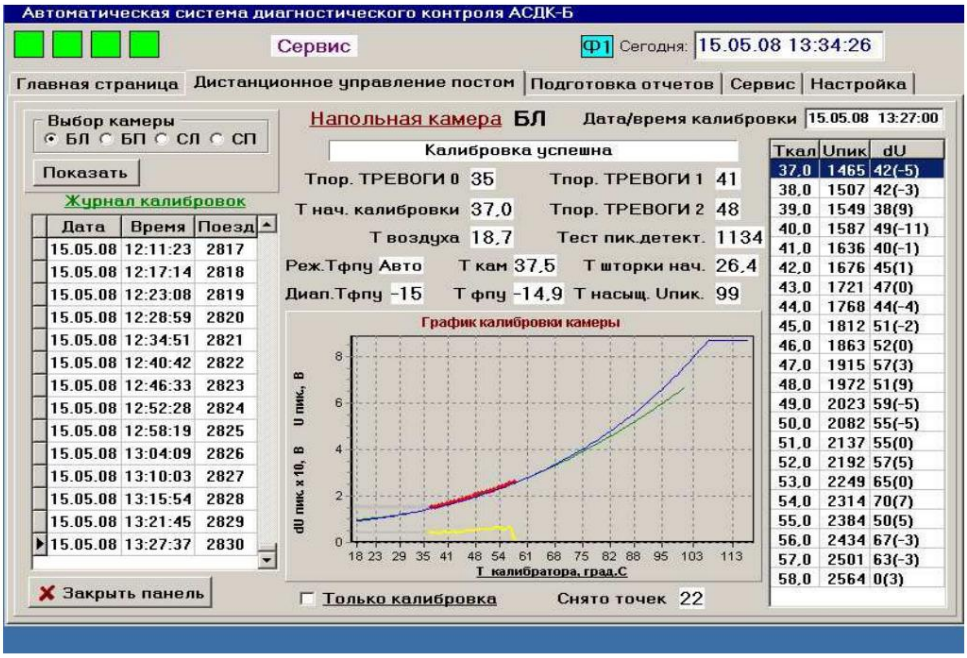


The practical lessons of the course are aimed at getting acquainted with the "Cascade" microprocessor system of dispatching control **and acquiring the skills of developing typical projects of** "tying" **the system to existing devices of railway automation.**



In the process of performing laboratory classes, students study and investigate the operation of the components of microprocessor control systems, learn to work with electronic measuring devices, oscilloscopes, computer simulators of electronic components and electrical circuits Multisim.





Completion of individual tasks contributes to the recovery and consolidation of knowledge and skills acquired during the study of related disciplines that complement the course topics; forms the student's informational and communicative competence.

Course resources

Information about the course is posted on the University website (), including the curriculum, lecture materials, presentations, assignments and course evaluation rules)

Additional material and links to electronic resources are available on the University's website in the "distance learning" section.

RECOMMENDED BOOKS

1. **Neychev O.V. Dispatching management systems: Education. manual.** – **Kharkiv: UkrDUZT,** 2015. - 260 p.

2. **Microprocessor dispatching centralization "CASKAD"/ M.I. Danko, V.I. Moiseyenko, V.Z. Rakhmatov, V.I. Trotsenko, M.M. Cheptsov: Education. manual. - Kharkiv,** 2005 – **176p.** 3. "CASKAD" **microprocessor control system .** Communication **network design methodology .** 13436911.1 84 154.M3.10.01. 4. **Sapozhnikov V.V. etc. Concentration and centralization of the operational management of the movement of trains / V.V. Sapozhnikov, D.V. Gavzov, A.B. Nikitin. -** M.: **Transport.** 2002.- 102 p. 5. **Methods of building harmless microelectronic systems of railway automation / V.V. Sapozhnikov,** Vl.V. **Sapozhnikov, H.A. Hristov, D.V. Gavzov; Edited by** Vl.V. **Sapozhnikova.** - M.: **Transport.** 2005.- 272 p.

6. **Trestman E.E., Lozinsky S.E., Obraztsov V.P. Automation of control of tow points in by train** M.: **Transport,** 1983. 7.

Diagnostics of devices of railway automation and aggregates of mobile units / Boynyk A.B., Zagaryy G.I., Koshevoy S.V., Lukhanyn N.Y., Poeta N.V. Textbook - Kh.: **ChP Izdatelsto "New Word",** 2008. - 304 p.

8. **Methodical instructions for the implementation of course project No.** 686. - **Kharkiv: UkrDAZT,** 2006.

Approximate plan of lectures, practical and laboratory classes

You day	How many hours	The topic of the lecture	How many hours	Topic of laboratory, practical classes
	1	2	3	4
Module 1. **Microprocessor systems of dispatching management and control Analysis of**				
1	2	**operational experience L.r. Acquaintance with microprocessor systems of DC on PTB. development of management and control systems Research centralization "TEMP".** Pr.z. **Introduction Control**	2	**the list of laboratory and practical work with and dispatching**
2	2	**Construction of microprocessor systems** DC: **functions, structure, information transmission channels. Technical means of DC. Technical schematic decisions on coordination of DC systems and railway station systems automation**	2	**occupation. residual of knowledge Issuance of the task for implementation course of the project**
3	2	**Microprocessor code control system of remote stations "NAVIGATOR": operational characteristics, structure. Methods and means of ensuring functional safety during the transfer and implementation of responsible commands.** 2 **Microprocessor dispatching centralization "TEMP", operational characteristics, structure,**	2	**L.r. Research of technical means of microprocessor control and control systems**
4		**principle of action. Methods of ensuring the required range and**	2	Pr.z. **Design of the equipment of the central dispatch center complex.**

		communication		
5		quality . 2 Microprocessor system control room, operational characteristics, "CASKAD" structure, principle of action. Comparative characteristics by analogues. The composition, purpose and operation of the technical means of the central control complex. Structural diagrams of local networks. The structure of the complex of linear points of LP CASKAD. Interaction of the component parts of the complex during the transmission of control information	2	L.r. Study of devices for coordination of MPDC with devices of electrical centralization.
6	2	(TC signal), deciphering and implementation of command information (TU signal). Structure of the DK CASKAD subsystem. The interaction of the constituent parts of the subsystem during the control of the state of distillation devices of CJSC systems.	2	Pr.z. Development of the structure of the local interstation network.
7	2		2	L.r. Research of the ARM of MSDC "KASKAD". Acquiring the skills of an operator of an automated workplace MSDC Pr.z. Compilation of the list of control and
8	2 Methods and means of coordination of electrical centralization circuits with dispatch control systems.		2	management objects, calculation of the required number of modules for interaction with CSB devices with
9		Modular control of knowledge		
Module 2. Information systems and complexes				
10	2	Purpose, classification, technical and economic justification of the implementation of information systems in railway transport. Rolling stock control systems: development trends. Characteristics of objects of control, causes of overheating of boxes, characteristics of methods of determining their condition. Thermotechnical characteristics of bushing units, conditions for the onset of heat balance. Statistical characteristics of the telemetry	2	L.r. Study of the structure and algorithm of the PONAB system.
11	2	signals of the box. Basics of the theory of infrared radiation, factors influencing the density of the infrared radiation flux. Signs of recognition of heated bucks. The influence of the results of	2	Pr.z. Determination of the structure of intermodular connections in the composition of complexes of technical means of LP.
12	2	processing additional recognition features on the reliability of control. what	2	L.r. Study and research of the operation of the car marking unit of diagnostic systems.

13	2	**Technical means of diagnostic systems rolling stock: sensors of diagnostic systems, schematic and algorithmic solutions. Performance criteria of the steering units, justification of the choice and control parameters, justification of the points choice of places of placement of diagnostic and metacomplexes of the system of diagnostics of the condition of the mobile "PONAB", "DISK". composition Operational**	2	Pr.z. **Analysis schemes of coordination systems of dispatching centralization with** EC devices.
14	2	**characteristics, structure, principle of action. quality of communication Methods of ensuring the required and recording information about the state of rolling stock Means of collecting and diagnostic system** ASDK-B: **operational characteristics, structure, principle of operation of rolling stock; comparative**	2	**L.r. Research of diagnostic sensors systems rolling stock**
15	2	**characteristic of predecessors. Methods and means of increasing the accuracy of measuring the temperature of bushing nodes and the reliability of control in** ASDK-B.	2 (3) Pr.z. **The method of calculating the delay time in the delivery of control information from linear points to** the CPU. **Design of the DK-CASKAD distillation device state control subsystem .** 2(1) **L.r. Acquiring the skills of the** ASDK-B ARM operator.
16	2		**Study of distillation and station devices of the ASDC system.**
17		**Modular control of knowledge** **Announcement of results of modular control - session**	

Evaluation rules

Theoretical knowledge and practical skills are checked: a) **during current control - in the process of a control survey and based on the results of solving test tasks in practical classes; when checking the performance of tasks for independent work;** b) **during the intermediate control - based on the results of the control work, course project and modular testing on a personal computer;** c) **in summary - based on the results of PC testing, course project defense, and discipline exam.**

When evaluating learning outcomes, be guided by the Regulation on control and evaluation of the quality of students' knowledge at UkrDUZT and its amendments.

According to the Regulation on the implementation of the organization's credit modular system 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		
Current CONTROL	**Modular control (Tests)**	**Total points for the module**
Up to 60	**Up to** 40	**Up to** 100
Current CONTROL		X **semester**
Attending classes. **Activity in classes (Lectures, practical: see** p. a) **Performance**		30
of an individual task (KP)		30
Result		**to** 60

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 curriculum.

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

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)

Definition of the name for state scale (estimate)	**Determination of the title according to the ECTS scale**	**Behind the 100 ballroom scale**	**ECTS assessment**
EXCELLENT - 5	**Excellent - excellent performance with only a small number of errors Very good**	90-100	A
GOOD - 4	**- above average with a few errors Good - generally good work with some glaring**	82-89	B
	errors Satisfactory - not bad, but with a significant number of shortcomings Fair -	75-81	C
SATISFACTORY - 3	**performance meets the minimum criteria Unsatisfactory - needs work before how to**	69-74	D
	get a credit or an exam (without re-studying the module) Unsatisfactory - serious further	60-68	E
UNSATISFACTORY - 2	**work is needed (re-studying the module)**	35-59	FX
	———————	<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).