Ukrainian State University of Railway Transport

APPROVED

Minutes of the meeting of the department of automation and computer telecontrol of train traffic

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SYLLABUS OF THE DISCIPLINE

DIAGNOSTICS AND TESTING OF RAILWAY AUTOMATION SYSTEMS

_II_semester 2022 - 2023 academic year

Level of higher education (master's degree).
Branch 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 schedule .

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Web page of the course:
https://do.kart.edu.ua/course/view.php?id=9581

Join the Zoom conference
https://us04web.zoom.us/j/5298584223?pwd=cmsvTC9FbUdYaTN1aWRNKzRUanBOdz09
Conference ID: 529 858 4223
Password: 057623

1 Abstract

The study program of the normative educational discipline "Diagnostics and testing of railway automation systems" is compiled in accordance with the educational program of the second-level higher education (master's degree) specialty 151 "Automation and computer-integrated technologies".

The subject of the discipline is the study of the main categories and concepts, methods, models and means of technical diagnostics and testing of modern railway automation systems (microprocessor electrical and dispatching centralization, automatic and semi-automatic blocking, etc.). It provides the basic concepts of the theory and practice of organizing and carrying out technical control and diagnostics of the technical condition of microelectronic systems and devices of railway automation through tests using models of various types and orders (physical, simulated, combined).

2 Purpose and tasks of the academic discipline

The purpose of teaching the educational discipline "Diagnosis and testing of railway automation systems" is to prepare masters for creative activities in research, development, certification, design and operation of railway automation systems.

The main tasks of studying the discipline "Diagnostics and testing of railway automation systems" are the master's student's assimilation of theoretical provisions and acquisition of practical skills in technical diagnostics and testing of railway automation systems, built on a diverse element base, in the conditions of production, operation and repair.

know:

1. Principles of construction, algorithms of operation, methods of automation of design, basic technical characteristics and features of current and prospective means of testing and technical diagnostics of RA systems.
2. Current and prospective methods, models and means of tests and diagnostics development of microelectronic systems and devices RA.
3. Features of physical, mathematical and simulation modeling of technological processes in railway transport for the purpose of its use in tests and diagnostics of RA devices.
4. Quantitative and qualitative requirements for RA systems, methods of their testing, subincreasing the reliability and safety of functioning in accordance with national and international standards.
5. Methods of assessing the reliability and effectiveness of microprocess tests weed systems for various purposes.
6. The main normative documents of Ukraine, Europe and the world, which regulate processes of execution and processing of test results of modern ASK TP, including by rail transport.

be able to:

1. Rationally choose the main destination indicators and corresponding rmatics of RA systems and their functional nodes.
2. Develop methods of simulation, bench and operational tests trials of RA systems for various objects of implementation.
3. Form models for testing systems FOR various objects of implementation development with the use of computer-aided design tools.
4. Develop test scenarios (program scripts) for programmable microelectronic systems RA.
5. Organize and conduct tests according to the main indicators appointment of RA systems and established methods.
6. Develop and design test stands and diagnostic complex systems RA.
7. Process test results of RA systems, carry out forecasting on their basis the state of RA systems using the methods of mathematical statistics and the theory of experiment planning.
8. Calculate and evaluate the reliability and effectiveness of the results tests using simulation, physical and combined models according to various criteria.

have an idea:

1. About the ways of improving methods, models and means of testing and diagnostics of RA systems in the near and distant future.
2. Features of certification of modern RA systems.

3 Interdisciplinary connections

Interdisciplinary connections. The teaching of the discipline is based on knowledge, skills and interdisciplinary connections. The teaching of the discipline is based on the knowledge, abilities and skills acquired during the study of the disciplines "Fundamentals of the theory of reliability and functional safety", "Mathematical models of production processes", "Station automation systems", "Automation systems in races", "Innovation systems remote control and control", "Technical diagnostics". The discipline ensures mastery of basic professional competences by students of the second level of higher education, and also ensures the performance of coursework (projects), qualification works and diploma works (projects).

4 Формат дисципліни

Blended Learning – the teaching of an academic discipline involves a combination of training of traditional forms of classroom training with elements of electronic training learning that uses special information technologies, such as computer graphics, audio and video, interactive elements, online counseling, etc.

During the session, the face-to-face format (*offline / Face to face*), in the intersessional period - remote (*offline / online*).

5 Компетентності

Planned general competences (GC), professional competences (FC), learning outcomes (LO):

GK 01. Synthesis and analysis. Ability to abstract thinking, analysis and synthesis of technological processes, phenomena, mechanisms and understanding of their cause and effect relationships.

GK 02. Interpersonal interaction. The ability to work in a team, conduct scientific discussions, convince and influence other participants in group processes, demonstrate a wide range of cognitive, legal and intellectual skills for the purposes of effectively ensuring the functioning of train control and regulation systems, protecting intellectual property.

GK 03. Scientific and research skills. The ability to carry out scientific research in professional activity and / or innovative activity, the ability to generate new ideas. FC 02. Information technology skills. Ability to search, process and analyze information, develop and implement information systems, identify and use optimal software in professional activities.

FC 03. Forecasting skills. The ability to identify problems, set strategic goals, forecast the development of technological and economic processes, phenomena and mechanisms.

FC 04. Calculation skills. Ability to use methods of planning, design, modeling, control, strategic analysis of technological and economic events, phenomena and mechanisms.

FC 05. Deep knowledge and understanding. Ability to develop models. To analyze and structure technological and economic events and phenomena from the point of view of knowledge of modern theoretical organizational and methodical foundations of the construction and functioning of systems of control and regulation of train traffic.

FC 06. Assessment skills. The ability to recognize the need and initiate changes based on the assessment of technological and economic events and phenomena, to develop algorithms for solving management problems using appropriate tools.

FC 07. Solving problems. The ability to structure and solve problems in various professional situations, the ability to apply acquired skills, knowledge, experience and to engage in international cooperation in professional activities.

FC 08. Motivational skills. The ability to think positively in a professional environment, the ability to show professionalism and the ability to learn.

PRN 01. The ability to demonstrate a systematic understanding of professional knowledge in planning and forecasting the operation of automation systems and computer-integrated technologies by calculating their main technical and economic indicators based on data from technical diagnostics, analysis of technical documentation.

LO 02. The ability to apply knowledge in the development and implementation of innovations, solving complex problems in professional activity, taking into account the relationship and interaction with other spheres of activity.

LO 03. The ability to conduct scientific research on the development, analysis and research of automation systems and computer-integrated technologies individually or as part of a team, which requires a sufficient level of knowledge of methodology, processing of scientific sources, analysis of qualitative and quantitative accounting data, reporting .

LO 04. Develop and propose new technical solutions and apply new technologies.

LO 05. The ability to demonstrate knowledge of the development of criteria for the adoption and implementation of scientific-practical and managerial decisions using appropriate methods and principles in the field of professional activity.

LO 12. Know and identify possible risks, ensure personal safety and the safety of other people in the field of professional activity.

LO 13. To use the system of quality and product certification in the field of professional activity.

LO 14. The ability to demonstrate the ability of strategic analysis and predictive assessment of the technological processes of the functioning of automation systems and computer-integrated control and research of the effectiveness of the results of their improvement, development and design.

LO 15. The ability to master the skills of working with applied software packages for automated design and research of automation systems and computer-integrated control, to use information technologies to solve practical tasks in the field of professional activity.

LO 16. The ability to act autonomously and be independent in planning and implementing projects at a professional level.

LO 17. To be able to use the principles and methods of system analysis in scientific and technical activities, to analyze cause-and-effect relationships between significant factors and technical and economic characteristics.

LO 20. A person's ability to solve complex tasks and problems in a certain field of professional activity or in the learning process, which involves conducting research and/ or implementing innovations and is characterized by uncertainty of conditions and requirements.

6 Policy of the course

The teacher must:

1. Conduct classes at a good methodical level.
2. Cover all topics described in the syllabus.
3. To conduct various types of classes with OPV and, if necessary, additional classes.
4. Patiently explain to students questions that are incomprehensible to them.
5. Do not be late for classes.
6. Do not be distracted, turn off the mobile phone.
7. To be tolerant, open and friendly to students.

The student is obliged to:

1. Do not be late for classes.

2. Do not be distracted or talk during class, turn off your mobile phone.
3. To submit educational tasks in the established terms
4. Do not miss classes, in case of absence due to illness, provide a certificate.
5. Take an active part in the educational process.
6. To be tolerant, open and friendly to fellow students and the teacher.

When organizing the educational process at the Ukrainian State University of Railway Transport, students, teachers, methodologists and the administration act in accordance with: Regulation on independent work of students (link); Regulations on the organization of the educational process (link); Regulations on the procedure for transfer, expulsion and renewal of students (link); Regulations on student practice (link); Regulations on the rating system of knowledge assessment (link); Regulations on academic integrity (link); Regulations "Criteria for evaluating students' knowledge" (link); Regulations on the qualification (graduation) work of the student (link); Provisions on the conclusion and control over the execution of the contract for the provision of educational services (link);

7 Forms of control

Control of students' knowledge and skills (current and final) from the course is carried out according to the credit-module system of the organization of the educational process. The student's rating for mastering the discipline is determined on a 100-point scale.

PROCEDURE FOR ASSESSMENT OF LEARNING RESULTS

The procedure for evaluating learning results is determined by the Regulation on control and evaluation of the quality of students' knowledge at the Ukrainian State University of Railway Transport.

Fgrading based on a 100-point scale poop

Maximum number of points	
type of control	Сума балів
Current control: 1) individual tasks 2) practical classes 3) laboratory classes	to 60 to 30 to 15 to 15
Modular control	up to 40
Course work/project	up to 100

Notes. The current control includes total points for the performance of individual tasks, except for CP/CW, evaluation of the results of practical, laboratory and other types of training sessions

Maximumthe number of points that a student of higher education can get per module, is100(to60 points of current control and up to 40 points of modular control). The arithmetic mean of the sum of the module grades is the grade for the semester.

When filling out the credit and examination information and the credit book and the individual study plan (upon successful passing of the exam/ credit) of the student of higher education, the grade given on a 100-point scale must be transferred to the national scale (excellent, good, satisfactory (unsatisfactory) for exams, term papers/projects or passed/failed for credits) and the ECTS scale (A, B, C, D, E, F).

Determination of the name according to the national scale (rating)	Determination of the title according to the ECTS scale	For 100 ballroom scale	ECTS the price
EXCELLENT – 5	**Perfectly** - excellent performance only with with a small number of errors	90-100	A
GOOD – 4	**Very good** - above average level with by several mistakes	82-89	B
	Fine - generally correct work with a certain number of gross errors	75-81	C
SATISFACTORY - 3	**Satisfactorily** - not bad, but with significant number of defects	69-74	D
	Enough – performance satisfies minimal criteria	60-68	E
UNSATISFACTORY - 2	**Unsatisfactorily** - you need to work before getting a credit or exam (without repeating the module)	35-59	FX
	Unsatisfactorily - a serious approach is required further work (re-study of the module)	<35	F

8. Technical and software/equipment

During the session, it is desirable to have a mobile device (phone) for operational communication with the administration, methodologist and teachers regarding the conduct of classes and consultations. In the intersessional period, computer equipment (with access to the global Inernet network) and office equipment for communication with the administration, methodologist, teachers and preparation (printing) of an individual task (coursework).

9. Course resources

Information about the course is posted onwebsite of the University , 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, along with questions to

consider when preparing for classroom discussion. Necessary preparation must be completed before the start of the next lecture. During the discussion, it is suggested to reflect critically on the topics of the course. The student should be ready for discussions.

10. Topics of the course

The list of main topics of lectures and practical classes of the course is given below. The student needs to follow the changes in the schedule.

Lectures:

1. Testing of RA systems as a means of their technical control and diagnostics and certification. Purpose and main types of tests.
2. Normative documents that regulate requirements for tests. Vlastiffness and test characteristics
3. Concept of method, tool, model, program and test methodology. Youto the document "Test program and methodology"
4. Simulation during tests. Simulation tests (testsimulations, machine models) and their characteristics. Ways of implementing test tools during simulation modeling of RA elements and devices.
5. Bench tests. Schemes of test benches for various systems topics RA**.**
6. Synthesis of simulation and physical modeling during system tests topics FOR. Combined tests. The structure and methods of configuration of the combined test complex of the microprocessor electrical interlocking.
7. Evaluation of the effectiveness of various types of tests.
8. Validity of test results.
9. Processing of test results.
10. Design of test equipment hardware.
11. Automated design and configuration of models for production of railway automation/
12. Use of simulation and combined models for tests in operation process.
13. Periodic control of the reliability of technical hazard diagnosis furnace state of microprocessor controllers based on simulation.
14. Use of control and diagnostic tools and quality models simulators for operative and technical personnel of RA.

Practical training::

1. Development and analysis of regulatory documents in the field of diagnostics and tests of railway automation systems.
2. Test objects and their characteristics. Defining the goal and objectives according to tests of the RA system.
3. Determination of methods of modeling individual components of the test object baths Choosing a system of representatives to connect to the stand.

4. Selection and justification of methods and models for system testing BY. The configuration of the combined test complex of the microprocessor.

5. Development of a structural diagram of a combined test complex of the microprocessor. Ways to connect the system of representatives.

6. Calculation of the effectiveness of combined tests of the microprocessor system of station according to the criterion of minimum equipment.

7. Calculation of the reliability of combined tests of the microprocessor system with using the maximum likelihood method.

8. Development of the program and testing methods of the iron microprocessor system station on simulation models.

9. Analysis of methods and means of automated design and configuration development of simulation models of RA systems.

10. Configuration of the simulation model of the microprocessor system using special alized language XML.

11. Graph-analytical methods of configuration of models for testing. Makegiving a graphic model of the microprocessor system.

12. Analytical interpretation of the graphic model of the microprocessor system based on parametric topological matrices. Block-diagonal method.

13. Electronic presentation of the graph-analytical model of track development to the microprocessor system. Synthesis of a model for tests using CAD.

14. Checking the correctness of automated design and configuration model testing for microprocessor tests using a control graph.

15. Reconfiguration of the combined model for testing the microprocessor system with for the purpose of checking the dependencies of the electrical interlocking at the station.

16. Reconfiguration of the combined model for testing the microprocessor system with for the purpose of periodic control of the technical diagnostics subsystem.

Laboratory classes:

1. Analysis of the OSVR QNX file system 6.3.2. Definition of files, sharethem in the work of the stand of the specialized simulation model (SSM) of the microprocessor.

2. Study of the components of the SSM complex of the three-channel microprocessor system performance (2 out of 3).

3. Study of the components of the SSM complex of the single-channel RMC system implementation.

4. Simulation tests of the microprocessor system in the part of individual keRuling by objects of centralization.

5. Simulation tests of the microprocessor system in terms of installation and implementation zation of routes and opening of signals.

6. Simulation tests of the microprocessor system in terms of the functioning of the axle count systems.

7. Simulation tests of the microprocessor system in terms of introduction and implementation responsible teams.

8. Generalization of the results of tests of the microprocessor system. Compilation of protokol tests.

11. Code of academic integrity

The policy of ensuring that the participants of the educational process observe academic integrity is determined by the Code of Academic Integrity of the Ukrainian State University of Railway Transport. The main measures to prevent and detect academic plagiarism are determined by the Regulations on the Organization of the Educational Process of the Ukrainian State University of Railway Transport. The code is available forlink .

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 forlink .

In particular, compliance with the Code of Academic Integrity of UkrSURT 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 should indicate the degree of their involvement in the work.

12. 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 link.