Ukrainian State University of Railway Transport

Recommended
at a meeting of the department
specialized computer systems
prot. . № 1 dated 25.08.2025

ORGANIZATION AND DATABASE AND KNOWLEDGE MANAGEMENT SYSTEMS

I-II semester 2025-2026 academic year

Level of higher education: second

Degree of higher education: master's degree

Specialty: 123 – Computer engineering

Educational program: Intelligent information technologies

Amount: 5 ECTS credits

Number of modules: 2

Reporting: exam

Lectures and laboratory classes according to the schedule http://rasp.kart.edu.ua/

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

TEAM OF TEACHERS

Lecturers: Dotsenko Serhiy Ilyich (lecturer)

Contacts: 38 (057) 730-10-61, e-mail: sirius_3k3@ukr.net

Lecturer assistants:

Reception and consultation hours: 13.00-14.00 Tuesday - Thursday

Course web pages:

Additional information materials:

Additional information materials: http://metod.kart.edu.ua

The teaching of the educational discipline "Knowledge Base Creation Technologies" consists in preparing students to participate in the development, design, construction and operation of information systems in railway transport.

The task of studying the discipline "Technology of creating knowledge bases" is: the use of modern software in the processing of operational information and the formation of knowledge bases for the ARM of operational workers.

6 credits / 180 hours of EST5 are assigned to the study of the academic discipline.

Why should you choose this course?

If you are interested in the problems of development and implementation in production of modern computer systems for controlling the movement of trains, control systems for responsible processes and productions of state importance, if you want to get an interesting and high-paying job in Ukraine and abroad in the future, where In recent years, there has been a very high demand for specialists in information systems and technologies, then this course is exactly what you need!

Applicants are expected to have: a basic understanding of physics, mathematics, the basics of programming computer systems and controllers, knowledge of the basics of circuitry, methods of building computer system architecture, as well as knowledge of the analysis of technical and software solutions.

The content of the course is devoted to issues of knowledge presentation, development of systems based on knowledge, elements of expert systems, technology of designing and developing knowledge bases, theoretical aspects of knowledge engineering, knowledge acquisition, knowledge extraction, knowledge structuring, as well as knowledge engineering technologies . For this purpose, each candidate develops their own knowledge bases in laboratory classes with automated workplaces "ARM - (bachelor's final thesis)", "ARM - Library", "ARM - Educational activity", the architecture model of which is based on the open architecture of the knowledge model. This ensures the acquisition of the skills of the scientific organization of work of the applicant at the stage of his education.

The team of teachers and our production colleagues will be ready to provide any help with the most difficult aspects of the course by e-mail and in person - during working hours.

Course overview

The course is studied over the course of one semester and gives students a deep understanding of the problems of building and developing knowledge bases that arise at the first stages of the life cycle of information systems and ways to solve them, and provides a reliable basis for quick adaptation at the first workplace when employed in production in Ukraine or in countries near and far abroad.

The course consists of one lecture per week and one laboratory session per week. 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 the development of projects of their own knowledge bases "ARM - Graduation work of a bachelor", "ARM - Library", "ARM - Educational activity". The course includes lectures by invited employers (specialists of Radio Information Systems LLC, INSOLAR-CLIMAT LLC).

The laboratory classes of the course involve learning the methods and means of developing knowledge bases, as well as the development of projects of own knowledge bases: knowledge bases "ARM - Bachelor's thesis", "ARM - Library", "ARM - Educational activity". Completion of the tasks is accompanied by immersion in related disciplines that complement the topics and forms the student's informational and communicative competence.

Course resources

Information about the course is posted on the University's website in the "distance learning" section, along with questions that need to be considered when preparing for a discussion in the classroom. The necessary preparation must be completed before the start of the next lecture. During the discussion, we will invite you to critically consider and analyze known technical solutions of systems used in Ukraine and European countries for the needs of railway transport. You should be ready for discussions and brainstorming - we want to know your opinion on the following questions!

Examples of questions for discussion are available on the slides of the respective presentations. Here are some of them:

1. Describe modern ideas about the purpose of introduction
knowledge bases for railway transport and industry
in general.

2. What tasks are set in the Strategy for the introduction of digitalization of industry in Ukraine (for the concept of Industry 4.0).

3. Explain what role knowledge bases play in the development of information systems and technologies.

4. Using the example of specific systems, show the principles of developing knowledge bases.

5. In your opinion, what role does a human operator play in railway automation systems, the reasons for dangerous actions of personnel, the principles of securing man-machine systems of critical purpose.

Course Topics

Module 1

Content Module 1 Fundamentals of Database Methodology

Topic 1 Introduction to Databases

Topic 2. Database Environment

Topic 3 Database Management Systems

Topic 4 Relational Data Model

Topic 5 Relational Algebra

Topic 6 Information System Development Life Cycle

Topic 7 Conceptual Database Design

Content Module 2 Fundamentals of Database Design Methodology

Topic 8 Building the Entity-Relationship Model

Topic 9 Logical Database Design

Topic 10 Normalization

Topic 11 Elements of SQL Language (4 hours)

Topic 12 Physical Database Organization

Topic 13 Tools for Database Design Automation

Topic 14 Database Applications

Module 2

Content Module 3 Intelligent Systems Based on Knowledge

Topic 1 Intelligent Systems Based on on knowledge

Topic 2 Expert systems

Topic 3 Logical inference

Topic 4 State space search

Topic 5 Decision-making process

Topic 6 Knowledge and its properties

Topic 7 Knowledge representation

Content module 4 Representation models and methods of processing explicit knowledge

Topic 8 Semantic networks

Topic 9 Frame models

Topic 10 Decision trees

Topic 11 Associative rules

Topic 12 Software tools for representing and processing knowledge (4 hours)

Topic 13 Examples and illustrations

INTERDISCIPLINARY RELATIONS

The discipline is based on the main provisions of the disciplines:

Higher mathematics

Physics

Engineering and computer graphics

Computer control systems

The discipline is the basis for studying the disciplines:

Software engineering

Computer systems for collecting and processing technological information

Technology and automation of the design of devices and computer systems

PLANNED LEARNING OUTCOMES (COMPETENCES)

Integral competence

The ability to solve complex tasks and problems in the field of professional activity with an in-depth level of knowledge and skills of an innovative nature, a sufficient level of intellectual potential to solve problematic professional tasks in a certain field of development of information systems based on artificial intelligence models, in the creation of industrial Internet of Things, smart machines and other highly intelligent industries.

General competences

ZK 1. Synthesis and analysis. The ability to think abstractly, analyze and synthesize technological processes, phenomena, mechanisms and understand their cause-and-effect relationships.

ZK 3. Scientific and research skills. The ability to carry out scientific research in professional activity and/or innovative activity, the ability to generate new ideas.

Special (professional, subject) competences

FC 2. Information technology skills. Ability to search, process and analyze information, develop and implement information systems, identify and use optimal software in professional activities.

FC 4. Calculation skills. Ability to use methods of planning, design, modeling, control, strategic analysis of technological and economic events, phenomena and mechanisms.

FC 5. Deep knowledge and understanding. The ability to develop models, conduct analysis and structure technological and economic events and phenomena from the point of view of knowledge of modern theoretical, organizational and methodological foundations of highly intelligent productions related to the industrial revolution 4.0.

The normative content of the training of higher education applicants, formulated in terms of learning outcomes

The final, summative and integrative learning results determined by the educational program, which determine the normative content of training:

RN 2. 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.

RN 3. The ability to conduct scientific research on the issues of development, analysis and research into the functioning of highly intelligent industries related to the industrial revolution 4.0, 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.

RN 6. The ability to demonstrate a wide range of cognitive and intellectual skills in the formation, improvement and implementation of information support systems.

RN 14. The ability to possess the skills of working with applied software packages for automated design and research of informatization systems and computer-integrated management, to use information technologies to solve practical tasks in the field of professional activity.

RN 15. The ability to act autonomously and be independent in planning and implementing projects at a professional level.

RN 16. The ability to bear responsibility for the development of professional knowledge and demonstrate proficiency in a foreign business language.

Ability to abstract thinking, analysis and synthesis.

Ability to learn and master modern knowledge

Ability to identify, pose and solve problems

Ability to apply the legal and regulatory framework, as well as national and international requirements, practices and standards in order to carry out professional activities in the field of computer engineering

Ability to use design automation tools and systems to develop components of computer systems and networks, Internet applications, cyberphysical systems, etc.

Ability to identify, classify and describe the work of software and hardware, computer and cyberphysical systems, networks and their components through the use of analytical and modeling methods.

When filling in the student's test report and test book (individual curriculum), the grade set on a 100-point scale must be transferred to the state scale (5, 4, 3,) and the ECTS scale (A, B, C, and , D)

Determination of the name on the state scale (assessment)	Determination of the name on the ECT scales	**On a 100-point scale**	**ECTS 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 errors	82-89	B
	Good - in general, the right work with a number of gross errors	75-81	C
SATISFACTORY - 3	Satisfactory - not bad, but with many shortcomings	69-74	D
	Enough - the performance meets the minimum criteria	60-68	E
Unsatisfactory - 2	Unsatisfactory - you need to work before getting a test or exam (without re-studying the module)	35-59	FX
	Unsatisfactory - serious further work required (re-study of the module)	<35	P

Dotsenko Sergey Ilyich http://kart.edu.ua/kafedra-ckc-ua/kolectuv-kafedru-sks-ua/butenko-vm-ua?id=3275 - lecturer on information technologies. He received a degree of Ph.D. in specialty 05.13.06 information technology in 2017 at KhNUMG. ОНМ. Бекетова. Areas of research: cybernetic systems, intelligent information technology, security of computer systems.

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 links: http://kart.edu.ua/documentu-zvo-ua

In particular, compliance with the Code of Academic Integrity of the Ukrainian DUZT means that all work on exams and tests must be performed individually. During independent work, students can consult with teachers and other students, but must solve problems 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 documented. In the case of working together 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, material independence and socialization of young people with disabilities 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 based on modern pedagogical, information and telecommunication technologies has been created. Access to distance learning materials from this course can be found at: https://do.kart.edu.ua