Ministry of Education and Science of Ukraine
National Aerospace University
«Kharkiv Aviation Institute»

Department of Computer Systems, Networks and Cybersecurity (№ 503)

APPROVED

Educational Programme Guarantor

(signature) Ievgen BABESHKO (First name and LAST NAME)

« 31 » August 2025

SYLLABUS OF COMPULSORY ACADEMIC DISCIPLINE

Qualification Work
(name of the academic discipline)

Field of knowledge: F «Information Technologies»
(code and name of the field of knowledge)

Speciality: F7 «Computer Engineering»
(code and name of the speciality)

Educational and Professional Programme: «System Programming»
(name of the educational programme)

Level of higher education: **Second (Master's)**

Syllabus effective from 01.09.2025

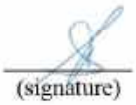
Kharkiv – 2025

Developer(s): Babeshko I.V., Associate Professor,
(surname and initials, position, academic degree and title)

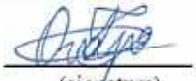

(signature)

The syllabus of the academic discipline was reviewed at the Department meeting of Computer Systems, Networks and Cybersecurity
(name of the department)

Minutes of meeting No. 1 dated « 29 » August 2025

Head of Department Prof.  Viacheslav KHARCHENKO
(academic degree and title) (signature) (First name and LAST NAME)

Agreed with the student representative:


(signature) Polina OHARKO
(First name and LAST NAME)

1. General Information about Instructors

Full name: Babeshko Ievgen

Position: Associate Professor

Academic degree: Candidate of Technical Sciences

Academic title: Associate Professor

List of disciplines taught:

Industrial IoT systems
Security of Industrial Systems and the Internet of Things
Programming Technologies

Research areas:

Modelling and assessment of reliability and safety, development and verification of software for critical industries, industrial Internet of Things.

Contact information:

e.babeshko@csn.khai.edu

Full name: Duzhy Viacheslav

Position: Associate Professor, Department of Computer Systems, Networks and Cybersecurity

Academic degree: Candidate of Technical Sciences

Academic title: Associate Professor

List of disciplines taught:

– Fundamentals of Computer Operation
– Computer and Quantum Processor Architecture
– Operating Systems

Research areas: functional safety of information and control systems (ICS)

Contact information:

v.duzhy@csn.khai.edu

Full name: Zemlianko Heorhii

Position: Associate Professor, Department of Computer Systems, Networks and Cybersecurity

Academic degree: Doctor of Philosophy in Cybersecurity and Information Protection

Academic title: -

List of disciplines taught:

- Programming of Internet of Things Systems,
- Building and Cybersecurity of the Internet of Things,
- Database Organisation and Security,
- Blockchain Technologies and Cryptocurrency Security

Research areas:

smart city technologies and digital security, Internet of Things (IoT) systems, information security and data protection, cyber-risk analysis, database systems, smart network technologies, telecommunications and network technologies, intelligent systems, smart system security.

Contact information:

g.zemlynko@csn.khai.edu

Full name: Karpenko Andrii Serhiiovych

Position: Senior Lecturer

Academic degree: Ph.D.

Academic title: none

List of disciplines taught:

information security in computer networks, theoretical foundations of cryptology, information security management, theory and technologies for developing secure distributed systems.

Research areas:

cloud technologies, cybersecurity, software testing.

Contact information:

a.karpenko@csn.khai.edu

Full name: Kliushnikov Ihor Mykolaiovych

Position: Associate Professor, Computer Systems, Networks and Cybersecurity

Academic degree: Candidate of Technical Sciences

Academic title: Senior Research Fellow

List of disciplines taught: "Reliability and Functional Safety of Information-Computer Systems", "Mobile Programming", "Intelligent Mobile Systems", "Mobile Systems Security".

Research areas: dependability of complex technical systems, application of mobile intelligent systems, service-oriented mobile systems, artificial intelligence.

Contact information:

i.kliushnikov@csn.khai.edu

Full name: Kolisnyk Maryna Oleksandrivna

Position: Associate Professor, Department of Computer Systems, Networks and Cybersecurity

Academic degree: Candidate of Technical Sciences

Academic title: Associate Professor

List of disciplines taught:

Information Theory and Coding

Research areas: Internet of Things, Dependability, Cybersecurity, Reliability, Optimisation Methods, Signal Processing Methods

Contact information:

m.kolisnyk@csn.khai.edu

Full name: Kulanov Vitalii Oleksandrovych

Position: Associate Professor, Department of Computer Systems, Networks and Cybersecurity

Academic degree: Candidate of Technical Sciences

Academic title: Associate Professor

List of disciplines taught: Programmable Artificial Intelligence Tools, Programmable Security Tools, Design and Modelling Patterns, System-on-Chip Programming, Medical Information Protection Technologies, Databases (Course Project)

Research areas: computer system architectures, data storage systems, internet of things (IoT), cloud technologies, AI/ML

Contact information:

v.kulanov@csn.khai.edu

Full name: Leichenko Kyrylo Mykolaiovych

Position: Associate Professor

Academic degree: Doctor of Philosophy (PhD)

Academic title:

List of disciplines taught:

- Computer Networks;
- Programming Fundamentals;
- Data Science Technologies;
- Industrial Internship

Research areas:

Routing and deployment of unmanned intelligent systems, monitoring of critical infrastructure facilities, big data.

Contact information:

k.leychenko@csn.khai.edu

Full name: Morozova Olha Ihorivna

Position: professor

Academic degree: Doctor of Technical Sciences

Academic title: professor

List of disciplines taught:

Programming of Artificial Intelligence Tools in Python, Methods of Modelling and Optimisation of Secure Computer Systems, Theory and Methods of Internet Computing, Python for Artificial Intelligence Systems

Research areas:

Dependability of UAV fleets and intelligent Industrial Internet of Things systems. Methods and technologies of university–industry cooperation in the learning process, including dual education, training, and joint R&D projects; intelligent decision-support tools for generating and selecting cooperation models and implementing intelligent Industrial Internet of Things systems.

Contact information:

o.morozova@khai.edu

Full name: Orekhov Oleksandr Oleksandrovych

Position: Professor

Academic degree: Candidate of Technical Sciences

Academic title: Associate Professor

List of disciplines taught:

Technologies for designing software systems
Technologies for Quality Assurance of Software-Hardware Complexes

Research areas:

Modelling and quality assessment of software development for critical industries.

Contact information:

a.orehov@csn.khai.edu

Full name: Piskachev Oleksandr Ivanovych

Position: Associate Professor, Department of Computer Systems, Networks and Cybersecurity

Academic degree: Candidate of Technical Sciences

Academic title: senior researcher

List of disciplines taught: "Technical Information Protection Systems", "Regulatory and Legal Support for Information Security",

"Intellectual Property", "Organisation of Scientific Research and Intellectual Property Protection", "Legal Information and Computer Technologies in Legal Practice"

Research areas:

Information Protection and Unmanned Systems Security

Contact information:

a.piskachev@csn.khai.edu

Full name: Uzun Dmytro Dmytrovych

Position: professor

Academic degree: Candidate of Technical Sciences

Academic title: Associate Professor

List of disciplines taught:

DevOps Technologies
Operating Systems
Cloud Security Technologies
DevSecOps Technologies
Cybersecurity Domains
DevOps and Cloud Technologies

Research areas:

Implementation of modern technologies for automating the development cycle and ensuring the security posture of IT projects

Contact information:

d.uzun@khai.edu

Full name: Fesenko Herman Viktorovych

Position: Professor

Academic degree: Doctor of Technical Sciences

Academic title: Professor

List of disciplines taught:

Big Data Technologies,
Big Data Processing Technologies,
Big Data for Cybersecurity,
Processing and Analysis of Research Results Using IT,
Theory and Methods of Data Science and Artificial Intelligence.

Research areas:

Dependability of unmanned intelligent systems, monitoring and cybersecurity of critical infrastructure facilities, big data.

Contact information:

h.fesenko@csn.khai.edu

Full name: Shostak Anatolii Vasylovych

Position: Associate Professor, Department of Computer Systems, Networks and Cybersecurity

Academic degree: Candidate of Technical Sciences

Academic title: Associate Professor

List of disciplines taught: Programming Technologies, Data Models and Structures, Programming Technologies (Course Project), Databases (Course Project).

Research areas: data structures, algorithms, neural networks.

Contact information:

a.shostak@csn.khai.edu

2. Description of the Academic Discipline

Form of education	Full-time
Semester	3
Language of instruction	English
Type of discipline	Compulsory
Course volume: ECTS credits / number of hours	20 ECTS credits / 600 hours
Types of learning activities	Individual work
Types of assessment	Defense
Prerequisites	The discipline is based on knowledge acquired during the study of compulsory training components in the general and professional training cycle provided by the speciality curriculum.

3. Objectives and Tasks of the Academic Discipline, Lists of Competencies and Expected Learning Outcomes

Objective – determination of the graduate's level of preparedness for independently organising and conducting research, using modern methods and approaches to problem solving in modern information technologies, particularly computer engineering and system programming, based on the application of theoretical knowledge and practical skills acquired throughout the entire period of study in accordance with the requirements of higher education standards.

Tasks – systematisation, consolidation and expansion of theoretical knowledge acquired during the educational and professional programme training, and their practical application in solving specific scientific, applied, engineering, socio-economic and production issues in a particular field of professional activity; development of Individual work skills, mastery of research and experimentation methodology, physical or mathematical modelling, use of modern information technologies in solving tasks envisaged by the qualification work assignment; determination of the graduate's training level compliance with the requirements of educational degree qualifications, readiness and ability for Individual work in a market economy, modern production, and progress of science, technology and culture.

Competencies acquired:

General Competencies (GC):

- GC1. Ability to adapt and act in new situations.
- GC2. Ability to think abstractly, analyse and synthesise.
- GC3. Ability to conduct research at the appropriate level.
- GC4. Ability to search for, process and analyse information from various sources.
- GC5. Ability to generate new ideas (creativity).
- GC6. Ability to identify, pose and solve problems.
- GC7. Ability to make well-reasoned decisions.
- GC8. Ability to communicate in a foreign language.

Professional Competencies (PC):

- PC1. Ability to determine the technical characteristics, design features, application and operation of software, software-hardware tools, computer systems and networks of various purposes.
- PC2. Ability to develop algorithmic and software components of computer systems and networks, Internet applications, cyber-physical systems using modern programming methods and languages, as well as computer-aided design tools and systems.
- PC3. Ability to design computer systems and networks taking into account objectives, constraints, technical, economic and legal aspects.

– PC4. Ability to build and investigate models of computer systems and networks.

– PC5. Ability to build the architecture of and create system and application software for computer systems and networks.

– PC6. Ability to use and implement new technologies, including smart, mobile, green and secure computing technologies, participate in modernisation and reconstruction of computer systems and networks, various embedded and distributed applications, in particular to improve their efficiency.

– PC8. Ability to ensure the quality of IT products and services throughout their life cycle.

– PC9. Ability to present the results of own research and/or developments in the form of presentations, scientific and technical reports, articles and papers at scientific and technical conferences.

– PC10. Ability to identify, classify and describe the operation of software-hardware tools, computer systems, networks and their components;

– PC11. Ability to select effective methods for solving complex computer engineering problems, critically evaluate the results obtained and justify decisions made.

– PC12. Ability to use methods of analysis, identification and synthesis of computer systems and networks, cyber-physical systems, Internet of Things devices and IT infrastructures.

– PC13. Ability for personal and professional self-improvement, learning and self-development.

Programme Learning Outcomes (PLO):.

– PLO1. To apply general cognitive approaches, methods of mathematics, natural and engineering sciences to solving complex computer engineering problems.

– PLO2. To find the necessary data, analyse and evaluate them.

– PLO3. To build and investigate models of computer systems and networks, assess their adequacy, and determine the limits of applicability.

– PLO4. To apply specialised conceptual knowledge that includes modern scientific achievements in the field of computer engineering, necessary for professional activity, original thinking and research, critical comprehension of information technology problems at the intersection of knowledge fields.

– PLO5. To develop and implement projects in computer engineering and related interdisciplinary projects, taking into account engineering, social, economic, legal and other aspects.

– PLO6. To analyse the problem area, identify and formulate specific problems requiring solution, and choose effective methods for their resolution.

– PLO7. To solve problems of analysis and synthesis of computer systems and networks.

– PLO8. To apply knowledge of technical characteristics, design features, purpose and operating rules of software-hardware tools of computer systems and networks to solve complex computer engineering problems and related issues.

– PLO9. To develop software for embedded and distributed applications, mobile and hybrid systems.

– PLO10. To search for information in various sources to solve computer engineering problems, and analyse and evaluate this information.

– PLO11. To make effective decisions on the development, implementation and operation of computer systems and networks, analyse alternatives, assess risks and probable consequences of decisions.

– PLO12. To communicate freely both orally and in writing in Ukrainian and one foreign language (English, German, Italian, French, Spanish) when discussing professional issues, research and innovations in the field of information technologies.

– PLO13. To clearly and unambiguously communicate own knowledge, conclusions and reasoning on information technology issues and related cross-sectoral matters to specialists and non-specialists, including students.

– PLO14. To plan and conduct scientific research in the field of computer engineering, formulate and test hypotheses, select methods and tools, analyse results, and justify conclusions.

4. Content of the Academic Discipline

MODULE 1
Content Module 1. Preparation and Defense of the Qualification Work

Topic 1. Assignment Allocation. Problem Formulation.

Individual work: Justification of the research direction and formulation of the problem for further investigation.

Topic 2. Analytical Review.

Individual work: Systematisation and analysis of literature sources on topics studied during preparation of the qualification work, taking into account the best structural, methodological, algorithmic, software, technological and production achievements currently available. Thorough and systematic presentation of the current state of issues and problems addressed during qualification work preparation. Work with English-language sources.

Topic 3. Design Section.

Individual work: Main scientific and technical aspects of solving the stated problem, proposed solutions, their analysis, results of developing system engineering, methodological, algorithmic, functional and software components. Theoretical and logical solution of the stated problem, comparative evaluation of different solution variants by main technical characteristics, complexity, problem-solving time, reliability indicators, errors, and validity of results obtained. Development of software products.

Topic 4. Research Section.

Individual work: Objective, description of specific experiment programmes, their purpose, accuracy and validity estimates of data obtained. Comparison of theoretical and experimental data, results of developing special test programmes and their application to main software products. Technological support of the process of creating, debugging and testing software products. Preparation of publications, conference abstracts, conference presentations.

Topic 5. Business Plan.

Individual work: Economic justification of the project feasibility, assessment of economic indicators and competitiveness.

Topic 6. Development of the Explanatory Note.

Individual work: Requirements of DSTU 3008:2015. Formatting of the explanatory note in accordance with the rules for formatting educational and research documents. Checking the explanatory note for violations of academic integrity.

Topic 7. Presentation Development and Public Defense.

Individual work: Developing the presentation. Preparing the report.

5. Individual Assignments

The individual assignment for the qualification work is agreed upon with the supervisor.

6. Teaching Methods

Consultations with the supervisor, as well as Individual work of students using relevant materials (Sections 11, 12).

7. Assessment Methods

Final assessment in the form of a public defense.

8. Assessment Criteria and Score Distribution, received by students

Table 8.1 – Score distribution received by students

Components of academic work	Points per assignment	Number of sessions (assignments)	Total number of points
Content Module 1			
Individual work	0…65	1	0…65
Public defense	0…35	1	0…35
Total per semester			**0…100**

Table 8.2 – Assessment scales: point-based and traditional

Total points	Grade on the traditional scale	
	Exam, defense	Pass/fail
90 – 100	Excellent	Passed
75 – 89	Good	
60 – 74	Satisfactory	
0 – 59	Unsatisfactory	Failed

Assessment criteria for student work during the semester

Satisfactory (60-74) – Demonstrate minimum knowledge and skills. Be able to justify the topic (relevance, practical significance, formulate the objective and tasks of the work); demonstrate the ability to generalise and systematise new progressive solutions on the research topic; demonstrate the results of the research part (completion of assigned tasks, results obtained, design, development, etc.); be able to work on the qualification work throughout the semester under the supervisor's guidance. The research part must contain an analytical component comparing own development with existing ones.

Good (75-89) – Have a firm command of the necessary knowledge for a positive grade, demonstrate results of reviewing approaches and analysing existing solutions, be able to justify the research objective and clearly formulate the problem statement; demonstrate the results of the research part (completion of assigned tasks, independently obtained results, design, development, etc.); be able to work independently and steadily on the qualification work throughout the semester.

Excellent (90-100) – Have excellent knowledge and demonstrate the necessary volume of knowledge during the defense for a positive grade. Be able to formulate directions for further research and propose further improvements. Have proof of work approbation in the form of published conference abstracts, articles, etc.

9. Course Policy

1. **Compliance with academic integrity requirements** by students during the study of the academic discipline. During the study of the academic discipline, students must comply with generally accepted moral and ethical norms and rules of conduct, academic integrity requirements stipulated by the Academic Integrity Policy of the National Aerospace University «Kharkiv Aviation Institute» (https://khai.edu/polozenna-pro-akademicnu-dobrocesnist). Students' works are expected to be their original research. Failure to cite sources, fabrication of sources, plagiarism, and interference with the work of other students constitute, but are not limited to, examples of possible academic dishonesty. Detection of academic integrity violations in the explanatory note to a student's qualification work is grounds for denial of admission to the defense.

Conflict Resolution. The procedure and processes for resolving conflicts are governed by the Code of Ethical Conduct at the National Aerospace University «Kharkiv Aviation Institute» (https://khai.edu/kodeks-etiki).

10. Methodological Support

1. Discipline page in the distance learning system «Mentor» [Electronic resource]. URL: https://mentor.khai.edu/course/view.php?id=8328

11. Recommended Literature

Core

1. Koliesnikov O. V. Fundamentals of Scientific Research: study guide; Ministry of Education and Science of Ukraine, Kyiv: Centre for Educational and Practical Literature, 2019. 144 p.
2. Dolzhanskyi I.Z. Business Plan: Development Technology: study guide, 2nd ed. Kyiv: Centre for Educational and Practical Literature, 2020. 384 p.

3. Rules for Formatting Educational and Research Documents: study guide / Yu. A. Vorobiov, Yu. O. Sysoiev. 4th ed. [Electronic resource]. URL: http://library.khai.edu/library/fulltexts/metod/Vorobjov_Pravila.pdf

4. DSTU 3008:2015. Information and documentation. Reports in the field of science and technology: Structure and formatting rules. Kyiv: SE «UkrNDNC», 2016. 26 p.

5. DSTU 8302:2015. Information and documentation. Bibliographic reference: General provisions and rules of compilation. Kyiv: SE «UkrNDNC», 2016. 16 p.

Supplementary

2. DSTU ISO 5807:2016. Information processing. Symbols and conventions for data, programme and system flowcharts, programme network charts and system resources charts.

3. Regulations on Academic Integrity at the National Aerospace University «Kharkiv Aviation Institute» [Electronic resource]. URL: https://khai.edu/polozenna-pro-akademicnu-dobrocesnist

12. Information Resources

1. Law of Ukraine on Higher Education [Electronic resource]. URL: https://zakon.rada.gov.ua/laws/show/1556-18#Text

2. Digital institutional repository of the National Aerospace University «Kharkiv Aviation Institute» [Electronic resource]. URL: https://dspace.library.khai.edu

3. Materials of international projects under the TEMPUS, ERASMUS+, H2020 [Electronic resource]. URL: . https://csn.khai.edu/view/article/id/3420.html