MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL TECHNICAL UNIVERSITY
"KHARKIV POLYTECHNICAL INSTITUTE"

# EDUCATIONAL-PROFESSIONAL PROGRAM
## System analysis and management
## The second (master's) level

| | |
|---|---|
| **specialty** | **124 System analysis** |
| **field of knowledge** | **12 Information Technology** |
| **qualification** | **Master of Systems Analysis** |

APPROVED by Academic Council
Chairman of the Academic Council
NTU "KhPI"

_____L.L. Tovaznansky

«____» _____ 20___ .
protocol №__ from «__» _____ 2019.

The educational program is put into action
from _____ 2019 y.
Rector _____ E.I. Sokol
(order № __ from «___» _____ 2019.)

NTU «KhPI»
Kharkiv 2019

# PREAMBLE

## Developed by a working group

Chairman of the working group

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Members of the working group:

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# C O N T E N T

# 1. EDUCATIONAL PROFESSIONAL PROGRAM PROFILE

## System analysis and control
## from the specialty 124 System Analysis

| 1 – General information | |
|---|---|
| Full name of university and institute / faculty | National Technical University "Kharkiv Polytechnic Institute"<br>Computer Science and Software Engineering Faculty |
| Higher education and the name of the qualification in the language of the original | Degree – магістр (Master)<br>Qualification – магістр з системного аналізу (Master of systems analysis) |
| Level of NQF (National Qualifications Framework) | Ukrainian NQF– 8th level, FQ-EHEA – second cycle, EQF-LLL – 7 level |
| Educational program official name | Educational and professional program of the master of system analysis preparation (practical direction) |
| Type of diploma and volume of educational program | Master's degree, unitary, 90 credits,<br>ehe term of training is 1 year 4 months |
| Accreditation | Certificate of Accreditation: Serie PD - IV № 2158945 from 12 august 2013 year |
| Prerequisites | Bachelor's degree |
| Language (s) of teaching | Ukrainean/English |
| The duration of the educational program | Until next accreditation |
| Internet address of the permanent placement of the educational program | http://web.kpi.kharkov.ua/say |
| **2 – The purpose of the educational program** | |
| Training of a specialist capable of solving complex problems and problems in the field of system analysis and decision-making and to carry out innovative professional activities. | |
| **3 – Characteristics of the educational program** | |
| Subject area (knowledge branch, specialty, program) | Knowledge branch: 12 Information Technology<br>Specialty: 124 System analysis<br>Program: System analysis and control |
| Orientation of the educational program | Educational-professional |
| The main focus of the educational program and specialization | Special education in the field of information technology in the specialty System analysis of the program System analysis and control<br>Keywords: decision-making, risks, complex systems, management and forecasting, system analysis, financial market |
| Features of the program | Mandatory specialty in the IT companies of the department's partners |

| 4 – Придатність випускників до працевлаштування та подальшого навчання | |
|---|---|
| Suitability for employ-ment | Types of economic activity:<br>72 Activities in the field of informatization<br>73 Research and development<br>80 Education<br>Professional titles:<br>2149.2 Analyst Systems<br>2131.1 Researcher in the field of computing systems<br>2121.2 Mathematical analyst for operations research<br>2139.1 Researcher (Computing) |
| Further training | Possibility to continue studying at the third (educational-scientific) level for obtaining the degree of Doctor of Philosophy |
| **5 – Teaching and Rating** | |
| Teaching and learning | Lectures, workshops and seminars, computer workshops and laboratory work; mixed learning technology; master's work |
| Rating | Oral and written exam, testing. Evaluation is carried out on a national scale (excellent, good, satisfactory, unsatisfactory); 100-point scale and ECTS scale (A, B, C, D, E, FX, F). |
| **6 – Програмні компетентності** | |
| Integral competence | Ability to solve complex specialized problems and practical problems that are characterized by complexity and uncertainty of conditions and requirements in various fields, which involves conducting research and / or carrying out innovations using theoretical positions and methods of system analysis. |
| **General competencies (ЗК)** | |
| ЗК 1 | Ability to think, analyze and synthesize. |
| ЗК 2 | Ability to communicate in a foreign language. |
| ЗК 3 | Ability to conduct research at the appropriate level. |
| ЗК 4 | Ability to learn and master modern knowledge. |
| ЗК 5 | Ability to search, process and analyze information from various sources. |
| ЗК 6 | Ability to generate new ideas (creativity). |
| ЗК 7 | Ability to identify, put and solve problems. |
| ЗК 8 | Ability to make informed decisions. |
| ЗК 9 | Ability to communicate with representatives of other professional groups of different levels (with experts from other fields of knowledge / types of economic activity). |
| ЗК 10 | Ability to work in an international context. |
| ЗК 11 | Ability to design and manage projects. |
| ЗК 12 | Determination and persistence on the tasks and duties taken. |
| **Professional competence of the specialty (ФК)** | |
| ФК 1 | Ability to develop and analyze mathematical models of natural, technological, economic and social objects and processes. |
| ФК 2 | Ability to plan and carry out systematic research, perform mathematical and informative modeling of dynamic processes. |
| ФК 3 | Ability to use the methodology of system analysis for decision making in complex systems of different nature. |
| ФК 4 | Ability to form new hypotheses and research tasks in the field of system analysis and decision-making, to choose the appropriate directions for their application. |
| ФК 5 | Ability to formulate, analyze and synthesize in solving scientific problems at an abstract level. |
| ФК 6 | Ability to design the architecture of intelligent information systems. |

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|---|---|
| ФК 7 | Ability to apply intelligent data analysis when building decision support systems, expert and advisory systems. |
| ФК 8 | Ability to develop the functions of forecasting the dynamics of the development of processes of different nature in a deterministic and stochastic environment and to evaluate the quality of the forecast. |
| ФК 9 | Ability to apply quantitative and qualitative risk assessment methods, development of risk management algorithms in complex systems of different nature. |
| ФК 10 | Ability to apply modern information technology to solve problems of system analysis. |
| ФК 11 | Ability to model, predict and design a business-enterprise process based on methods and tools of system analysis. |
| ФК 12 | The ability to reveal situational and system uncertainties, develop conflict resolution algorithms. |
| ФК 13 | Ability to plan and conduct scientific research, to prepare and present the results of research activities. |
| ФК 14 | Ability to self-education and professional development. |
| **Professional competence in specialization** | |
| ФКС 1 | Ability to choose the appropriate architecture, synthesize, train and simulate artificial neural networks for specific applications. |
| ФКС 2 | Ability to use data mining models and methods for solving problems of data mining. |
| ФКС 3 | Ability to develop strategies for managing logical output and methods for improving the efficiency of findings in expert systems. |
| ФКС 4 | Ability to use the programming environment and information technology to solve problems of mathematical modeling, analysis and synthesis of complex systems and processes. |
| ФКС 5 | The ability to model processes in complex systems, analyze the results and make appropriate conclusions. |
| **7 – Program learning outcomes** | |
| Program results of specialty training | |
| РН 1 | Know and be able to apply in practice methods of system analysis, methods of mathematical and information modeling for construction and research of models of objects and processes of informatization. |
| РН 2 | To know the methods of uncovering uncertainties in the tasks of system analysis, to be able to reveal situational uncertainties, and uncertainties in the problems of interaction, counteraction and conflict of strategies, to find a compromise when disclosing conceptual uncertainty, etc. |
| РН 3 | Know the methods of forecasting the dynamics of processes of different nature, be able to develop prediction functions. |
| РН 4 | Know and be able to apply risk measures, evaluate and use them in the analysis of multi-factor risks of accidents and disasters. |
| РН 5 | Be able to develop and effectively use system-analytical risk protection tools in business processes. |
| РН 6 | Know and be able to apply the methods of evolutionary modeling and genetic optimization methods, inductive modeling methods and mathematical apparatus of fuzzy logic, neural networks, game theory and distributed artificial intelligence, etc. |
| РН 7 | Be able to develop expert and advisory systems in conditions of poorly structured data of different nature. |
| РН 8 | Know and be able to identify (estimate) the parameters of mathematical models of objects of management in real time in conditions of changes in its dynamics and the effects of random perturbations, using the measured signals of the input and output coordinates of the object. |

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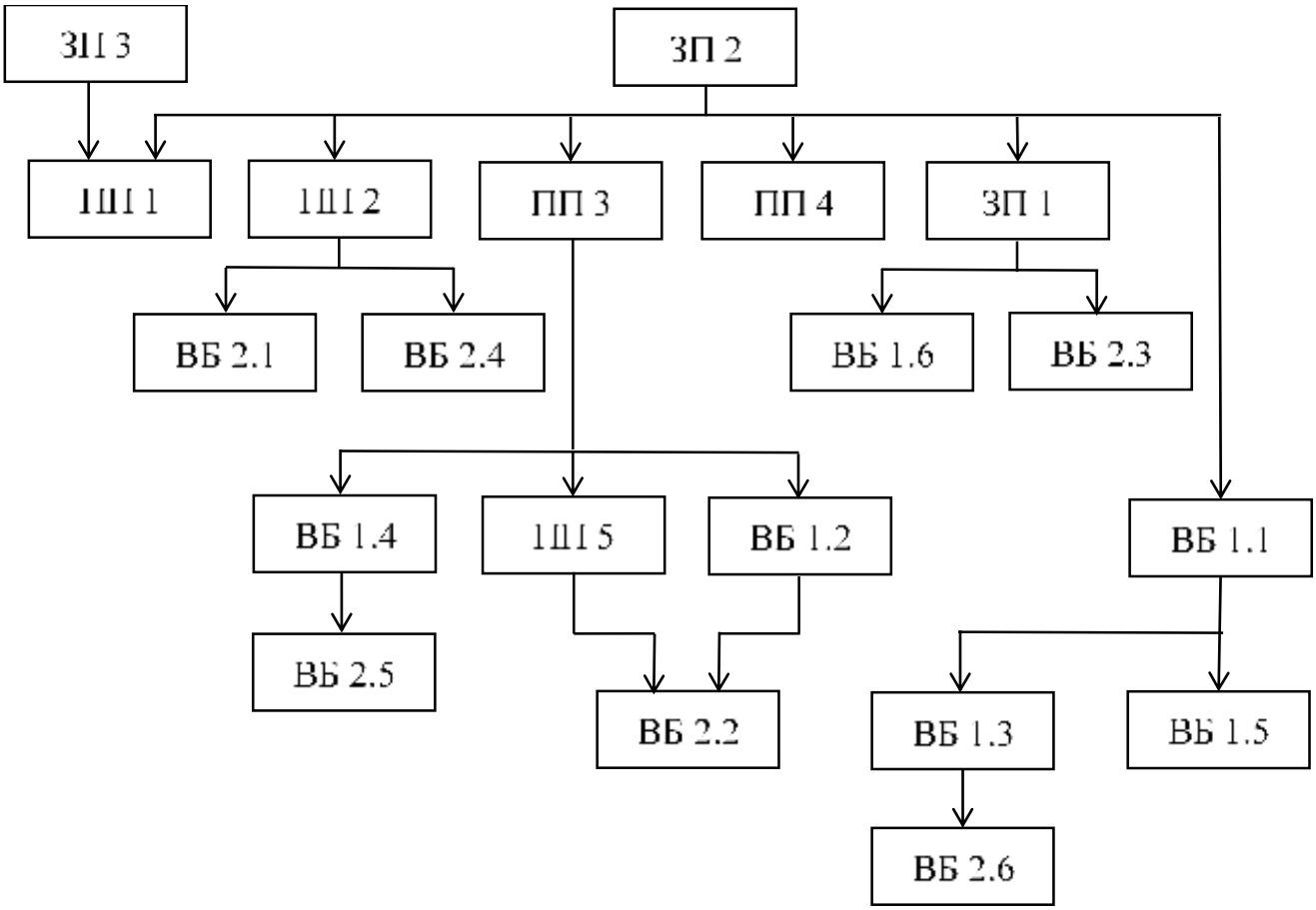
|---|---|
| PH 9 | Know and be able to implement highly loaded computing and data processing systems in system analysis and management tasks, and decision support systems. |
| PH 10 | Know the models, methods and algorithms for decision making under conflict conditions, some information, uncertainty and risk. |
| PH 11 | Ability to search information in specialized literature in the field of system analysis using a variety of resources: journals, databases, on-line resources. |
| Program results of specialization training | |
| PHC 1 | Be able to implement, test, implement, accompany, operate software tools for working with data and knowledge in computer systems and networks. |
| PHC 2 | Know the purpose and principles of building OLAP-systems and data warehouses, as well as the peculiarities of their application in the tasks of intellectual data analysis. |
| PHC 3 | Know the methods of acquiring, formalizing and structuring knowledge, be able to choose the tool for the development of expert systems depending on the subject area and the specifics of a specific task. |
| PHC 4 | Be able to create effective algorithms for computational tasks of system analysis and decision support systems. |
| **8 – Resource support for the implementation of the program** | |
| Personnel support | It meets the personnel requirements for ensuring the implementation of educational activities in the field of higher education for the second (master) level in accordance with the requirements of Appendix 12 to the Licensing Terms, approved by the Resolution of the Cabinet of Ministers of Ukraine dated December 30, 2015 № 1187 |
| Material and technical support | It meets the personnel requirements for ensuring the implementation of educational activities in the field of higher education for the second (master) level in accordance with the requirements of Appendix 13 to the Licensing Terms, approved by the Resolution of the Cabinet of Ministers of Ukraine dated December 30, 2015 № 1187 |
| Information and educational and methodological support | It meets the personnel requirements for ensuring the implementation of educational activities in the field of higher education for the second (master) level in accordance with the requirements of Appendix 14 to the Licensing Terms, approved by the Resolution of the Cabinet of Ministers of Ukraine dated December 30, 2015 № 1187 |
| **9 – Academic mobility** | |
| National Credit Mobility | Possibility to conclude agreements on academic mobility and double diploma |
| International Credit Mobility | Possibility of concluding agreements with the countries of the European Union on academic mobility and double diploma |
| Teaching foreign applicants for higher education | |

## 2. LIST OF COMPONENTS OF EDUCATIONAL PROFESSIONAL PROGRAM

| Number in order | Components of the educational program (study disciplines, course projects / course works, practices, qualification work) | ECTS credits | Form of final control |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| **1. General training** | | | |
| ЗП 1 | Organization of Production and Marketing | 3,0 | Set-off |
| ЗП 2 | Intellectual Property | 3,0 | Set-off |
| ЗП 3 | Occupational Health | 3,0 | Set-off |
| **2. Professional training** | | | |
| **Compulsory components of the educational program** | | | |
| ПП 1 | Basics of the Scientific Research | 3,0 | Set-off |
| ПП 2 | Modern Methods of Optimal Control | 4,0 | Exam |
| ПП 3 | Intelligent Data Analysis and Decision Support Systems | 4,0 | Exam |
| ПП 4 | Modern methods of developing 3D applications | 5,0 | Exam |
| ПП 5 | Artificial Neural Networks | 6,0 | Exam |
| ***Optional disciplines*** | | | |
| Discipline block 01 "System Analysis and Control" | | | |
| ВБ 1.1 | Programming in Computer Networks | 4,5 | Exam |
| ВБ 1.2 | Expert Systems and Knowledge Bases | 4,5 | Exam |
| ВБ 1.3 | System and Network Infrastructure Design and Support | 4,0 | Exam |
| ВБ 1.4 | Big Data Processing Technologies | 5,0 | Exam |
| ВБ 1.5 | Modern Web-programming Technologies | 5,0 | Exam |
| ВБ 1.6 | Statistical Processing of Socio-economic Information | 6,0 | Exam |
| | Practice | 15,0 | Set-off |
| | Attestation | 15,0 | |
| Discipline block 02 "Information Technologies of System Analysis" | | | |
| ВБ 2.1 | Project Management | 4,5 | Exam |
| ВБ 2.2 | Banking Information Systems | 4,5 | Exam |
| ВБ 2.3 | Mathematical and Software of Economic Calculations | 4,0 | Exam |
| ВБ 2.4 | Modeling and Identification of Control Systems | 5,0 | Exam |
| ВБ 2.5 | Data Mining Technologies | 5,0 | Exam |
| ВБ 2.6 | Interactive Multimedia Systems | 6,0 | Exam |
| | Practice | 15,0 | Set-off |
| | Attestation | 15,0 | |
| Total for **general training**: | | **9,0** | |
| Total for **professional training**: | | **22,0** | |
| Total for **compulsory component**: | | **31,0** | |
| Total for **selective component**: | | **59,0** | |
| **Total for education period** | | **90** | |

## 3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROFESSIONAL PROGRAM "SYSTEM ANALYSIS AND CONTROL"



# 4. GRADUATE CERTIFICATE OF HIGHER EDUCATION

Graduate certification of higher education students for an educational program of specialty 124 System analysis is carried out in the form of the protection of qualification work and ends with the issuance of the document (diploma) of the established sample on awarding his bachelor's degree with qualification: **Master of Systems Analysis for the Educational Program System Analysis and Control**.

Final certification is carried out openly and publicly.

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## 5. 5. COMPLIANCE OF PROGRAM COMPETENCIES WITH COMPONENTS OF THE EDUCATIONAL-PROFESSIONAL PROGRAM MATRIX

| | ЗП 1 | ЗП 2 | ЗП 3 | ПП 1 | ПП 2 | ПП 3 | ПП 4 | ПП 5 | ВБ 1.1 | ВБ 1.2 | ВБ 1.3 | ВБ 1.4 | ВБ 1.5 | ВБ 1.6 | ВБ 2.1 | ВБ 2.2 | ВБ 2.3 | ВБ 2.4 | ВБ 2.5 | ВБ 2.6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ЗК 1 | | | | + | + | + | | + | | | | | | + | | | | + | + | |
| ЗК 2 | | | | | | | | | + | | | | + | | | | | | | |
| ЗК 3 | | | | + | | | | | | | | + | | + | | | | | | |
| ЗК 4 | + | | | | + | + | + | + | + | | + | | + | + | | | | + | + | |
| ЗК 5 | + | + | | + | + | + | | + | | + | | + | | + | | | | | + | + |
| ЗК 6 | + | + | | + | | | | | | | | | + | | + | | | | | |
| ЗК 7 | + | + | + | + | | + | | + | | + | + | | | | + | | | + | + | + |
| ЗК 8 | + | + | + | + | | + | | | | + | + | | | + | + | | + | | + | |
| ЗК 9 | + | + | | + | | + | | | | + | + | | | | + | + | | | | + |
| ЗК 10 | + | + | | + | | | + | | | | + | | + | + | | | | | | |
| ЗК 11 | + | | | | | | | | | | + | | | | + | | | | | |
| ЗК 12 | + | | | + | | | | | | | + | | | + | + | | | | | |
| ФК 1 | | | | + | + | + | | | | | | | | | | | + | + | | |
| ФК 2 | + | | | + | + | | | | | | | | | | + | | + | + | | |
| ФК 3 | + | | | | + | + | | | | | + | + | | | | | | | | |
| ФК 4 | + | | | + | | + | | | | | | + | | | | | | + | + | |
| ФК 5 | + | | | + | | + | | | | + | | | | | + | + | + | | | |
| ФК 6 | | | | | | + | | | | + | | | | | | + | | | + | + |
| ФК 7 | | | | | | + | | | | + | | | | | | + | | | + | + |
| ФК 8 | | | | | + | + | | + | | + | | | | | | | | | + | |
| ФК 9 | | | + | | | + | | | | | | | | + | | | | | | |
| ФК 10 | | | | | | | | | | | | + | + | | | + | | | + | + |

| | ЗП 1 | ЗП 2 | ЗП 3 | ПП 1 | ПП 2 | ПП 3 | ПП 4 | ПП 5 | ВБ 1.1 | ВБ 1.2 | ВБ 1.3 | ВБ 1.4 | ВБ 1.5 | ВБ 1.6 | ВБ 2.1 | ВБ 2.2 | ВБ 2.3 | ВБ 2.4 | ВБ 2.5 | ВБ 2.6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ФК 11 | + | | | | | | | | | | + | | | + | | | + | | | |
| ФК 12 | + | | | | + | + | | | | + | + | | | | | | | + | | |
| ФК 13 | | | | + | | + | + | | | | | | | | + | | | | | + |
| ФК 14 | | + | | + | | | | | | | | | | | | | | | | |
| ФКС 1 | | | | | | | | + | | | | | | | | | | | | |
| ФКС 2 | | | | | | + | | | | | | | | | | | | | + | |
| ФКС 3 | | | | | | | | | | + | | | | | | | | | | |
| ФКС 4 | | | | | | | + | + | + | | | + | + | | | | | | + | |
| ФКС 5 | | | | | + | + | | | | | | + | | + | | | + | + | + | |

## 6. PROVIDING PROGRAMMATIC LEARNING OUTCOMES FOR THE RELEVANT COMPONENTS OF AN EDUCATIONAL AND PROFESSIONAL PROGRAM MATRIX

| | ЗП 1 | ЗП 2 | ЗП 3 | ПП 1 | ПП 2 | ПП 3 | ПП 4 | ПП 5 | ВБ 1.1 | ВБ 1.2 | ВБ 1.3 | ВБ 1.4 | ВБ 1.5 | ВБ 1.6 | ВБ 2.1 | ВБ 2.2 | ВБ 2.3 | ВБ 2.4 | ВБ 2.5 | ВБ 2.6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| РН 1 | | | | + | + | + | + | | | | | | | + | | | | + | + | |
| РН 2 | | | | + | | | | + | | | | | | | + | | | | | |
| РН 3 | + | | | | | + | + | + | | + | | | | + | | | | | + | |
| РН 4 | | | + | | | | | | | | + | + | | | + | | | | + | |
| РН 5 | + | | + | | | + | + | | | | | | | + | + | + | | | + | |
| РН 6 | | | | | | + | + | + | | + | | | | | | | | | + | |
| РН 7 | | | | | | + | | | | + | | | | + | | | | | + | |
| РН 8 | | | | | + | | | | | | | | | | | | | + | | |
| РН 9 | | | | | + | + | + | | | | | + | | + | | + | + | | | |
| РН 10 | | | + | | + | + | | | | + | | + | | | + | | | + | + | |
| РН 11 | | + | | + | | | | | | | | | + | | | + | | | | + |
| РНС 1 | | | | | | | + | | + | | + | | + | | | | + | | | |
| РНС 2 | | | | | | + | | | | | | | | | | | | | + | |
| РНС 3 | | | | | | | | | | + | | | | | | | | | | |
| РНС 4 | | | | | | | | | + | | + | | + | | | | + | | | + |