

## I GENERAL DESCRIPTION

<b>The level of higher education</b>	The first (bachelor's degree) level
<b>Degree that is assigned</b>	Bachelor's degree
<b>Area of knowledge</b>	12 «Information Technologies» according to List of areas of knowledge and specialities (the resolve № 266 of Cabinet of Ministers of Ukraine (CMU) dated 29.04.2015).
<b>Specialty</b>	122 «Computer Sciences and Information Technologies» according to List of areas of knowledge and specialities (the resolve № 266 of CMU dated 29.04.2015).
<b>Limitation is in relation to the forms of studies</b>	none
<b>Educational qualification</b>	A bachelor's degree of computer sciences and information technologies
<b>Professional qualification (only for the managed professions)</b>	3121 Professional in Information Technology (after the National classifier of professions DK 003:2010).
<b>The qualification in the diploma</b>	A Bachelor's degree of Ccomputer Sciences and Information Technologies. Professional qualification "Professional in Information Technology".
<b>Description of subject domain</b>	<p><i>Object(s) of study and/or activity :</i></p> <ul style="list-style-type: none"> <li>– mathematical, information, simulation models of systems and processes;</li> <li>– theory, analysis, design, evaluation of the effectiveness, implementation and practical application of algorithms;</li> <li>– mathematical modeling of real phenomena, objects, systems, processes and software;</li> <li>– data mining and decision-making;</li> <li>– evolution and applyin of computer science as a fundamental scientific basis of information technologies;</li> <li>– high-performance computing including parallel computing and big data;</li> <li>– data model represent as a category of information support systems;</li> <li>– models, methods and technologies for receiving, storage, processing, transmission and use of information;</li> <li>– systems analysis for areas of use of information systems and formalization of problems, that is arising in them, and scenarios decision-making;</li> <li>– methodology of construction of information systems, including intelligent information systems that based on the concept of knowledge-based system and neural network technology for decision-making;</li> <li>– methods and algorithms for sensor detection signals, sounds, pictures and images, learning, reasoning processes for solving problems and planning, understanding languages;</li> <li>– mathematical software of information systems, automated system for</li> </ul>

	<p>data processing and management, computer-aided design and information support for life cycle of industrial products, software, system for decision-making;</p> <ul style="list-style-type: none"> <li>– linguistic, information and software for various systems.</li> </ul> <p><i>Objectives of studies:</i> to acquiring competencies for use mathematical foundations, algorithmic principles and computability theory in modeling and designing, maintenance of information systems and technologies; to implementation and maintenance of intelligent systems for analysis and data processing, information systems and technologies, software, for organizational, technical, natural and socio-economic systems.</p> <p><i>Theoretical contents of subject domain:</i> modern methods, algorithms, technologies, processes, methods of obtaining, analysis, transmission, storage, processing, presenting information and prediction of results in information systems.</p> <p><i>Methods, methodologies and technologies:</i> mathematical models, methods and algorithms for solving of theoretical and applied problems that is arising in the development of information technologies and information systems; modern paradigms, technologies and platforms for programming; methods of collection, analysis and consolidation of distributed information; technology and methods of design, development and quality assurance of components of information technologies and information systems; data visualization technologies.</p> <p><i>Tools and equipments:</i> CASE-technology for simulation and desing of information technologies and information systems; multiprocessors systems and distributed systems; computer networks; cloud-technologies.</p>
<b>Academic rights for graduating students</b>	Chance to continue of education after the second (Master's degree) level of higher education, receiving of the second education in higher educational establishment.
<b>Employment of graduating students (for the managed professions - necessarily)</b>	<p>Professional in the development of mathematical, information and software for information systems, in the field of information technologies, in database administration.</p> <p>Workplaces according to the National classifier of professions DK 003:2010:</p> <p>2131.2 Database Administrator</p> <p>2131.2 Data Administrator</p> <p>2131.2 Access administrator</p>

## **II THE AMOUNT OF ECTS CREDITS NECESSARY TO OBTAIN A CERTAIN DEGREE HIGHER EDUCATION**

The amount of the educational program of bachelor's degree of specialty 122 «Computer Sciences and Information Technologies» is 240 credits of ECTS.

Minimum the 50% of the amount of the educational program should be directed at providing of general and special (professional) competencies of specialty, defined by the standard of higher education.

The University has the right to reduce the amount of educational program for obtaining a Bachelor's degree from a Junior Specialist's degree. The possibility of obtaining a Bachelor's degree of specialty 122 "Computer Science and Information Technologies" based on Junior Specialis's degree and limited by related specialties of knowledge area 12 "Information Technology".

### III THE LIST OF COMPETENCIES FOR GRADUATING STUDENT

<b>Integral competence</b>	Ability to solve complex specialized practical problems in a particular area of professional activity or in the learning process that involves the use of certain theories and methods relevant science and characterized by complexity and uncertainty conditions.
<b>General competencies</b>	<ol style="list-style-type: none"> <li>1. Ability to classify cultural phenomena in their historical importance, national origin and stylistic features, and to analyze the prospects of development of Ukrainian culture and have citizenship, a high historical and political culture.</li> <li>2. Possession in academic level skills written and spoken communication in a foreign language.</li> <li>3. Basic understanding of the basic philosophy, political science, contributing to the development of general culture and socialization, tendency to ethical values, knowledge economy, understanding the causation of social development and the ability to use them in professional and social activities.</li> <li>4. Ability to apply legal, political science and information knowledge in professional activities.</li> <li>5. Ability to apply legal, political knowledge, and knowledge of regulatory and legal documents on intellectual property and copyright.</li> <li>6. Ability to effectively communicate in professional and social levels in native and foreign languages.</li> </ol>
<b>Special (professional) competence</b>	<ol style="list-style-type: none"> <li>1. Ability to mathematical and logical thinking; knowledge of basic theories, concepts, concepts, ideas and methods of basic mathematics; the ability to use a professional activity modern mathematical tools, formulate and explore mathematical models of problems strictly prove the allegations to substantiate the correctness of solving theoretical and applied problems, interpret results obtained formal methods, in terms of the original domain.</li> <li>2. Ability to perceive objects and discrete formulation discrete mathematical models in different subject areas; Know and understand the basic concepts of discrete mathematics, the basic concepts of set theory, algebraic expressions, the theory of binary relations on sets, combinatorics and graph theory, basic methods of discrete mathematics and their scope, the principles of the use of models, methods and algorithms of discrete mathematics in problems of applied nature; be able to use the methods of discrete mathematics to create efficient algorithms research models, evaluation of their quality in the process of solving problems of professional activity.</li> <li>3. Knowledge of patterns of random events, key terms, key terms and theorems of the theory of stochastic phenomena and processes, statistical methods of processing and analyzing data; ability to perform qualitative and quantitative mathematical analysis of random events, random variables and system of values; use variance and correlation analysis in the study of random variables, probability and statistical evaluation methods of stochastic processes in the process of solving professional problems.</li> <li>4. The capacity for logical and algorithmic thinking, constructing logical conclusions, using formal languages and models of algorithmic calculations; knowledge of basic definitions and concepts of the theory of algorithms, understanding Turing thesis-Chorcha-Markov; possession of the theory of algorithms and fundamental approaches to determining evidence theorems and formulas, efficiency and complexity estimation algorithms, solvability and unsolvability algorithmic problems; ability to apply mathematical</li> </ol>

	<p>apparatus of the theory of algorithms for solving professional problems using computers; ability to master modern technologies of mathematical modeling of objects, processes and phenomena in professional activities; develop computational models and algorithms for numerical solution of problems of mathematical modeling, designed for implementation on a computer; implement digitization tasks, identify errors, to assess the effectiveness of numerical methods, including convergence, stability and ease of implementation; use approximate numerical methods for solving mathematical problems in algebra, mathematical analysis and differential equations.</p> <ol style="list-style-type: none"> <li>5. Ability to economic and mathematical modeling and building models of organizational and technical operations systems and their operation; knowledge of the principles of building operating models, basic stages and essence of operational research; ways of solving problems by mathematical programming; ability to apply algorithms of optimization problems using a computer; to analyze the optimal solutions for sensitivity by changing the parameters of the model; operations research methods used in the analysis and synthesis of information systems for various purposes and tasks of organizational and economic governance.</li> <li>6. Ability to analyze mathematical problems of choice in the given set of acceptable solutions to the problem, to develop mathematical models and decision-making methods in different situations, solve problems making decisions involving mathematical methods, information technologies, experts and individuals make decisions; know the basic facts, concepts, models and methods of decision making; conditions of use and practical limitations; be able to apply the theoretical basis for the formation of individual and group decisions, decision-making methods antagonistic and conflicting situations in terms of probability and fuzzy uncertainty, methods of selecting the best alternatives to using functions preferences and utility function in the study and management and technical solutions in different situations.</li> <li>7. Ability to systems thinking; knowledge of the theoretical and practical foundations of system analysis methodology to study the complex problems of different nature, methods of formalizing systematic problems with conflicting objectives, risks and uncertainties; ability to solve practical scientific, technical and socio-economic tasks of professional activities, to find solutions to poorly structured problems, make recommendations on the creation of fundamentally new or improved systems.</li> <li>8. Knowledge of the theoretical and practical foundations methodology and simulation technology in the research, design and operation of technical facilities and information, processes and other objects of professional activity; the ability to implement algorithms for simulation study of the characteristics and behavior of complex objects to experiment with the program simulation processing and analysis of results.</li> <li>9. Ability to algorithmic thinking; knowledge of the principles of structured programming, contemporary procedure-oriented languages, basic data structures and algorithms on them; ability to apply algorithms and data structures during program implementation practical problems of professional activity in the field of computer science.</li> <li>10. Knowledge of the theoretical and practical foundations methodology and simulation technology in the research, design and operation of information systems, products, services, information technology and other objects of</li> </ol>
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	<p>professional activity; the ability to implement algorithms for simulation study of the characteristics and behavior of complex objects.</p> <ol style="list-style-type: none"> <li>11. Ability to apply the methods, approaches and tools for designing Web applications; knowledge of the technologies of Web servers and Web applications kliyentivnyh ability to use technology and tools to develop web applications, web services, web sites and web interfaces to integration of external data and software.</li> <li>12. Ability to modeling software systems using different programming paradigms with corresponding sets of models and methods of computation, data structures and control mechanisms; knowledge of the principles, models and techniques and technologies for developing complex software products, the ability to choose the programming paradigm from the standpoint of convenience and quality to implement the use and production of specific software.</li> <li>13. Knowledge of standards, methods and tools for process management and information lifecycle software systems, products and services information technology; possession of technology software development according to customer requirements and restrictions, use of modern technologies and tools of planning, design, development, testing, deployment and implementation of information systems and software, the ability to apply them in all stages of the life cycle.</li> <li>14. The ability to perform parallel and distributed computing, to understand the fundamental concepts and concepts and structures of modern parallel computing; knowledge of the principles of parallel and distributed software applications, numerical methods and algorithms for parallel structures, parallel programming languages; the ability to build, test and operate parallel and distributed software application packages using modern and standard parallel programming.</li> <li>15. Knowledge of the concepts of databases and data warehouses, data models, technology, database design and data warehousing, Structured Query Language; the ability to design database based on the normalization of relations, create distributed database and storage; the ability to design logical and physical models of databases, query them, searching, processing transactions in the profession.</li> <li>16. The capacity for data mining and online analytical processing; knowledge of methods, objectives and standards Data Mining, data visualization methods, technologies Text Mining; Web Mining, Process Mining, OLAP architectures of systems; the ability to use technology tools and software for Data Mining modeling and analysis, OLAP-services and software for data manipulation, visualization, statistical evaluation and simulation.</li> <li>17. Ability to acquire knowledge of the theoretical foundations of the organization, construction, design principles, configuration and use of various modern operating systems, ensure the organization of computing processes in enterprise information systems, economic, administrative, industrial, scientific and other purposes; ability to address the effectiveness, safety, diagnostics, recovery, monitoring and optimization of operating systems.</li> <li>18. Knowledge of drafting local area network based on standard protocols and interfaces, planning network infrastructure, software and hardware development of logical and physical models of local computer networks; ability to develop topology structured cable systems use computer systems and data network in the profession; connect computers to networks and work</li> </ol>
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	<p>in networks; exercise informed choice media data; analyze the quality of the networks; work with network applications.</p> <p>19. Knowledge of patterns of knowledge, methods of extracting and structuring knowledge inference for the development of knowledge base and intelligent systems, methods, knowledge engineering, semantic networks and ontologies; ability to develop artificial intelligence, expert systems, intelligent agents, ontology in various subject areas; skills a business analyst with the use of data mining and logic programming.</p> <p>20. Knowledge of and information security in terms of widespread use of information technology, basic types of threats to information security and technical information leakage, methods of detection and blocking; ability to exercise effective choice of computer systems and technical protection of information in the profession.</p> <p>21. Knowledge of methods of analysis, modeling, reengineering business processes of information systems, the ability to use CASE-tools during their design; the ability to use CASE-tools for the design and modeling of business processes and information systems software development information systems.</p> <p>22. Basic knowledge in computer engineering to the extent necessary for an understanding of the basic principles of organization and functioning of the hardware of modern information processing systems, main characteristics, features and applications of computer systems for various applications; the ability to use the hardware of modern information processing systems, computing systems for various purposes. The knowledge-aided design methodology for complex objects and systems, the ability to use modern computer technology for their system, functional, design and technological design.</p> <p>23. Ability to use basic concepts and methods of management and implementation of projects in the field of information technology; knowledge of theoretical bases, processes and procedures for managing IT projects PMBOK standards and principles of teamwork; teamwork and apply project management software systems.</p>
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#### IV THE NORMATIVE CONTENT OF THE PREPARATION APPLICANTS OF HIGHER EDUCATION, FORMULATED IN TERMS OF LEARNING OUTCOMES

Name of competence	Knowledge	Understanding	Application of knowledge	Analysis	Synthesis	Evaluation
The capacity for mathematical and logical thinking; knowledge of basic theories, concepts, concepts, ideas and methods of basic mathematics; the ability to use a professional activity modern mathematical tools, formulate and explore mathematical models of problems strictly prove the allegations to substantiate the correctness of solving theoretical and applied problems, interpret results obtained formal methods, in terms of the original domain.	Remember, play the basic concepts of the theory of real numbers, functions of real variable theory of limits, differential and integral calculus of functions of one and several variables; basic concepts and theoretical principles of the theory of numerical and functional series; methods of proving theorems; main types of problems and methods of their solution.	Understand and interpret the basic objects of research and concepts of mathematical analysis, the possibility of problem solving methods A fundamental and applied mathematics and computer science.	Use the knowledge, concepts and methods for solving problems of theoretical and applied using the fundamental provisions of the mathematical analysis, precision of argumentation in mathematical reasoning.	Organize, analyze, and share the components classified methods and models, data and facts on mathematical analysis, in particular to analyze infinitesimal, use functional analysis to solve professional problems of proof theory	combine, generalize, justify integrate concepts, regulations, methods and theories of mathematical analysis, applied in the synthetic approach, I build models of the objects ..	Conducting empirical research in the process of solving professional problems of mathematical analysis using analysis, synthesis, comparison, abstraction, generalization, inductive and deductive methods and so on.



	Remember and play concept, theoretical concepts and methods of vector algebra on a plane and in space, lines and planes, curves and surfaces of the first and second orders, the theory of matrices, determinants, systems of linear equations, linear operators, functions on vector spaces.	Understand and interpret mathematical apparatus of analytical geometry and linear algebra	Use the knowledge, concepts and methods from the field of analytical geometry and linear algebra, explore the compatibility of linear algebraic equations; find solutions to analytical methods; operate with matrices and vectors; define the line on the plane and surfaces in space; reduce quadratic forms to canonical form; use properties of these objects to solve engineering problems	Organize, analyze, and share the components classified methods and models, data and facts from analytical geometry and linear algebra, including the use of vector analysis, algebraic curves etc.	combine, generalize, justify integrate concepts of linear algebra, vector algebra, analytic geometry	Conducting empirical research in the process of solving professional problems of analytical geometry and linear algebra
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<p>The ability to perceive objects and discrete formulation discrete mathematical models in different subject areas; Know and understand the basic concepts of discrete mathematics, the basic concepts of set theory, algebraic expressions, the theory of binary relations on sets, combinatorics and graph theory, basic methods of discrete mathematics and their scope, the principles of the use of models, methods and algorithms of discrete mathematics in problems of applied nature; be able to use the methods of discrete mathematics to create efficient algorithms research models, evaluation of their quality in the process of solving problems of professional activity.</p>	<p>Identify and describe the play basic concepts, laws, theorems, methods, algorithms and mathematical logic theorem proving, combinatorial analysis, graph theory and trees, Boolean functions, relations and operations on them, finished machines</p>	<p>Understand, interpret, recognize and explain the theoretical principles, concepts, methods and algorithms use the basic discrete mathematics problems in different professional activities in computer science, information systems and technologies</p>	<p>Use modern methods of discrete mathematics, including methods of mathematical logic, set theory, combinatorics, graph theory and trees, automata theory for formalize and solve applied problems .in the analysis, synthesis and design of information systems by industry</p>	<p>Organize, analyze, classify concepts, methods, algorithms, discrete mathematics to develop methods and tools for solving problems in computer science, information systems and technologies</p>	<p>Generalize, integrate, design and synthesize discrete mathematical models, structures, objects and processes.</p>	<p>Relate practical problems with appropriate functions and models of interpretation associated operations and terminology in the context of discrete structures and applications.</p>
<p>Knowledge of patterns of random events, key terms, key terms and theorems of the theory of stochastic phenomena and processes, statistical methods of processing and analyzing data; skill perform qualitative and quantitative mathematical analysis of random events, random variables and system of values; use variance and correlation analysis in the study of random variables, probability and statistical evaluation methods of stochastic processes in the process of solving professional problems.</p>	<p>Identify, describe, verify the regularity of random phenomena, properties and operations on them, probabilistic methods of complex systems, definitions of basic concepts of probability theory, stochastic processes and mathematical statistics; fundamental theorem of probability theory, the laws of distribution of random variables, statistical distributions and criteria; principles of statistical sampling study populations;</p>	<p>Discuss provide, explain and identify objects of study of probability theory, mathematical methods to systematize and use of statistics for scientific and practical problems.</p>	<p>Untie typical tasks using basic theorems of probability theory; build distribution laws of random variables and calculate their numerical characteristics; build models of random processes and make their mathematical analysis; apply probabilistic and statistical methods for evaluation of stochastic processes; use modern</p>	<p>Organize, analyze, classify, allocate tasks ymovirnostnoho theoretical and statistical analysis of complex computer and information systems</p>	<p>Build describe, analyze and synthesize models of real processes, phenomena and systems.</p>	<p>Evaluate, install, argue statistical hypothesis statistical estimation of probability distributions and parameters that are included in them.</p>

	foundations correlation analysis		environment for solving problems probabilistic statistical analysis of experimental data.			
The capacity for logical and algorithmic thinking, constructing logical conclusions, using formal languages and models of algorithmic calculations; knowledge of basic definitions and concepts of the theory of algorithms, understanding Turing thesis-Chorcha-Markov; possession of the theory of algorithms and fundamental approaches to determining evidence theorems and formulas, efficiency and complexity estimation algorithms, solvability and unsolvability algorithmic problems; ability to apply mathematical apparatus of the theory of algorithms for solving professional problems using computers; ability to master modern technologies of mathematical modeling of objects, processes and phenomena in professional activities; develop computational models and algorithms for numerical solution of problems of mathematical modeling, designed for implementation on a computer; implement digitization tasks, identify errors, to assess the effectiveness of numerical methods, including convergence, stability and ease of implementation; use approximate numerical methods for solving mathematical problems in algebra, mathematical analysis and differential	Identify, build formal models to describe the basic algorithms and computable functions; properties of recursive and recursive perelichnyh sets Recursive and partially recursive predicates and predicates of arithmetic sets etc. identify, reproduce and describe general concepts related to numerical methods; setting typical mathematical problems; Numerical methods for linear and non-linear algebra, approximation of functions, numerical differentiation and integration of functions, solving ordinary differential and integral equations, numerical solution of partial differential equations, numerical methods theoretical features and capabilities to adapt them to engineering problems.	To have an idea of modern swagger, partial solvability and unsolvable mass problems; be aware, understand and develop practical methods for solving mathematical problems in the engineering and modeling physical systems, means of payments on current computers using software packages.	Use formal models and algorithms, computable functions, use Chorcha thesis; set swagger, partial solvability and unsolvable algorithmic problems and establish a class set of the predicate; design, program, test and debug applications that implement numerical methods; solve math problems using mathematical packages; reasonably choose numerical methods in solving engineering problems in the design and modeling software and information systems and technologies.	Analyze, classify, compare, explore the effectiveness of algorithms and numerical methods for solving mathematical problems in the design and simulation software and information systems and technologies.	Argue, summarize, modify computer algorithms and numerical methods for solving problems in the design and simulation software and information systems and technologies	Evaluate the accuracy of the results in the use of mathematical models and methods; evaluate and compare methods for numerical criteria complexity, convergence rate, convergence, stability to errors in calculations and output data in the design and simulation software and information systems and technologies.

equations.						
Ability to economic and mathematical modeling and building models of organizational - technical systems and operations of their operation; knowledge of general methodological principles of building operational models, essence and main stages of operational research; ways of solving problems by mathematical programming; ability to apply algorithms of optimization problems using a computer; to analyze the optimal solutions for sensitivity by changing the parameters of the model; use operations research methods in the analysis and synthesis of information systems for various purposes and tasks of organizational and economic governance.	Identify, reproduce and describe the concept of operation, operating system, model operation stages of model development operations; Classification of economic and mathematical models and methods; principles of modeling organizational and technical systems and operations; methods of solution of linear, integer, nonlinear, stochastic and dynamic programming; design features and multi solving problems.	Calculate, interpret and describe methods of operations for prospective and current planning, designing various facilities, production management and technological processes, predicting the development of certain sectors of the economy; .	To make a meaningful description of the investigated transactions, build a mathematical model of the problem; choose the performance of operations according to the purpose; apply appropriate methods for solving optimization problems of linear, integer, nonlinear, stochastic and dynamic programming; determine optimal production plans, transportation of goods, etc; determine optimal management.	Investigate and analyze the obtained optimum stability plans; identify classes of problems and methods of solving particular problem of allocation of resources and reserves, timing purpose equipment repair, choice of means of transportation, scheduling transportation schedules, location of new industries, collection of information in information systems management and others.	Using optimization methods for solving problems of synthesis of information systems, technologies and basic tasks of operations research.	To carry out a comparative assessment of different options for performance and operations; evaluate the impact on the result of the operation of various parameters; research "bottleneck" control system, which can affect the success of the operation.

<p>The ability to analyze mathematical problems of choice in the given set of acceptable solutions to the problem, to develop mathematical models and decision-making methods in different situations, solve problems making decisions involving mathematical methods, information technologies, experts and individuals make decisions; know the basic facts, concepts, models and methods of decision making; conditions of use and practical limitations; be able to apply the theoretical basis for the formation of individual and group decisions, decision-making methods antagonistic and conflicting situations in terms of probability and fuzzy uncertainty, methods of selecting the best alternatives to using functions preferences and utility function in the study and management and technical solutions in different situations.</p>	<p>Identify, reproduce and describe general aspects of decision-making; binary relations, functions and mechanisms of choice; metryzovani relationship and expert assessment; models and methods of decision making under bahatokryterialnosti, uncertainty; method of analytical hierarchy; decision making under uncertainty and linguistic fuzziness; foundations of game theory, utility theory, the theory of collective decision-making.</p>	<p>Understand the nature of decision-making processes, laws and principles cover basic properties tai research subject relationship, technologies and systems to justify the decision, to determine trends in the development of processes and decisions through elections organizational forms and methods of control object.</p>	<p>Formalize the problem of decision making, build a mathematical model; reasonably choose the appropriate method for optimizing decisions taken, depending on the class of models, develop appropriate decision algorithm and software to implement it.</p>	<p>Analyze the results of solving problems of decision-making models and methods of decision-making as the mathematical basis of organizational management.</p>	<p>Argue, compile and make a synthesis of fuzzy sets,, synthesize the optimal solution in the choice of organizational forms and methods of control object.</p>	<p>Develop methods problems of decision support systems, principles and methods for evaluating their effectiveness, measures to improve the activities of persons who make decisions.</p>
<p>Ability to systems thinking; knowledge of the theoretical and practical foundations of system analysis methodology to study the complex problems of different nature, methods of formalizing systematic problems with conflicting objectives, risks and uncertainties; ability to solve practical scientific, technical and socio-economic tasks of professional activities, to find solutions to poorly structured problems, make recommendations on the creation of fundamentally new or improved</p>	<p>Identify and play methodology of systems analysis in the analytical study of deterministic and stochastic models of objects and processes, design and operation of information systems, products, services, information technology and other objects of professional activity</p>	<p>Understand and interpret methods of system analysis and mathematical modeling for analytical study of deterministic and stochastic models of objects and processes, design and operation of information systems, products, services, information</p>	<p>Describe, subject, region and apply the principles of a systematic approach to modeling, design of IP objects and Information, perform system analysis of business processes of information objects, uncertainty disclose and analyze multifactorial risks.</p>	<p>Analyze, classify, compare methods and results of system analysis in the practical solution of scientific, technical and socio-economic problems of professional activity;.. apply analytical and synthetic approaches to the modeling of objects of professional activity.</p>	<p>Argue, synthesize, integrate and methods and results of system analysis in the practical solution of scientific, technical and socio-economic problems of professional activity.</p>	<p>Evaluate, reytynhuvaty and measure the quantitative characteristics of the information to determine its quality properties, identify critical situations in the operation of information systems, products, services, information technology and other</p>

systems.		technology and other objects of professional activity.				objects of professional activity.
Knowledge of the theoretical and practical foundations methodology and simulation technology in the research, design and operation of the technical information objects and processes, and other objects of professional activity; the ability to implement algorithms for simulation study of the characteristics and behavior of complex objects to experiment with the program simulation processing and analysis of results	Identify, reproduce and describe models of queuing systems, Petri nets; probabilistic modeling methodology for simulation modeling objects, processes and systems; planning and conducting experiments with models, decision-making simulation results; simulation and manufacturing information systems.	Understand the theoretical foundations and practical modeling methodologies and technologies in the research, design and operation of information systems, products, services, information technology and other objects of professional activity.	Use modeling complex objects and systems; use the software for simulation objects, processes and systems.	Analyze, classify, compare methods and results of mathematical modeling in the process of solving practical scientific, technical and socio-economic problems of professional activity;. apply analytical and synthetic approaches to the modeling of objects of professional activity.	Argue, synthesize, integrate and methods and results of mathematical modeling in the process of solving practical scientific, technical and socio-economic problems of professional activity.	Evaluate modeling complex objects and systems.
Ability to algorithmic thinking; knowledge of the principles of structured programming, contemporary procedure-oriented languages, basic data structures and algorithms on them; ability to apply algorithms and data structures during program implementation practical problems of professional activity in the field of computer science.	Identify, reproduce, interpret and process the broadcast of programs, have basic knowledge in the areas of broadcast programming languages and static code analysis, to know the principles of structured programming features contemporary procedure-oriented programming languages, data structures and basic algorithms for solving them professional tasks in computer science, information systems and technologies.	Discuss, explain programming model underlying the various programming languages, understand the stages of compilation (lexical, syntactic, semantic analysis, code generation), select and develop algorithms, applications, and data structures by applying the principles of structured programming, contemporary	Calculate, experiment and test data structures and algorithms, programs on the selected programming language for the problems of professional work in computer science and information technology.	Analyze and argue the decision on the development or selection of basic algorithms and data structures for software implementation of applications professional activities in computer science and information technology.	Monitor changes and additions in the synthesis algorithms and software implementation of applications professional activities in computer science and information technology.	Effective use of the programming language, evaluate their limitations, to conduct empirical research and evaluate the effectiveness of algorithms, data structures and elect good programming style in the implementation of applications professional activities in computer science and information technology.

		procedure-oriented language programming in the process of solving professional problems.				
The ability to object-oriented thinking, knowledge of the methodology of object-oriented analysis and design principles and as object-oriented programming; ability to apply object-oriented approach in the design of complex software systems, to effectively use the language of object-oriented programming and evaluate their limitations.	Determine, play and interpreted object-oriented programming languages in the process of object-oriented analysis, modeling, design, and software programming of complex objects of professional activity; know the principles of the PLO, class libraries, the process of handling exceptions, event management and more.	Understand choose to discuss object-oriented approach to design and implement well-structured, reliable operation of software systems just modified in the course of professional activity	To build the object model of the domain, making the object-oriented analysis, object-oriented modeling and design, develop, test and debug object-oriented software.	Analyze and argue the decision on the results of object-oriented analysis, design and implementation of object-oriented software systems and complex objects of professional activity	Monitor changes and additions in the synthesis of object-oriented programs on the basis of object-oriented analysis and object-oriented design	Conduct empirical research and evaluate the effectiveness of the decisions and quality of object-oriented software systems and complex objects of professional activity
The ability to apply the methods, approaches and tools for designing Web applications; knowledge of web technologies and client-server applications, the ability to use technology and tools to develop web applications, web services, web sites and web interfaces to integration of external data and software.	Build, describe, find solutions and define the basic principles, new technologies, tools and programming languages for creating web applications, web services, web sites and web interfaces to integration of external data and software, using the methods of information protection.	Understand the processes and technology of web applications, web services, web sites and web interfaces to integration of external data and software.	Choose and use the hypertext markup language, web programming languages, database tools and content management system CMS to create and design Web applications to be able to post them on Web servers.	Analyze and argue the decision on the methods of developing web applications, models of architectures, integration tools web application with external data and software, methods of data security code and so on.	To carry out the synthesis of architecture and algorithms for efficient operation of the web applications in process modeling, design and software programming of complex objects of professional activity.	Conduct empirical studies to evaluate the effectiveness of solutions and quality web applications, define criteria for choosing a platform for developing Web applications.
Ability to modeling software systems using different programming paradigms with corresponding sets of models and methods of computation, data	Identify the features of different programming paradigms, including imperative, object-	To understand feasibility of certain programming paradigms, including	Develop software complex objects of professional activity with the use of	Analyze and model the domain different software models, based on different	To carry out the synthesis of information object in solving professional	Investigate, analyze, identify and evaluate the features advantages in

structures and control mechanisms; knowledge of the principles, models and techniques and technologies for developing complex software products, the ability to choose the programming paradigm from the standpoint of convenience and quality to implement the use and production of specific software.	oriented component, aspect-oriented service-oriented, multi-agent, in the development of declarative programming model complex objects of professional activity.	imperative, object-oriented component, aspect-oriented service-oriented, multi-agent, declarative, in the process of building reliable software systems that meet the requirements of customers and users.	programming paradigms, including imperative, object-oriented component, aspect-oriented service-oriented, multi-agent, declarative, in the process of building reliable software systems that meet the requirements of customers and users.	programming paradigms.	tasks, to generalize accordance with the selected programming paradigms.	programming paradigms in the development of software models of complex objects of professional activity.
Knowledge of standards, methods and tools for process management and information lifecycle software systems, products and services information technology; possession of technology software development according to customer requirements and restrictions, use of modern technologies and tools of planning, design, development, testing, deployment and implementation of information systems and software, the ability to apply them in all stages of the life cycle.	Identify, describe, reproduce stages and processes of life cycle of software systems, including identification of requirements analysis and specifications, development, design, verification and validation, deployment / implementation, operation / maintenance and operation / maintenance of software systems.	Understand the standards, methods and tools for process management and information lifecycle software systems, products and services information technology.	Use standards, methods and tools for process management and information lifecycle software systems, products and services information technology; technology software development according to customer requirements and restrictions, use of modern technologies and tools for planning, design, development, testing, deployment and implementation of information systems and software.	Investigate, analyze, detect functional and non functional requirements for software information systems and facilities of professional activity, architecture, business logic applications, mathematical models and algorithms in the software development	To carry out the synthesis of architecture and efficient software algorithms operation with the peculiarities of different programming paradigms and technologies to implement them.	Conduct empirical studies to assess the effectiveness, quality and reliability of software designed taking into account the characteristics of different programming paradigms and technologies to implement them.
Knowledge of architecture and standard component models, communication	Identify the fundamentals of concurrency and parallel decomposition,	Understand the job of parallel algorithms have an idea on	Use the concept of parallel processing; methods and software	To build parallel algorithms and analyze them	Synthesize parallel algorithms and software, various	Analyze and evaluate the quality of parallel and distributed



tools, and distributed and parallel computing, the ability to solve problems of scalability, supporting remote interaction of various components and software platforms in distributed enterprise information systems of the company; the ability to solve the problem of scalability, support for remote interaction of various components and software platforms in distributed enterprise information systems of the company.	coordination and communication between processes, describe and explain the parallel architecture parallel algorithms aware of parallel and distributed programming define parallel performance distributed systems and cloud computing, to build formal models and semantics.	strategies parallel decomposition, architecture, parallel systems, parallel algorithms determine performance distributed computing.	tools for parallel and distributed systems; develop parallel algorithms and programs parallelization of processes (threads), running processes and their interactions; implement parallel and distributed computing; create and debug parallel and distributed programs.	according to the criteria of performance, scalability, efficiency and more parallelism.	models of parallel computing systems; solve combinatorial logic-synthesis problem decomposition parallel algorithms.	algorithms to improve the performance of parallel calculations, optimize computing resources.
Title concepts of databases and data warehouses, data models, technology, database design and data warehousing, Structured Query Language; the ability to design database based on the normalization of relations, create distributed database and storage; the ability to design logical and physical models of databases, query them, searching, processing transactions in the profession.	Know the concept of database and data warehousing, data model, stages and methods of designing databases and data warehouses, Structured Query Language; identify methods and technologies develop conceptual, logical and physical database structures and data warehousing, transaction processing technologies, creating and managing distributed databases in development methodologies database management and data stores.	Understand, visualize, discuss data model, methodology of logical and physical database design and data warehousing, data integration and aggregation.	Provide structured information in the design of the database; use conceptual, logical and physical database structures, Structured Query Language; carry out normalization of relational databases; create multidimensional database; perform aggregation and integration of heterogeneous data; provide storage and retrieval of information.	Reason, classify, design and develop a database and data warehouse to analyze and select the database and data model; identify methods of processing and administration of databases and data warehouses.	Synthesize topology algorithms and data warehouse management of distributed file storage of data;	Analyze and evaluate the scalability, availability and usability of developed databases and data warehouses.
The capacity for data mining and online	Identify, describe,	Identify, describe,	Use technology	Analyze and compare	To generalize the	Conduct empirical

<p>analytical processing; knowledge of methods, objectives and standards Data Mining, data visualization methods, technologies Text Mining; Web Mining, Process Mining, architecture OLAP systems; the ability to use technology tools and software for Data Mining modeling and analysis, OLAP-services and software for data manipulation, visualization, statistical evaluation and simulation.</p>	<p>reproduce concept stage, objectives, standards Data Mining; methods of classification, prediction, cluster analysis, associative search rules; visual data analysis - Visual Mining; analysis of textual information - Text Mining; obtaining knowledge of the Web - Web Mining; means of analysis processes - Process Mining; multidimensional data model; architecture OLAP-systems; -kuby OLAP, OLAP - operation, types of OLAP implementation; Analysis of data using query language MDX.</p>	<p>interpret methods and algorithms for online analytical processing and data mining, architecture and key components of software support for multidimensional data analysis;</p>	<p>OLAP, Data Mining, Visual Mining, Text Mining, Web Mining analytical process mining of multidimensional data; solve the problem using professional methods of classification, prediction, cluster analysis, associative search rules.</p>	<p>the methods of online analytical processing and data mining.</p>	<p>problem area and the use of Data Mining and OLAP technologies, in particular to analyze corporate data, integrating various sources raznorodnyh data, choose the best scheme of storage and more.</p>	<p>research, evaluate performance, quality, online analytical processing and data mining.</p>
<p>The ability to acquire knowledge of the theoretical foundations of the organization, construction, design principles, configuration and use of various modern operating systems, ensure the organization of computing processes in enterprise information systems, economic, administrative, industrial, scientific and other purposes; ability to address the effectiveness, safety, diagnostics, recovery, monitoring and optimization of operating systems.</p>	<p>Identify, describe, play structure and function of the OS; planning and scheduling tasks, management memory data processes O devices; filesystems virtual machines, real-time and embedded systems; design of system software.</p>	<p>Understand, identify and interpret the architecture of operating systems, memory management, threads and processes, file system, network, multi-operating system and data protection.</p>	<p>To plan and scheduling tasks, managing memory, files, processes, O devices; handle interrupts using different operating systems; units develop operating systems.</p>	<p>To analyze the structure and function of the OS; subsystems planning and scheduling tasks, memory management, data, processes, O devices; file systems, virtual machines.</p>	<p>Perform synthesis structure OS subsystems planning and scheduling tasks, memory management, data, processes, O devices; file system.</p>	<p>Evaluate system performance, fault tolerance modern operating systems.</p>

Knowledge of drafting local area network based on standard protocols and interfaces, planning network infrastructure, software and hardware development of logical and physical models of local computer networks; ability to develop topology structured cable systems use computer systems and data network in the profession; connect computers to networks and work in networks; exercise informed choice media data; analyze the quality of the networks; work with network applications.	Identify, describe networking technologies, computer networking architecture, technology, administration of computer networks; software computer networks	To have an idea and understanding of network software, local and wide area networks resource allocation mobility networks, social networks.	Master the methods and means of work with computer networks; choose the configuration type and structure of a computer network; design and operate computer networks	Conduct analysis of the behavior of various network access methods at various load.	To carry out the synthesis of structure of a computer network for a given set of switches.	To investigate the decomposition structure of the computer network, evaluate the capacity of the computer network and memory network devices.
Knowledge of patterns of knowledge, methods of extracting and structuring knowledge inference for the development of knowledge base and intelligent systems, methods, knowledge engineering, semantic networks and ontologies; ability to develop artificial intelligence, expert systems, intelligent agents, ontology in various subject areas; skills a business analyst with the use of data mining, logic programming.	Identify, describe and interpret the fundamental question of intelligent systems (artificial intelligence) model of knowledge, logic statements, predicate logic; fuzzy logic, frames semantic networks and productive models; machine learning, reasoning under uncertainty, Intelligent agents natural language processing techniques based syntaksyschno- and semantically-oriented approaches; features logical programming models of neural networks architecture and design	Understand and interpret means of formalizing intellectual tasks like using artificial intelligence techniques of knowledge management, intelligent agents technology, natural language processing algorithms.	Using the methodology of designing intelligent systems, fuzzy models and neural networking tools for their implementation;. own methods of design and operation of intelligent systems; analyze and develop autonomous agents; apply different models of knowledge in the implementation of expert systems; exercise ontological analysis.	Interpret data, to diagnosis and decision support.	Project, plan and manage intelligent systems, to machine learning, monitoring and forecasting.	Conduct empirical research to evaluate the effectiveness and quality of decisions and intelligent systems, fuzzy models, neural networks and expert systems.

	techniques of expert systems.					
Knowledge of information security and in terms of the widespread use of information technology, basic types of threats to information security and technical information leakage, methods of detection and blocking; ability to exercise effective choice of computer systems and technical protection of information in the profession.	Identify, describe and interpret the fundamental questions of information security, safe design principles, the principles of network and Web security, cryptography, security platforms, and security policy management.	To have an idea and understanding of information security in terms of widespread use of information technology, basic types of threats to information security and technical information leakage, methods of detection and blocking.	Use the software and hardware of access to information in information systems and antivirus protection of information in personal computers; Computer use cryptographic information protection system.	Conduct analysis software and hardware of access to information in information systems and antivirus protection of information in personal computers.	Design, plan and manage data protection in terms of widespread use of information technology.	Conduct empirical research and evaluate the effectiveness of quality technical solutions and information security in the profession.
Knowledge of methods of analysis, modeling, reengineering business processes of information systems, the ability to use CASE-tools during their design; the ability to use CASE-tools for the design and modeling of business processes and information systems software development information systems.	Identify, describe and interpret basic modeling, design and reengineering business processes of information systems.	To have an idea and understanding of methods of analysis, modeling, reengineering business processes of information systems.	Use the CASE-tool for the design and modeling of business processes and information systems software development information systems.	Conduct analysis of business processes of information systems, analysis of CASE-tools for designing and modeling of business processes and information systems software development information systems.	To carry out the synthesis of the structure of information systems.	Conduct empirical research and evaluate the effectiveness of methods of analysis, simulation and reengineering business processes of information systems.
Basic knowledge of computer engineering to the extent necessary for an understanding of the basic principles of organization and functioning of the hardware of modern information processing systems, main characteristics, features and applications of computer systems for various applications; knowledge of methodology aided design of complex objects and systems.	Identify, describe, interpret basic principles of organization and operation of the hardware of modern information processing systems.	Languages modern technology automation design of complex objects and systems, products and services, information technology, modern paradigms and programming languages.	Use the hardware of modern information processing systems, computing systems for various purposes, the use of modern computer technology for their system, functional, design and technological design.	Conduct analysis of modern hardware systems of information processing and analysis of computer-aided design of complex objects.	Perform synthesis hardware structure of modern information processing systems.	Conduct empirical research and evaluate the effectiveness of current hardware processing.

The ability to use the basic concepts and methods of management and implementation of projects in the field of information technology; knowledge of theoretical bases, processes and procedures for managing IT projects PMBOK standards and principles of teamwork; teamwork and apply project management software systems.	Identify, describe and interpret basic questions of theoretical bases, processes and procedures for managing IT project PMBOK standards and principles of teamwork.	To have insight and understanding of the theoretical bases, processes and procedures for managing IT project PMBOK standards and principles of teamwork.	Use project management software systems.	Conduct analysis methods and software for management and implementation of projects in the field of information technology.	To carry out the synthesis of IT projects.	Evaluate the effectiveness of project management software.
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## V THE FORMS OF CERTIFICATION FOR HIGHER EDUCATION APPLICANTS

<b>Forms of attestation of applicants of the higher education</b>	<p>Final certification of persons enrolled in higher education in the specialty 122 "Computer Science and Information Technology," is based on the analysis of the success of training, evaluating the quality of applicants solve problems of higher education provided by this document and levels of competence specified in section 4.</p> <p>Final state attestation includes the defense of final qualifying degree (diploma project or work).</p>
<b>Requirements to qualifying work</b>	<p>Requirements for the content, scope and structure of qualification Bachelor determined by higher education institution.</p> <p>Final qualifying work of bachelor specialty 122 "Computer science and information technology" should be unique and be tested for academic integrity (plagiarism).</p>
<b>Requirements to attestation/ only state qualification to examination (examinations) (at presence of)</b>	It is not foreseen
<b>Requirements to public defense (demonstrations) (at presence of)</b>	<p>Graduates should show their ability to independently prepare and publicly defend their work on current issues 122 specialty "Computer science and information technologies", demonstrating the ability to work with literature, analyze and summarize, logical teaching material, reason, make independent conclusions and make proposals represent material in the form of reports and its arguments publicly defend. Illustrations (graphs, tables, figures, charts, diagrams, etc.) is in the form of computer presentations.</p>

## VI THE REQUIREMENTS TO THE SYSTEM OF THE INTERNAL PROVIDING OF QUALITY OF HIGHER EDUCATION

<b>Principles and procedures of providing quality of education</b>	Determined by Document about the system of the internal providing quality of education in Ternopil National Economical University (TNEU)
<b>Monitoring and periodic revision of the educational programs</b>	Determined by Document about organization of educational process in TNEU
<b>Annual evaluation of higher education applicants</b>	Determined by Document about an evaluation in TNEU
<b>Advanced qualification of pedagogical and scientific workers</b>	It is determined by Document about the pedagogical and scientific advanced qualification and the internship of pedagogical and scientific workers of higher educational establishments, approved by the order Ministry of Education, Youth and Sports of Ukraine № 567 dated 24.01.2013.
<b>A presence of necessary resources for organization of educational process</b>	It is determined by requirements to logistical support of specialty
<b>A presence of information systems for effective educational process control</b>	It is determined by Document about organization of educational process in TNEU
<b>Publicity of information about educational programs, degrees of higher education and qualifications</b>	Information is placing on a website TNEU in open access
<b>Prevention and detection of academic plagiarism</b>	Checking for plagiarism

The system of providing of quality of educational activity by higher educational establishment and quality of higher education (system of the internal providing of quality) after the giving of institution of higher learning is estimated by the National agency to providing of quality of higher education or independent establishments of evaluation and providing of quality of higher education which is accredited by National agency for the purpose accordance with requirements to the system of the providing of quality of higher education (National agency approves those requirements) and accordance with international standards and recommendations to providing of quality of higher education.