

**The Ministry of Education and Science of Ukraine**  
**Ternopil Ivan Puluj National Technical University**

**EDUCATIONAL PROFESSIONAL PROGRAM**  
**COMPUTER SCIENCE**  
**first level of higher education**  
**for the specialty 122 «Computer Science»**  
**of the knowledge field 12 «Information Technologies»**  
**Qualification: The Professional on Information Technologies**

**APPROVED**

**by the Academic Council**

\_\_\_\_\_ /P. Yasniy/

**(protocol № 4 of 16 Apr. 2019 y.)**

**Rector** \_\_\_\_\_ /P. Yasniy/

**(order № 4/7-381 of 23 Apr. 2019 y.)**

**Ternopil, 2019**

**APPROVEMENT PAGE**  
for educational professional program

|                        |  |
|------------------------|--|
| Higher education level | First (bachelor)                             |
| Field of knowledge     | 12 Information Technologies                  |
| Specialty              | 122 Computer Science                         |
| Qualification          | The Professional on Information Technologies |

**COMPOSED AND APPROVED**

University Science-Methodical Board  
Protocol № 4 of 11 Apr. 2019 y.

The head of SMB \_\_\_\_\_ M. Mytnyk

Pro-Rector on Scientific and Pedagogical Work  
10 Apr. 2019 y.

\_\_\_\_\_ S. Dyachuk

Head of Educational department  
09 Apr. 2019 y.

\_\_\_\_\_ I. Tkachenko

## **PREFACE**

Developed by project group of the specialty 122 «Computer Science»:

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2. Mykola Pryimak – Doctor of Science (Engineering), professor, the head of Computer Science of Ternopil Ivan Puluj National Technical University.
3. Bohdana Mlynko – Ph.D. (Engineering), Assoc. Prof. of the Computer Science dept. of Ternopil Ivan Puluj National Technical University.

Reviews of external stakeholders:

1. M. Tymoshyk – director of LLC «Маркетингові технології ПБС», Ternopil;
2. P. Khimeichuk – executive director of LLC «Future processing», Ternopil.

## 1. Program specification (Bachelor) of 122 «Computer Science»

| <b>1 – General information</b>  |   |
|---|---|
| <b>Higher educational institution and department</b>  | Ternopil Ivan Puluj National Technical University, Computer Science dept.   |
| <b>Full name of qualification</b>   | Professional in Information Technologies  |
| <b>Official name of educational program</b>   | Computer Science  |
| <b>Diploma type and number of credits according to the program</b>  | Bachelor's Diploma (Single Honours), 240 credits<br>ЄKTC, term of study 4 years   |
| <b>Valid accreditation</b>  | The certificate of accreditation HD №2087398 of 02 Aug. 2017 y. valid to 01 Jul. 2024 p.                                      |
| <b>Cycle/level</b>  | HPK of Ukraine – 7 <sup>th</sup> level, FQ-EHEA – first cycle, QF-LLL – 6 <sup>th</sup> level                                 |
| <b>Pre-requirements</b>   | Accomplished secondary education  |
| <b>Language of education</b>  | Ukrainian   |
| <b>Educational program valid to</b>   | 1 Jul. 2024 y.  |
| <b>URL of educational program</b>   | <a href="http://tntu.edu.ua/storage/pages/00000366/op122b_en.pdf">http://tntu.edu.ua/storage/pages/00000366/op122b_en.pdf</a> |
| <b>Main concepts and their definitions</b>  | The program contains main concepts and their definitions according to the Law of Ukraine “On the Higher Education”            |
| <b>2 – Program purpose</b>  |   |
| Formation and development of general and professional competencies of specialists with fundamental knowledge and practical skills in the field of computer science, promoting social stability and mobility in the labor market of graduates who are able to solve complex specialized practical problems by means of information systems and technologies. |   |
| <b>3 – Program characteristics</b>  |   |
| <b>Domain (field of knowledge, specialty)</b>   | Field of knowledge: 12 – Information technologies<br>Specialty: 122 – Computer Science  |

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| <b>Program orientation</b>              | The Bachelor's degree program is designed for students who want to become specialists in the field of engineering and research in the field of computer science. The program has an applied nature focused on the formation of the widest possible scientific and technical worldview of the future professional.   |
| <b>Program focus and specialization</b> | General program: Computer Science. Emphasis is placed on the formation and development of professional competencies in the field of information technology; study of theoretical and methodological provisions, organizational and practical tools in the field of computer graphics, systems analysis, modeling of information systems, database management, design of complex objects and systems, IT project management, protection of computer information, computer architecture and computer networks.  |
| <b>Program features</b>                 | Combining professional knowledge and skills of creating software products with intelligent data analysis technologies and business intelligence. Possibility to be passed in English, participation in academic mobility programs.  |
| <b>4 – Employment and further study</b> |   |
| <b>Employment</b>                       | Professional activity as a software engineer, software developer; system software developer, database developer, web-programmer, system administrator, information systems maintenance engineer, software development and testing specialist. Graduates can work in professions according to the National Classification of Occupations ДК 003:2010:<br>2131.2 Database administrator<br>2131.2 Data administrator<br>2131.2 Access administrator<br>2131.2 System administrator<br>2131.2 Software engineer<br>2132.2 Software engineer developer<br>2132.2 Developer (database)<br>2131.2 Software and multimedia analytic<br>2132.2 Application developer<br>2139.2 Engineer on computer utilization |

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|  | <p>2149.2 Research engineer</p> <p>3121.2 Professional on information technologies</p> <p>3121.2 Professional on software development and testing</p> <p>3121.2 Professional on software development</p> <p>3121.2 Professional on computer graphics (design)</p>  |
| <b>Aftergraduation study</b>               | A student who has been trained in this educational program and received a bachelor's degree can continue his studies in the educational institutions to obtain a master's degree in the field of knowledge "Information Technology".   |
| <b>5 – Teaching techniques and methods</b> |  |
| <b>Approaches to teaching and study</b>    | Lectures, practical classes, laboratory works, implementation of term papers and projects, independent work, consultations with teachers, work in small groups, project-oriented learning, the use of electronic training courses  |
| <b>Rating methods</b>                      | Written and oral exams, testing by means of electronic training courses, laboratory reports, essays, presentations, project defense, professional exam.  |
| <b>6 – Program competence</b>              |  |
| Integral                                   | Ability to solve specialized problems and practical tasks in the field of computer science during professional activities or in the learning process.  |
| General (Common)                           | <p>3K1. Ability to communicate, read and write in a foreign language</p> <p>3K2. Ability to work in a team and personally. Interpersonal skills</p> <p>3K3. Ability to learn and master modern knowledge</p> <p>3K4. Skills for safe operation of LC5. Ability to abstract thinking, analysis and synthesis at appropriate levels</p> <p>3K6. Knowledge and understanding of the subject area and professional activity</p> <p>3K7. Skills in the use of information and communication technologies</p> <p>3K8. Ability to apply knowledge in practical situations</p> <p>3K9. Ability to search, process and generalization of information from various sources</p> <p>3K10. Ability to develop and manage projects</p> <p>3K11. Ability to evaluate and ensure the quality of work performed</p> |
| Professional competencies of the specialty | ΦK1. Ability to analyze the design object and subject area   |

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|  | <p>ΦK2. Possession of educational and methodical bases and standards in the field of information systems and technologies (ICT), ability to apply them at development of functional profiles of ICT, at construction and integration of systems, products and services of ICT</p> <p>ΦK3. Ability to design system, communication and application software, hardware and communication and information technologies, networks and systems</p> <p>ΦK4. Ability to develop tools for the implementation of IST (methodological, informational, algorithmic, technical and software)</p> <p>ΦK5. Ability to develop, debug and improve software for computer-integrated systems.</p> <p>ΦK6. Ability to use modern design technologies in the development of algorithmic and software ICT</p> <p>ΦK7. Ability to apply, implement and operate modern ICT (manufacturing, decision support, data mining, business intelligence) in various fields of human activity, national economy and production</p> <p>ΦK8. Ability to participate in the work on the completion and development of ICT during the implementation, operation and preparation of documentation on ICT quality management</p> <p>ΦK9. Ability to manage the quality of ICT products and services throughout their life cycle</p> <p>ΦK10. Ability to assess production and non-production costs to ensure the quality of the design object, develop business solutions and evaluate new technological proposals</p> <p>ΦK11. Select, design, deploy, integrate, manage, administer, and support the application's communications networks, services, and infrastructure</p> <p>ΦK12. Ability to organize workplaces, their technical equipment, placement of computer equipment, use of organizational, technical, algorithmic and other methods of organizational and managerial activities</p> <p>ΦK13. Ability to formulate and correctly set tasks and manage junior technical staff; to connect technical and managerial divisions of the organization, and also to take an active part in training of users</p> <p>ΦK14. Ability to develop and use methods and mathematical and computer models of fundamental and applied disciplines for processing, analysis,</p> |
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|   | <p>synthesis and optimization of professional results, using methods of formal description of systems</p> <p>ΦK15. Ability to understand, deploy, organize, manage and use modern educational and research ICT (including those based on the use of the Internet), information and communication technologies</p> <p>ΦK16. Ability to conduct computational experiments, compare the results of experimental data and solutions and design the results obtained in the form of presentations, scientific and technical reports, articles and reports at scientific and technical conferences</p> <p>ΦK17. Ability to form new competitive ideas and implement them in projects (startups)</p>  |
| <b>7 – Program learning outcomes</b>                      |  |
| <p><b>Program learning outcomes for general study</b></p> | <p>3PH1. To know and have the skills and abilities of oral and written communication, the ability to communicate in dialogue in the field of professional activities with colleagues and experts in subject areas.</p> <p>3PH2. To know the basics of historical thinking, to have an idea of the sources of historical knowledge and ways to work with them.</p> <p>3PH3. To know the scientific, philosophical and religious pictures of the universe, the essence of the purpose and meaning of human life, to have an awareness of the originality of philosophy.</p> <p>3PH4. To know the conditions of formation of the person, his freedom, responsibility for the preservation of life, nature, culture, moral responsibilities of man in relation to others and himself, about spiritual values, their importance in everyday life.</p> <p>3PH5. To know and use basic science methods for solving and professional tasks.</p> <p>3PH6. To know the basics of construction and application of modern operating systems, basic office software, to be able to use packages of applications in accordance with professional activities.</p> <p>3PH7. To know the essence of the main economic categories, scientific bases and ways to increase production, to save resources.</p> <p>3PH8. To know the legal and regulatory framework of the state on the basics of occupational safety and health, as well as international standards in this area.</p> <p>3PH9. To know the legal support of the natural environment, be able to conduct instrumental measurements of numerical values of standardized</p> |



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|  | <p>indicators of the state of the environment and the production environment.</p> <p>3PH10. To know the basics of protection of production personnel and the population from accidents, catastrophes, to monitor the compliance of production processes with the requirements of environmental protection and life safety systems.</p> <p>3PH11. Know the basic tools, forms and methods, principles of physical education and basics of health.</p>  |
| <p><b>Program learning outcomes for professional study</b></p> | <p>ΦPH1. Ability to analyze problems in development of software information systems.</p> <p>ΦPH2. Understand, analyze, purposefully search for and select the necessary information and corresponding resources and knowledge to solve professional problems, taking into account modern advances in science and technology.</p> <p>ΦPH3. Know and be able to use methods and tools for collecting, formulating and analyzing information system requirements.</p> <p>ΦPH4. Know and be able to apply information technology processing, storage and transmission of data.</p> <p>ΦPH5. Conduct a pre-project survey of the subject area, systematic analysis of the design object.</p> <p>ΦPH6. Know, understand and apply effective approaches to ICT design.</p> <p>ΦPH7. Choose source data for design, guided by formal methods of describing requirements and modeling.</p> <p>ΦPH8. Know, understand and apply in practice the fundamental concepts and basic principles of language, instrumental and computing information systems and technologies.</p> <p>ΦPH9. Be able to apply methods of component software development.</p> <p>ΦPH10. Know, understand the basic processes, phases and iterations of the life cycle of information systems.</p> <p>ΦPH11. Know, understand and apply relevant mathematical concepts, methods of domain, system and object-oriented analysis and mathematical modeling for software development.</p> <p>ΦPH12. Ability to demonstrate the processes and results of professional activity, developing presentations, reports.</p> <p>ΦPH13. Have the skills to participate in team development, approval, design and release of all types of software documentation.</p> |

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|   | <p>ΦPH14. Be able to calculate the economic efficiency of software systems.</p> <p>ΦPH15. Apply in practice software tools for object-oriented, system and domain analysis, design, testing, visualization, measurement and documentation of software.</p> <p>ΦPH16. Motivated to choose programming languages to solve problems of creating and maintaining information systems.</p> <p>ΦPH17. Analyze, evaluate and select tools and computing tools of technology, algorithmic and software solutions to solve ICT problems.</p> <p>ΦPH18. Know and apply methods of algorithm development, software design and data and knowledge structures.</p> <p>ΦPH19. Know and have the skills to implement basic algorithms and data structures of programming.</p> <p>ΦPH20. Know and be able to apply technologies and methods of design and programming.</p> <p>ΦPH21. Know, understand and apply modern approaches to assessing and ensuring the quality of software.</p> <p>ΦPH22. Know and be able to apply software verification and validation methods.</p> <p>ΦPH23. Know, understand, analyze, choose, use qualified means of support information security and data integrity in accordance with the solved application tasks and created software systems.</p> <p>ΦPH24. Know, understand and apply professional standards and other legal documents in the field of information systems and technologies.</p> <p>ΦPH25. Ability to use information and communication technologies in communication and information exchange, collection, analysis and processing.</p> |
| <b>8 – Resources for program implementation</b>   |  |
| <b>Main characteristics of staff</b>              | Meets the personnel requirements for ensuring the implementation of educational activities in the field of higher education in accordance with current legislation of Ukraine (Resolution of the Cabinet of Ministers of Ukraine "On approval of licensing conditions for educational activities of educational institutions" of December 30, 2015 № 1187, Annex 12)   |
| <b>Main characteristics of logistical support</b> | Meets technological requirements for logistics support of educational activities in the field of higher education in accordance with current legislation of Ukraine  |

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|   | (Resolution of the Cabinet of Ministers of Ukraine "On approval of licensing conditions for educational activities of educational institutions" of December 30, 2015, 87 1187, Annex 13)  |
| <b>Main characteristics of educational and methodological and informational support</b> | Meets technological requirements for educational and methodological and informational support of educational activities in the field of higher education in accordance with current legislation of Ukraine (Resolution of the Cabinet of Ministers of Ukraine "On approval of licensing conditions for educational activities of educational institutions" of December 30, 2015, 87 1187, Annex 14– 15)<br>Disciplines are provided with electronic training courses, including a testing subsystem |
| <b>9 – Academic mobility</b>  |   |
| <b>National credit mobility</b>   | Based on bilateral agreements between Ternopil Ivan Puluj National Technical University and technical universities of Ukraine.  |
| <b>International credit mobility</b>  | Based on bilateral agreements between Ternopil Ivan Puluj National Technical University and foreign higher education institutions.  |
| <b>Study of foreign students</b>  | Possible after accomplish of Ukrainian or English language course   |

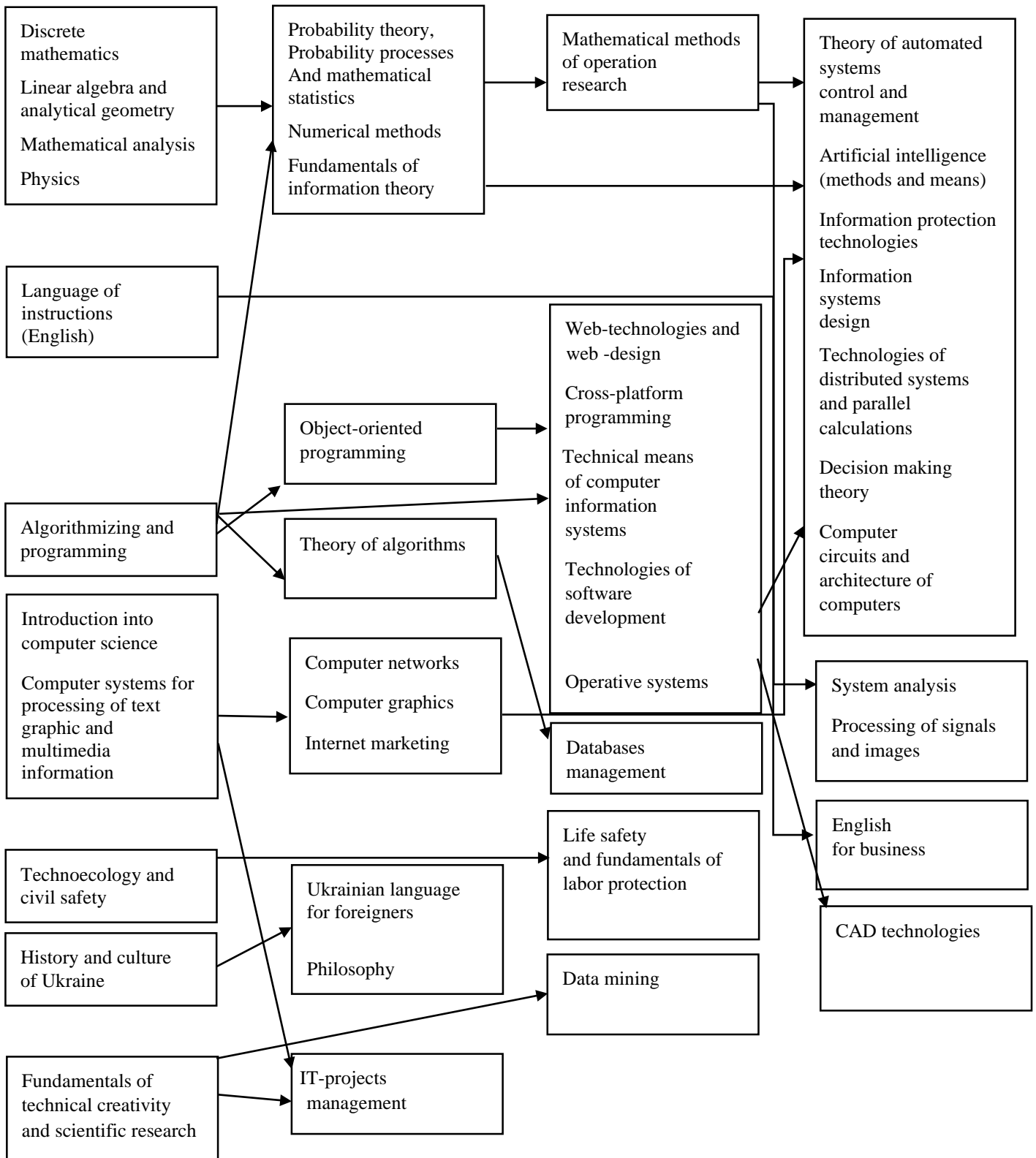
## 2. Program components list and their logical sequence

### 2.1. Program components list

| Code                         | Program components   | Credits | Form of final control |
|------------------------------|--|---------|-----------------------|
| 1                            | 2  | 3       | 4                     |
| <b>Compulsory components</b> |  |         |                       |
| OK1                          | Theory of Algorithms                                       | 4,5     | exam                  |
| OK2                          | Life Safety and Fundamentals of Labor Protection           | 4       | exam                  |
| OK3                          | Discrete Mathematics                                       | 6       | test,<br>exam         |
| OK4                          | Language of Instruction (English)                          | 6       | test,<br>exam         |
| OK5                          | History and Culture of Ukraine                             | 5       | test,<br>exam         |
| OK6                          | Linear Algebra and Analytic Geometry                       | 4       | exam                  |
| OK7                          | Mathematical Analysis                                      | 6       | exam                  |
| OK8                          | Mathematical Methods of Operations Research                | 4       | exam                  |
| OK9                          | Probability Theory and Mathematical Statistics             | 9       | test, exam            |
| OK10                         | Technoecology and Civil Safety                             | 4       | diff. test            |
| OK11                         | Ukrainian language for foreigners                          | 5       | test,<br>exam         |
| OK12                         | Physics  | 8       | test,<br>exam         |
| OK13                         | Philosophy   | 4       | exam                  |
| OK14                         | Numerical methods  | 3,5     | test                  |
| OK15                         | Algorithmizing and programming                             | 8       | exam                  |
| OK16                         | Databases management                                       | 7       | test,<br>exam         |
| OK17                         | Web-technologies and web-design                            | 9,5     | test, exam            |
| OK18                         | Introduction into Computer Science                         | 6       | exam                  |
| OK19                         | Data Mining  | 4,5     | test                  |
| OK20                         | Computer Networks  | 4,5     | exam                  |
| OK21                         | Object-Oriented Programming                                | 7,5     | test                  |
| OK22                         | IT Project Management                                      | 6       | exam                  |
| OK23                         | Cross-platform programming                                 | 4,5     | test                  |
| OK24                         | Distributed Systems Technologies and Parallel Computations | 8       | test,<br>exam         |
| OK25                         | Technologies of Information Protection                     | 3,5     | test                  |
| OK26                         | Internet Marketing   | 5       | test                  |
| OK27                         | CAD Technologies   | 5       | exam                  |
| OK28                         | Software Engineering Technologies                          | 3       | test                  |
| OK29                         | Computer graphics  | 4       | test                  |

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|--|--|-----|------------|
| OK30   | Introduction internship  | 3   | diff. test |
| OK31   | Production internship  | 3   | diff. test |
| OK32   | Technological internship   | 3   | diff. test |
| OK33   | Professional internship  | 7,5 | diff. test |
| OK34   | Graduate professional exam   | 1,5 |            |
| Total amount of compulsory components          |  | 177 |            |
| <b>Optional components</b>                     |  |     |            |
| Optional block 1 (Cycle of general study)      |  |     |            |
| BB1.1  | English for business   | 7,5 | exam       |
| BB1.2  | Fundamentals of Technical Creativity and Scientific Research             | 5,5 | test       |
| Optional block 2 (Cycle of professional study) |  |     |            |
| BB2.1  | Computer Circuits and Architecture of Computers                          | 8   | test       |
| BB2.2  | Theory of Automated Systems of Control and Management                    | 4   | exam       |
| BB2.3  | Decision Making Theory   | 4   | exam       |
| BB2.4  | Computer Systems for Word, Graphic and Multimedia Information Processing | 3,5 | exam       |
| BB2.5  | Artificial Intelligence (Methods and Systems)                            | 4   | exam       |
| BB2.6  | Operation Systems  | 3,5 | test       |
| BB2.7  | Design of Information Systems  | 5   | test       |
| BB2.8  | Technical Means of Computer Informational Systems                        | 3,5 | exam       |
| BB2.9  | Signal and Image Processing  | 3   | test       |
| BB2.10   | Fundamentals of Information Theory                                       | 4,5 | exam       |
| BB2.11   | System Analysis  | 4   | test       |
| BB2.12   | Certification, standardization and protection of software products       | 3   | test       |
| Total amount of optional components            |  | 63  |            |
| Total amount of program                        |  | 240 |            |

## 2.2. Program structure-logical schema



## 3. Form of certification of applicants for higher education

Attestation of higher education applicants is the estimation of compliance with the level and scope of knowledge, skills and competencies of higher education seekers

studying in the educational program, the requirements of higher education standards. Attestation of graduates of the specialty 122 "Computer Science" is carried out in the form of an examination in the specialty and ends with the issuance of documents of the active standard for awarding him a bachelor's degree with the qualification: Professional in Information Technologies. Certification is carried out openly and publicly.











