MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
LVIV POLYTECHNIC NATIONAL UNIVERSITY

Approved by
Rector of Lviv
Polytechnic National
University
Yu. Bobalo

Standards for quality assurance in
educational activity and higher education standards
(HES LP 01.01)

Regulations
on the Formation, Approval and Updating of Educational Programs

Lviv

1. General provisions

1.1. Regulations on the formation, approval and renewal of educational programs in Lviv Polytechnic National University (hereinafter - the Regulations) developed in accordance with the Law of Ukraine "On Higher Education" from 01.07.2014 № 1556-VII, "Standards and recommendations for quality assurance in European Higher Education Area ”of the European Association for Quality Assurance in Higher Education, adopted in May 2015, Regulations on accreditation of educational programs for higher education, approved by the order of the Ministry of Education and Science of Ukraine of July 11, 2019 № 977, Regulations on the organization of the educational process in Lviv Polytechnic National University and other internal regulations of the university.

1.2. Educational (educational-professional or educational-scientific) program (hereinafter - EP) is a single set of educational components (disciplines, individual tasks, practices, tests, etc.) aimed at achieving such learning outcomes, which gives the right to receive a certain educational or educational and professional qualifications. EP is developed for each specialty and specialization of the Lviv Polytechnic National University (hereinafter - the University).

1.3.According to the Law of Ukraine "On Higher Education" of 01.07.2014 № 1556-VII training of specialists at the University is carried out according to the following EP:

1.3.1. Educational and professional programs (hereinafter - EPP) training of junior bachelors in the amount of 120 ECTS credits.

1.3.2. EPP training of bachelors in the amount of 240 ECTS credits (indicating the maximum amounts of credit transfer)

1.3.3. EPP training of masters in the amount of 90-120 ECTS credits.

1.3.4. Educational and scientific programs (hereinafter - ESP) training of masters in the amount of 120 ECTS credits with the mandatory inclusion of research (scientific) components of at least 36 ECTS credits.

1.3.5. ESP training of doctors of philosophy with a normative term of four years with the amount of the educational component of 30-60 ECTS credits.

1.3.6. Educational and creative programs (ECP) for the preparation of a doctor of arts for a standard period of three years with an educational component of 30-60 ECTS credits.

1.4. According to the Law of Ukraine "On Higher Education" of 01.07.2014 № 1556-VII training of specialists at the University is carried out according to the following EP:

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EP:

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1.5.4. Educational and scientific programs (hereinafter - ESP) training of masters in the amount of 120 ECTS credits with the mandatory inclusion of research (scientific) components of at least 36 ECTS credits.

1.5.5. ESP training of doctors of philosophy with a normative term of four years with the amount of the educational component of 30-60 ECTS credits.

1.6. Successful implementation of the EP is the basis for awarding a person the appropriate degree of higher education.

1.7. The main principles on the basis of which the EP is developed are the following:

• compliance with the mission and strategy of the university;

• compliance of the EP with the standard of higher education (if available) and the National Qualifications Framework;

• compliance with the subject area and taking into account in the EP trends in the development of the specialty and the labor market, sectoral and regional contexts;

• taking into account the experience of similar domestic and foreign educational programs;

• taking into account the interests and proposals of all stakeholder groups;

• students' orientation is the orientation of the educational process on the applicant of higher education, his ability to learn and acquire appropriate competencies with the possibility of forming an individual educational trajectory;

• continuity is the presence of a consistent link between the various stages of the educational process and degrees of higher education;

• formation of competencies of higher education seekers through their program learning outcomes;

• systematic compliance with the purpose, content of the EP, methods, forms, tools, technologies and mechanisms for implementing the educational process to the expected learning outcomes;

• modularity is structuring the content of the EP;

• balance and realism of the EP is the objectivity of the allocation of loans to the components of the EP, the ability of applicants for higher education in certain periods of study to acquire the expected program competencies based on the results of the program;

• flexibility and mobility of the EP structure is the ability to adapt the structure and content of the EP to changes in the needs and interests of stakeholders; enrollment of program results of studying received in non-formal and informal education and re-enrollment of program results of studying received in other educational institutions as a result of academic mobility;

• availability of educational components in the EP, which allow to ensure the acquisition of social skills by higher education students during the training period;

• availability of practical training of higher education seekers in the EP, which allows to form the competencies necessary for further professional activity;

• innovation and integration of education and science - taking into account modern achievements in science and reflecting the results of research in the content of EP;

• integration of the educational process into the European Higher Education Area;

• taking into account the requirements for academic integrity in the development of EP.

1.6. Requirements for EP, which are regulated by higher education standards:

• the amount of ECTS credits required to obtain an appropriate higher education degree;

• requirements for re-crediting loans in terms of the degree of education in the EP;

• availability of a list of graduate competencies and program learning outcomes that are achieved by compulsory educational components;

• normative content of training of higher education seekers, formulated in terms of learning outcomes;

• forms of certification of applicants for higher education;

• compliance with the requirements of the system of internal quality assurance of educational activities and the quality of higher education of the University;

• requirements for forms of education;

• requirements of professional standards (if available).

2. Structure and content of educational programs

2.1.EP should contain (example of EP is given in Appendix 1):

- title page;
- page (letter) of approval of the EP;
- preface;
- description of the EP profile;
- description of program competencies and program learning outcomes;
- distribution of the content of the EP by groups of educational components and training cycles;
- list of EP components;
- information on the scientific component of the EP (only for educational and scientific programs);
- structural and logical scheme of the sequence of studying the educational components of the EP;
- information on forms of attestation of higher education seekers;
- matrices for ensuring competencies and program learning outcomes with relevant educational components of the educational program.
- information on re-crediting and recognition of ECTS credits (if such a procedure is provided for in the EP).

2.2.Requirements for the content of the EP:

2.2.1. The preface of the EP indicates its compliance with existing standards, information about the guarantor of the EP, the composition of the working (project) group of the scientific-methodical commission of the specialty, the list of stakeholders with which the EP was developed other scientific institutions, applicants for higher education, etc.), external reviewers, information on the discussion and approval of the EP at the Academic Council and the Scientific and Methodological Council of the Educational and Scientific Institute, information on the approval of the EP.

2.2.2. The description of the EP profile reflects its main features and the most important information about it, determines the subject area to which it belongs, specific features that distinguish EP from other similar programs. The description of the EP

profile contains general information, the purpose of the EP, the characteristics of the EP, as well as information on: the graduate's ability to work and further study; teaching and assessment; program competencies (integrated, general and professional); program learning outcomes (knowledge, skills, ability to communicate, independent activity, responsibility); resource provision of program implementation and academic mobility. In the 1st part of the description of the profile "General information" the Internet address of the EP (the link to the page of the Information package of University) is specified.

2.2.3. The distribution of the content of the EP by groups of educational components and training cycles reflects the distribution of the volume of the components of the EP by cycles of general and vocational training and mandatory and optional components.

2.2.4. List of educational components of the EP indicates the names of mandatory and optional components of the EP with their codes, amounts in loans and forms of final control in terms of cycles of general and vocational training.

2.2.5. Structural and logical scheme of the sequence of studying the educational components of the EP is a schematic representation of the logical sequence of the study of academic disciplines and other components of the EP.

2.2.6. Information on forms of attestation - the forms of final attestation of higher education seekers based on the results of the EP (qualification (final) exam and / or defense of qualification work taking into account the requirements of higher education standard) are indicated.

2.2.7. Existence of a description of the policy of adherence to the principles of ensuring academic integrity in the implementation of the EP.

2.2.8. The matrices of compliance of program competencies with the components of the educational program and the provision of program learning outcomes with the relevant components of the educational program show the relationship between program learning outcomes, program competencies and educational components of the EP.

2.2.9. The structural-logical scheme and matrices of correspondence indicate only the obligatory educational components and the educational components of the sample blocks.

2.3. The distribution of the content of EP by groups of components and training cycles is carried out in accordance with the requirements of the Regulations on the organization of the educational process in Lviv Polytechnic National University and approved by the scientific and methodological commission of the specialty.

3. The order of formation and approval of educational programs

3.1. In order to form the EP, the Academic Council of the Educational and Scientific Institute (hereinafter - ESI) approves a working (project) group headed by the guarantor of the EP, which acts in accordance with the regulations approved by the University.

3.2. The guarantor of the EP must meet the requirements of the Licensing Conditions for Educational Activities, in particular:

• for EPP of bachelor's and master's training and ESP of master's training to have a scientific degree and / or academic title in the relevant or related specialty;

• for ESP training of doctors of philosophy and ECP training of doctors of art to have a scientific degree and academic (honorary) title in the relevant or related specialty;
• for all types of EP to have experience of scientific and pedagogical and / or scientific work not less than 10 years.

3.3. In order to form the EP, the Academic Council of the Educational and Scientific Institute (hereinafter - ESI) approves a working (project) group headed by the guarantor of the EP, which acts in accordance with the regulations approved by the University.

The working (project) group may include members of the scientific-methodical commission of the specialty (scientific-methodical commissions of specialties), representatives of student government and the Scientific Society of Higher Education, graduate students, doctoral students and young scientists of the university, enterprises, organizations, institutions - potential employers .

3.4. EP is approved by the Academic Council of the University.

3.5. The main stages of development and approval of EP:

3.5.1. Development of the EP project by the working (project) group.

3.5.2. Consideration of the draft EP at a meeting of the department (departments).

3.5.3. Consideration of the draft EP by the Scientific and Methodological Commission of the specialty (specialties) and its approval by reviewers (leading scientists and representatives of employers).

3.5.4. External review of the EP project.

3.5.5. Posting the draft EP on the official website of the University for public discussion for at least 1 month.

3.5.6. Consideration of the draft EP, proposals and comments on it based on the results of public discussion by the Scientific and Methodological Council of the Institute.

3.5.7. Consideration of the draft EP by the Academic Council of the Institute.

3.5.8. Approval of the EP project is needed:

• for the EP training of bachelors and masters by the head of the educational and methodical department of the University;
• for ESP training of doctors of philosophy and ECP training of doctors of art by head of the department of doctoral and postgraduate studies of the University.

3.5.9. Consideration of the draft EP by the Scientific and Methodological Council of the University.

3.5.10. Consideration of the draft EP and its approval by the Academic Council of the University.

3.5.11. Approval with the entry into force of the order of the Rector of the University

3.6. The curriculum is developed and approved on the basis of the EP.

4. Ongoing monitoring, periodic review and updating of educational programs

4.1. The monitoring of the EP is carried out by the scientific-methodical commission of the specialty, the guarantor and the working (project) group of the EP at least once a year.

4.2. The monitoring of EPs is aimed at determining whether the EPs achieve the set goal and whether they meet the needs of higher education seekers, employers and other stakeholders.

4.3. EP monitoring involves the assessment of:

• compliance of EP with the achievements of science in the relevant field of knowledge,

trends in the economy and society;

- taking into account changes in the needs of higher education seekers, employers and other stakeholder groups;
- the ability of higher education students to perform the training load on the EP and achieve program learning outcomes;
- demand in the labor market for specialists who have graduated from higher education;
- taking into account the comments and recommendations of expert groups and Sectoral Expert Councils NAZYAVO, formed during the last accreditation of this EP and other EP of the University.

4.4. Monitoring of EP is carried out using the following methods:

- survey (questionnaire) of higher education seekers, employers and other stakeholders;
- analyzing the results of assessment of educational and scientific achievements of higher education seekers and comparing them with the input parameters of rating assessments when applying for education at the appropriate level of higher education;
- comparison with the EP of related specialties (specializations) and the EP of other free economic zones, including foreign ones.

4.5. Based on the results of the current monitoring, the working (project) group updates the EP and compiles a table of changes made to the EP (Annex 2), and may recommend recommending a comparative table of similar educational programs (Annex 3), which are internal working documents of the scientific-methodical commission. specialty and working (project) group.

4.6. Approval of the updated EP is carried out in accordance with paragraphs. 3.5.8-3.5.10 of this Regulation.

Appendix 1

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
LVIV POLYTECHNIC NATIONAL UNIVERSITY

«APPROVED»
Rector of Lviv Polytechnic
National University

_____Yu. Bobalo

“____”_____2021

EDUCATIONAL PROFESSIONAL PROGRAM

«INFORMATION SYSTEMS AND TECHNOLOGIES»

HIGHER EDUCATION LEVEL	First (Bachelor’s) level
HIGHER EDUCATION DEGREE	Bachelor
FIELD OF KNOWLEDGE	12 Information technologies
SPECIALITY	126 Information systems and technologies

Considered and approved
at the Academic Council meeting of
Lviv Polytechnic National University
from «____» _____ 202__

Protocol №____

Lviv 202_

_APPROVAL LETTER
of educational professional program

HIGHER EDUCATION LEVEL	First (Bachelor's) level
HIGHER EDUCATION DEGREE	Bachelor
FIELD OF KNOWLEDGE	12 Information technologies
SPECIALITY	126 Information systems and technologies

DEVELOPED AND APPROVED

by Scientific and Methodological Commission of the specialty 126 Information Systems and Technologies
Protocol № _____
from "_____" _____ 20__

Chairman of the SMC of the specialty_____

APPROVED

Vicerector of Lviv Polytechnic National University

_____

«____»_____20___

Head of the Educational and Methodical Department of the University
_____V. Sviridov

«____»_____20___

RECOMMENDED

By Scientific and Methodological Council of the University
Protocol № _____
from "__" _____ 20___

Head of the University SMC
A. Zahorodnyi

Director of Educational and Scientific Institute of computer sciences and information technologies

_____ M. Medykovskyi_

«____»_____20____

PREFACE

Developed in accordance with the Standard of Higher Education of Ukraine of the first (bachelor's) level, field of knowledge 12 Information Technologies, specialty 126 Information Systems and Technologies, approved and put into effect by the order of the Ministry of Education and Science of Ukraine from December 12, 2018 №1380.

Developed by the working group of the scientific-methodical commission of the specialty 126 "Information Systems and Technologies" of Lviv Polytechnic National University consisting of:

Andryi Vasyliuk	– Guarantor of educational and professional program, Ph.D., Associate Professor, Associate Professor of Information Systems and Networks
Yevhen Burov	– Doctor of Technical Sciences, Professor, Professor of the Department of Information Systems and Networks
Liubomyr Demkiv	– Doctor of Technical Sciences, Professor, Professor of the Department of Information Systems and Networks
Nataliia Kunanets	– Ph.D., Professor, Professor of Information Systems and Networks
Viktoriia Vysotska	– Ph.D., Associate Professor, Associate Professor of Information Systems and Networks
Yaroslav Kis’	– Ph.D., Associate Professor, Associate Professor of Information Systems and Networks
Bohdan Dmytryshyn	– IT architect of Agaliway IT company
Dov Nimrats	– IS architect of the IT company GlobalLogic
Oleh Grytsyk	– applicant for higher education, bachelor of the 3rd year of the specialty "Information Systems and Technologies", IT-31 group
Ihor Diachenko	– applicant for higher education, bachelor of the 3rd year of the specialty "Information Systems and Technologies", IT-31 group

Guarantor of educational and professional program _____Vasyliuk A.
(signature)
(surname, initials)

External reviewers:

1.
2.
...

The draft of educational and professional program was discussed and approved at a meeting of the Academic Council of the Educational and Scientific Institute of Computer Science and Information Technology

Protocol № _____ from "___" _____ 20___

Chairman of the Academic Council of ICSI _____ M. Medikovskyi

(signature) (surname, initials)

The project of the educational-professional program was discussed and approved at the meeting of the Research Institute of Computer Science and Information Technologies

Protocol № _____ of ___ _____ 20__

Chairman of the SMC of ICSI _____ _____

(signature) (surname, initials)

APPROVED AND VALID

by order of the Rector of Lviv Polytechnic National University
from "_____" _____ 20____ № _____

1. Profile of the bachelor's program in the specialty "Information systems and technologies"

1 – General information	
Full name of the institution of higher education and structural unit	**Lviv Polytechnic National University,** department «Information systems and networks» Institute of computer sciences and information technologies
Higher education level	The first (bachelor's) level
Higher education degree	Bachelor
Field of knowledge	12 Information technologies
Specialty	126 Information systems and technologies
Name of the educational program	Information Systems and Technologies
Internet address of the educational program	
Restrictions on forms of education	Full-time, part-time (distant)
Educational qualification	Bachelor of Information Systems and Technology
Qualification in diploma	Degree of higher education – Bachelor Specialty - 126 Information systems and technologies Educational program - Information systems and technologies
Description of the subject area	**Object:** theoretical and methodological bases and tools for creating and using information systems and technologies; evaluation criteria and methods for ensuring the quality, reliability, fault tolerance, survivability of information systems and technologies, as well as models, methods and tools for optimization and decision-making in the creation and use of information systems and technologies. **The purpose of training:** formation and development of general and professional competencies in information systems and technologies that contribute to the social stability and mobility of graduates in the labor market; obtaining higher education for the development, implementation and research of information systems and technologies. **Theoretical content of the subject area:** concepts and principles of information management, system integration and administration of information systems, management of IT projects, architecture of IT infrastructure of enterprises. Methods, techniques, approaches and technologies of basic and applied sciences, modeling. **Tools and equipment:** computer equipment, measuring instruments, software and hardware complexes and tools, network equipment, specialized software, modern programming languages, etc.
Academic rights of graduates	Opportunity to continue studying in the educational program of the master's degree. Acquisition of additional qualifications in the system of postgraduate education.
Number of credits under the European Credit Transfer System required for obtaining the appropriate degree of higher education	- on the basis of complete general secondary education - 240 ECTS credits; - on the basis of the degree "Junior Bachelor" (educational qualification level "Junior Specialist") is 180 ECTS credits, study period is 3 years - At least 50% of the educational program is aimed at providing general and special (professional) competencies in the specialty defined by this standard of higher education.
Availability of accreditation	-
Cycle/level	National framework of Ukraine – 7 level, FQ-EHEA – the first cycle, QF-LLL – 6 level
Prerequisites	Complete secondary education
Language of teaching	Ukrainian
Basic concepts and their definitions	The program uses basic concepts and their definitions in accordance with the Law of Ukraine "On Higher Education" and the Standard of Higher Education of Ukraine: first (bachelor's) level, field of knowledge - 12

	Information Technologies, specialty - 126 Information Systems and Technologies.
2 – The purpose of educational program	
	Provide theoretical knowledge and practical skills sufficient for successful performance of professional duties in the specialty 126 - "Information Systems and Technologies" and prepare students for further study in the chosen specialization.
3 - Characteristics of the educational program	
Orientation of the educational program	The educational and professional program is based on well-known principles and results of modern scientific research on information systems and technologies. Emphasis on competencies in the creation and use of intelligent information technology and information and communication systems in various fields of human activity, national economy and production.
The main focus of the educational program and specialization	General education and training in the field of information systems and technologies, including training of graduates capable of analysis, forecasting, decision-making in the development, implementation and maintenance of complex information systems and technologies for various purposes and solving social problems.
Features and differences	In total there are 2 professional lines: **Line 1.** Integration of information systems. The program develops promising areas for consolidation of various types of resources and their inherent production processes in integrated technological cycles, dynamic integration and adaptive administration of distributed information systems and technologies. **Line 2.** IT project management The program develops promising areas of project approach to management and coordination of human, material and financial resources during the life cycle of creation and implementation of information technology products, taking into account the complexity and scope of work in IT, using a number of practices for technology with specialists of information and technological service.
4 – Suitability of graduates of the educational program to employment and further training	
Suitability for employment	Jobs in various fields of information systems and technologies, communication, administration, integration of information technology products and IT project management: IT companies, financial companies, insurance companies, government agencies, consulting.
Further training	Opportunity to study according to the program of the second (master's) level of higher education. Acquisition of additional qualifications in the system of postgraduate education.
5 – Teaching and assessment	
Teaching and learning	Combination of lectures, laboratory and practical classes, course work and projects, research laboratory work, independent work based on textbooks, manuals and lecture notes, consultations with teachers, preparation of bachelor's paper.
Assessment	Written and oral exams, laboratory reports, oral presentations, current control, bachelor's paper defense.
6 – Program competencies	
Integral competence	Ability to solve complex specialized and practical problems in the field of information systems and technologies, or in the learning process, characterized by the complexity and uncertainty of conditions that require the application of theories and methods of information technology.
General competencies	GC 1. Ability to abstract thinking, analysis and synthesis. GC 2. Ability to apply knowledge in practical situations. GC 3. Ability to understand the subject area and professional activity. GC 4. Ability to communicate in a foreign language. GC 5. Ability to learn and master modern knowledge.

	GC 6. Ability to search, process and summarize information from various sources. GC 7. Ability to develop and manage projects. GC 8. Ability to evaluate and ensure the quality of work performed. GC 9. Ability to exercise their rights and responsibilities as a member of society, to realize the values of civil (free democratic) society and the need for its sustainable development, the rule of law, human and civil rights and freedoms in Ukraine. GC10. Ability to preserve and increase moral, cultural, scientific values and achievements of society based on understanding the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, techniques and technologies. active recreation and healthy living.
Special (professional, subject) competencies	SC 1. Ability to analyze the object of design or operation and its subject area. SC 2. Ability to apply standards in the field of information systems and technologies in the development of functional profiles, construction and integration of systems, products, services and infrastructure elements of the organization. SC 3. Ability to design, develop, set up and improve system, communication and software and hardware of information systems and technologies, the Internet of Things (IoT), computer-integrated systems and system network structure, their management. SC 4. Ability to design, develop and use tools for the implementation of information systems, technologies and infocommunications (methodological, informational, algorithmic, technical, software and others). SC 5. Ability to assess and take into account economic, social, technological and environmental factors at all stages of the life cycle of infocommunication systems. SC 6. Ability to use modern information systems and technologies (production, decision support, data mining, etc.), cybersecurity techniques and techniques in the performance of functional tasks and responsibilities. SC 7. Ability to apply information technology during the creation, implementation and operation of the quality management system and estimate the costs of its development and provision. SC 8. Ability to manage the quality of products and services of information systems and technologies during their life cycle. SC 9. Ability to develop business solutions and evaluate new technological proposals. SC 10. Ability to select, design, deploy, integrate, manage, administer and maintain information systems, technologies and infocommunications, services and infrastructure of the organization. SC 11. Ability to analyze, synthesize and optimize information systems and technologies using mathematical models and methods. SC 12. Ability to manage and use modern information and communication systems and technologies (including those based on the use of the Internet). SC 13. Ability to perform computational experiments, compare the results of experimental data and solutions. SC 14. Ability to form new competitive ideas and implement them in projects (startups).
Professional competencies (FCC)	**Line 1. Integration of information systems:** 1.1. Ability to develop and improve methods and tools of intelligent information technology for the development of intelligent systems in various fields. 1.2. Ability to formulate new tasks and ideas in the field of intelligent information technology, choose the right directions and appropriate methods for their solution. 1.3. Ability to apply the DevOps concept to build a culture of collaboration in the team of information technology project developers. 1.4. Ability to develop conceptual and mathematical models of information

	systems and technologies, smart systems, to carry out their parameterization and verification of the requirements of the technical task. 1.5. Ability to use information technology techniques and tools to create information technology products, including continuous integration techniques, continuous testing practices, monitoring, infrastructure development and configuration. 1.6. Ability to deploy, administer and maintain information systems throughout the life cycle. **Line 2. IT project management:** 2.1. Ability to possess a wide range of knowledge, skills, abilities and acquire the competencies necessary for effective project management of an IT company at all stages of its life cycle. 2.2. Ability to be guided by the principles and objectives of project management in the IT industry. 2.3. Ability to have practical skills in creating a project management information system in modern project environments. 2.4. Ability to organize, plan, control and regulate IT project management processes and when reengineering business processes, consulting projects related to the implementation of information technology, etc. 2.5. Ability to use skills in working with data warehouses, operating systems and their tools. 2.6. Ability to have skills in working with digital content management environments.

Program learning outcomes

PR 1. Know linear and vector algebra, differential and integral calculus, function theory of many variables, series theory, differential equations for functions of one and many variables, operational calculus, probability theory and mathematical statistics to the extent necessary for the development and use of information systems, technologies and infocommunications, services and infrastructure of the organization.

PR 2. Apply knowledge of basic and natural sciences, systems analysis and modeling technologies, standard algorithms and discrete analysis in solving problems of design and use of information systems and technologies.

PR 3. To use basic knowledge of informatics and modern information systems and technologies, programming skills, technologies of safe work in computer networks, methods of creation of databases and Internet resources, technologies of development of algorithms and computer programs in high-level languages. project-oriented programming to solve problems of design and use of information systems and technologies.

PR 4. Conduct a systematic analysis of design objects and justify the choice of structure, algorithms and methods of information transfer in information systems and technologies.

PR 5. Argue the choice of software and hardware for the creation of information systems and technologies based on the analysis of their properties, purpose and technical characteristics, taking into account the requirements for the system and operating conditions; have the skills to debug and test software and hardware of information systems and technologies.

PR 6. Demonstrate knowledge of the current level of information systems technology, practical skills of programming and use of applied and specialized computer systems and environments for their implementation in professional activities.

PR 7. Justify the choice of technical structure and develop appropriate software that is part of information systems and technologies.

PR 8. Apply the rules of design materials of information systems and technologies, know the composition and sequence of design work, taking into account the requirements of relevant legal documents for implementation in professional activities.

PR 9. Carry out a systematic analysis of the architecture of the enterprise and its IT infrastructure, to develop and improve its element base and structure.

PR 10. Understand and take into account social, environmental, ethical, economic aspects, requirements of labor protection, industrial sanitation, fire safety and existing national and foreign standards in the formation of technical tasks and solutions.

PR 11. Demonstrate the ability to develop a feasibility study for the development of information systems and technologies and be able to assess the economic efficiency of their implementation.

Line 1. Integration of information systems.

1.1. Apply knowledge of specialized programming languages to solve applied problems of information systems integration.

1.2. Use knowledge and skills to implement DevOps methods for analysis, modeling, design and testing, continuous integration and continuous deployment of information systems.

1.3. Administer information systems in order to increase the efficiency and quality of their application.

1.4. Use basic knowledge and skills to develop components of visualization of information systems.

1.5. Develop data flow models, repositories and data spaces, knowledge bases for intelligent information systems, using charting techniques and information systems development standards.

1.6. Create big data analysis technologies based on the use of intelligent software components, artificial neural networks, machine learning, evolutionary modeling, genetic algorithms and fuzzy logic.

1.7. Use knowledge and skills to automate the deployment and configuration of infrastructure in different environments.

1.8. Develop functional environments using open systems, application programming interfaces, applications and applications with properties: scalability, scalability, interoperability, integration and reliability.

1.9. Use the knowledge of the implementation of high-performance computing based on cloud services and technologies, parallel and distributed computing in the development and operation of information systems.

Line 2. IT project management.

2.1. Solve optimization problems in the design of control and decision-making systems, namely: mathematical models, optimality criteria, constraints, management objectives; choose rational methods and algorithms for solving optimization and optimal control problems.

2.2. Demonstrate knowledge of basic and specialized technologies for business analysis of information processes.

2.3. Use basic knowledge and skills to evaluate and ensure the quality of IT project management.

2.4. Develop models of analytical repositories and data spaces for the project of intelligent information systems, using charting techniques and standards of information systems development.

2.5. Have a methodology for project analysis to identify, compare and justify alternative management decisions and projects, which will allow to make choices and make proven decisions in conditions of limited resources.

2.6. Use basic knowledge of cloud technology paradigms for the implementation of high-performance computing based on cloud services and technologies, parallel and distributed computing in the development and operation of information systems.

2.7. Know the basics of decision theory, be able to apply them in practice to solve applied management problems and design complex systems, have modern methods of making optimal decisions about IT project management.

2.8. Apply methods of business communication for the selection and formation of the project team; making project decisions; making decisions on preventing and responding to emergencies; formation and maintenance of a favorable psychological climate in the team of IT project developers.

2.9. Possess the technology of analytical-synthetic document processing (ASDP) for information analysis and synthesis, using methods of abstraction and generalization of large volumes of data.

Communication (KOM)	1) Ability to communicate, including oral and written communication in Ukrainian and foreign (English) languages; 2) Ability to use different methods of modern information technologies for effective communication non professional and social levels.
Autonomy and responsibility (A&R)	1) Ability to adapt to nes situations and take proper decisions; 2) Ability to be aware of studying necessity during the whole life in order to make the knowledge profound and obtain new professional knowledge; 3) Ability to do a job in a responsible way, take decisions independently, achieve the set aim to meet the professional ethics requirements; 4) Ability to demonstrate understanding of basic ecological fundamentals, labour and life safety and their applying.
8 – Resources provision of the program implementation	
Basic characteristics of human resources	80% of scientific and pedagogical staff involved to teaching of professionally oriented courses in the specialty 126 «Information systems and technologies» have scientific degrees and titles, 40% of staff with practical work experience by profession.
Basic characteristics of material and technical provision	Modern computer devices and specialized software using
-Main characteristics of information and methodical provision	Using of virtual learning environment of Lviv Polytechnic National University and author's developments of scientific and pedagogical workers, in particular: textbooks and manuals of textbooks stamped by the Ministry of Education and Science of Ukraine series "Informatics", "Computing" and "Consolidated Information"; textbooks and manuals with the stamp of the Academic Council of Lviv Polytechnic National University.
9 – Academic mobility	
National credit mobility	On the basis of bilingual agreements between Lviv Polytechnic National University and technical universities of Ukraine.
International credit mobility	On the basis of bilingual agreements between Lviv Polytechnic National University and higher education institutions of foreign countries-partners.
Teaching of higher education foreign applicants	Possible, after Ukrainian language course studying.

2. Distribution of educational and professional program content by groups of components and training cycles

№	Training cycle	The amount of study load of the higher education applicant (credits / %)		
		Mandatory components of the educational program	Selective components of the educational and professional program	Total for the entire period of study
1	2	3	4	5
1.	General training cycle	**82/34**	**6/2,5**	**88/36,5**
2.	Cycle of professional training	**98/41**	**54/22,5**	**152/63,5**
Total for the entire period of study		**180/75**	**60/25**	**240/100**

3. List of components of the educational and professional program

Code	The name of the EP component	The amount of the component in ECTS credits	Form of final control
1	2	3	5
Mandatory components of the educational program			
I. General training cycle			
CK1	Foreign language (for professional purposes)	9	exam
CK2	History of statehood and culture of Ukraine	3	exam
CK3	Ukrainian language (for professional purposes)	3	exam
CK4	Philosophy	3	exam
CK5	English technical language	5	exam
CK6	Discrete Math	6	exam
CK7	Higher mathematics	11	exam
CK8	Physics	8	exam
CK9	Electronics information systems	5	exam
CK10	Probability theory and mathematical statistics	4	exam
CK11	Fundamentals of information technology	6	dif. credit
CK12	Operating systems and network technologies	7	exam
CK13	Economics and entrepreneurship	3	exam
CK14	Legal support of intellectual property	4	exam
CK15	System analysis	5	exam
	Total per cycle:	**82**	
II. Professional training cycle			
CK16	Algorithmization and programming	6	exam
CK17	Object-oriented programming and teamwork	6	exam
CK18	Computer graphics and virtual reality technologies	4	exam
CK19	Circuitry of information systems	5	exam
CK20	System programming	5	exam
CK21	Databases (including CP)	9	exam
CK22	Web technologies and WEB design	6	exam
CK23	Embedded systems	4	exam
CK24	Information systems security	7	exam
CK25	Information systems design (together with CP)	7	exam
CK26	IT project management (with CP)	6	exam
CK27	Methods of artificial intelligence	4	exam
CK28	Innovations in IP and technologies	3,5	exam
CK29	Fundamentals of labor protection and life safety	3	dif.credit

CK30	Internship	6	dif.credit
CK31	Internship on the topic of bachelor's paper	4,5	dif.credit
CK32	Execution of bachelor's qualification work	9	
CK33	Defense of bachelor's thesis	3	
	Total per cycle:	**98**	
	Total mandatory components:	**180**	
Selective components of the educational and professional program			
I. General training cycle			
	Total per cycle:	**6**	
II. Professional training cycle			
Components of selective block 1: **Information systems integration**			
B11	Specialized programming languages	5	exam
B12	Integration of information systems	6	exam
B13	Administration of information systems	5	exam
B14	Virtualization of information systems	4	exam
B15	Storage and data space technologies	5	exam
B16	Big data analysis technologies	4	exam
B17	Deployment of information systems (together with CP)	7	exam
B18	Software engineering	6	exam
B19	Cloud services	6	exam
	Total per cycle:	**48**	
Components of selective block 2: **IT projects management**			
B21	Operations Research	5	exam
B22	Business analysis of information processes	5	exam
B23	IT project quality management (together with CP)	7	exam
B24	Analytical data warehouses	5	exam
B25	Project analysis	6	exam
B26	Cloud technologies	6	exam
B27	Decision theory	6	exam
B28	Methods of business communication	4	exam
B29	ASDP technologies	4	exam
	Total per cycle:	**48**	
Selective components of other educational and professional programs			
	Total:	**6**	
	Total selective components	**60**	
	Total for educational and professional program:	**240**	

4. Form of certification of applicants for higher education

Forms of certification of applicants for higher education	Certification is carried out in the form of public defense of the qualification work.
Requirements for the qualifying exam	Qualification paper involves solving a complex specialized task or practical problem in the field of modern information systems and technologies, which is characterized by complexity and uncertainty of conditions and requires the use of theories and methods of information technology. There should be no academic plagiarism, falsification or fabrication in the qualification paper.

	Qualification paper should be posted on the website or in the repository of Lviv Polytechnic National University.

5. Matrix of correspondence of program competencies to educational components of the bachelor's degree program in specialty 126 "Information systems and technologies"

КОП	General competencies											Special (professional, subject) competencies														Specialized – professional competencies											
	ІНТ	ЗК1	ЗК2	ЗК3	ЗК4	ЗК5	ЗК6	ЗК7	ЗК8	ЗК9	ЗК10	КС1	КС2	КС3	КС4	КС5	КС6	КС7	КС8	КС9	КС10	КС11	КС12	КС13	КС14	ФКС1	ФКС2	ФКС3	ФКС4	ФКС5	ФКС6	ФКС21	ФКС22	ФКС23	ФКС24	ФКС25	ФКС26
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
СК1	•	•	•			•	•	•	•		•	•	•		•		•				•	•		•												
СК2	•	•	•			•	•	•	•		•	•	•		•		•				•	•		•												
СК3	•	•	•			•	•	•	•		•	•	•		•		•				•	•		•												
СК4	•	•	•			•	•	•	•		•	•	•		•		•				•	•		•												
СК5	•	•	•			•	•	•	•		•	•	•		•		•				•	•		•												
СК6	•	•	•	•			•					•			•		•					•		•												
СК7	•	•	•	•			•					•			•		•					•		•												
СК8	•	•	•			•	•	•	•		•	•	•		•		•				•	•		•												
СК9	•	•	•			•	•	•	•		•	•	•		•		•				•	•		•												
СК10	•	•	•	•			•					•			•		•					•		•												
СК11	•	•	•	•				•	•		•			•	•	•								•												
СК12	•	•	•	•				•	•		•			•	•	•								•												
СК13	•		•	•			•	•	•			•							•	•	•	•		•	•											
СК14	•		•	•			•		•	•	•		•						•	•	•				•											
СК15	•	•	•			•	•	•	•		•	•	•		•		•				•	•		•												
СК16	•	•	•	•				•	•		•			•	•	•								•												
СК17	•	•	•	•				•	•		•			•	•	•								•												
СК18	•	•	•	•	•	•		•	•	•	•	•	•			•	•				•		•		•											
СК19	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•				•	•	•		•											
СК20	•	•	•	•				•	•		•			•	•	•								•												
СК21	•	•	•	•				•	•		•			•	•	•								•												
СК22	•	•	•	•				•	•		•			•	•	•								•												
СК23	•	•	•	•				•	•		•		•	•	•	•	•	•		•	•	•	•	•	•											
СК24	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•				•	•	•		•											
СК25	•	•	•	•				•	•			•		•	•	•			•	•	•			•	•											
СК26	•		•	•			•	•	•			•	•	•	•	•		•		•	•	•		•												
СК27	•	•	•	•	•	•		•	•	•	•	•	•			•	•				•		•		•											
СК28	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•			•		•	•	•											
СК29	•		•	•			•		•	•	•		•						•	•	•				•											
СК30	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•											
СК31	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•											
СК32	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•											
СК33	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•											
В11	•																										•									
В12	•																													•						
В13	•																														•					
В14	•																											•								
В15	•																												•							
В16	•																									•										
В17	•																											•			•					
В18	•																									•	•									
В19	•																												•							
В21	•																														•					
В22	•																																•	•		
В23	•																														•	•				
В24	•																																		•	
В25	•																																•			
В26	•																																•			
В27	•																														•					
В28	•																																			•
В29	•																																			•

Symbols: CKi - compulsory discipline, Bi-selective discipline, i - discipline number in the list of components of the educational component, IHT - integral competence, K31 ÷ K310 - general competence, KC1 ÷ KC14 - professional (special) competence, ФКСj - specialized –professional competencies, j - competence number in the list of specialized-professional professional competencies of the educational component.

6. Matrix for providing program learning outcomes with relevant components of the bachelor's degree program in specialty 126 "Information Systems and Technologies"

Learning outcomes	Mandatory components of the specialty																																		
	СК 1	СК 2	СК 3	СК 4	СК 5	СК 6	СК 7	СК 8	СК 9	СК 10	СК 11	СК 12	СК 13	СК 14	СК 15	СК 16	СК 17	СК 18	СК 19	СК 20	СК 21	СК 22	СК 23	СК 24	СК 25	СК 26	СК 27	СК 28	СК 29	СК 30	СК 31	СК 32	СК 33
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34		
ПР1						•	•			•																									
ПР2	•	•	•	•	•			•							•																				
ПР3											•	•				•	•			•	•	•	•												
ПР4																			•					•											
ПР5																							•		•										
ПР6																		•									•	•							
ПР7																									•										
ПР8																										•									
ПР9																												•		•	•	•	•		
ПР10														•															•	•	•	•	•		
ПР11													•																	•	•	•	•		
УМ1.1																																			
УМ1.2																																			
УМ1.3																																			
УМ1.4																																			
УМ1.5																																			
УМ1.6																																			
УМ1.7																																			
УМ1.8																																			
УМ1.9																																			
УМ2.1																																			
УМ2.2																																			
УМ2.3																																			
УМ2.4																																			
УМ2.5																																			
УМ2.6																																			
УМ2.7																																			
УМ2.8																																			
УМ2.9																																			
КОМ1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
КОМ2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
АіВ1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
АіВ2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
АіВ3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
АіВ4																										•			•						

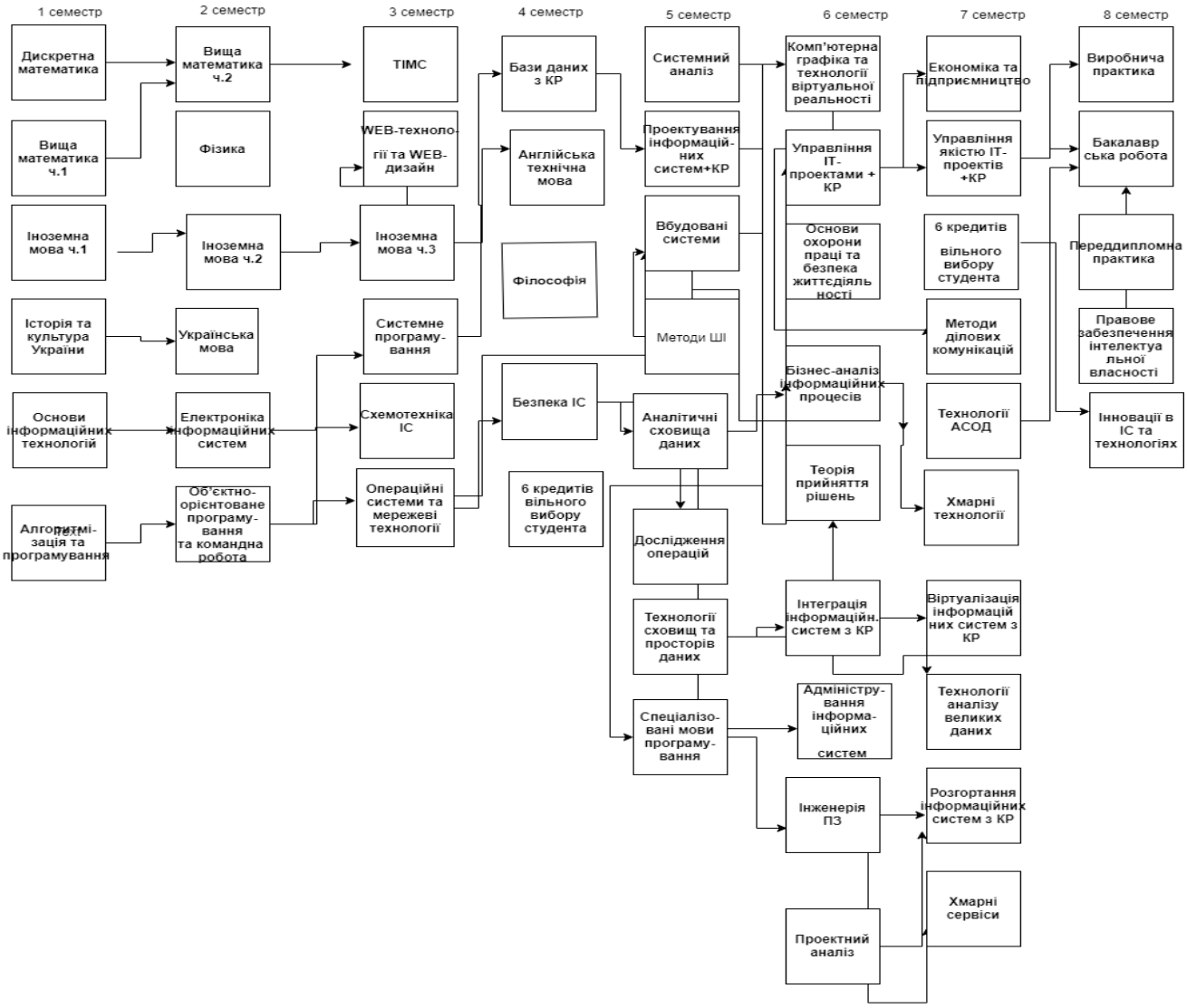
Learning outcomes	Components of the selective block of the specialty																	
	СК 1	СК 2	СК 3	СК 4	СК 5	СК 6	СК 7	СК 8	СК 9	СК 10	СК 11	СК 12	СК 13	СК 14	СК 15	СК 16	СК 17	СК 18
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
ПР1																		
ПР2																		
ПР3																		
ПР4																		
ПР5																		
ПР6																		
ПР7																		
ПР8																		
ПР9																		
ПР10																		
ПР11																		
УМ1.1	•																	
УМ1.2		•																
УМ1.3			•															
УМ1.4				•														
УМ1.5					•													
УМ1.6						•												
УМ1.7							•											
УМ1.8								•										
УМ1.9									•									
УМ2.1										•								
УМ2.2											•							
УМ2.3												•						
УМ2.4													•					
УМ2.5														•				
УМ2.6															•			
УМ2.7																•		
УМ2.8																	•	
УМ2.9																		•
КОМ1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
КОМ2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
АіВ1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
АіВ2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
АіВ3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
АіВ4																		

Symbols:

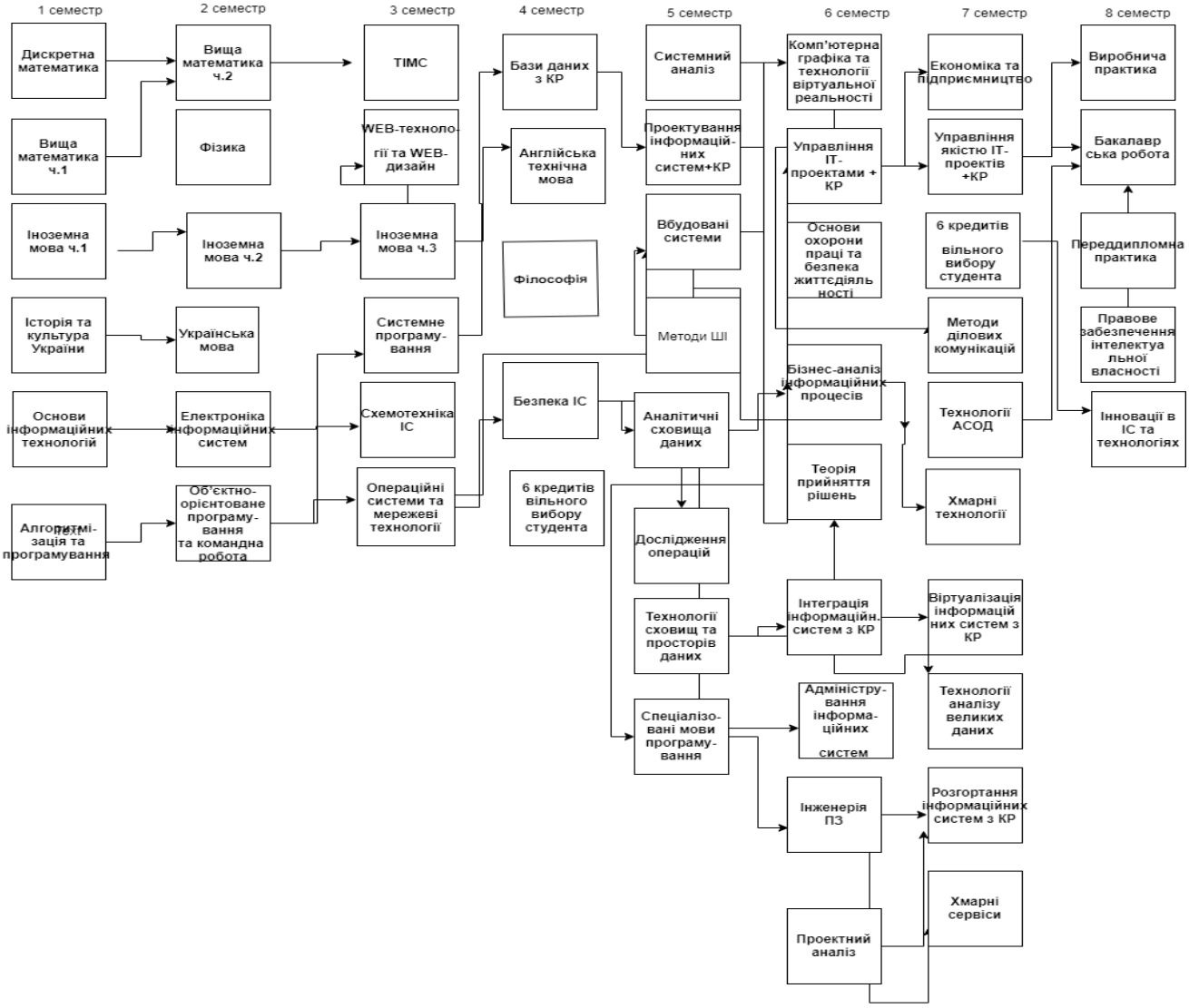
СКі - compulsory discipline**,** Bi - selective discipline, i - discipline number in the list of components of the educational component, ПРm - program results (knowledge), УМm - program results (skills), КОМm - program results (communication), АіВm - program results (autonomy and responsibility), m - the number of program results in the list of program results of the educational component.

7. Structural and logical scheme of the educational and professional bachelor's program

in the specialty 126 "Information Systems and Technologies" for the line "Information Systems Integration"



8. Structural and logical scheme of the educational and professional bachelor's program in the specialty 126 "Information Systems and Technologies" for the line "IT Project Management"



9. Re-crediting and recognition of ECTS credits, received within the educational program of training of the junior specialist

Distribution of the study load of applicants for higher education who enter on the basis of educational and qualification level "junior specialist", the amount of 180 ECTS credits, training period 3 years

№	Trasining cycle	The amount of study load of the higher education applicant (credits / %)		
		Mandatory of components of educational professional program	Selective components of educational professional programs	Total for the entire period of study
1	2	3	4	5
1.	General training cycle	**41/23**	**3/2**	**44/25**
2.	Professional training cycle	**82/45**	**54/30**	**136/75**
Total for the entire period of study		**123/68**	**57/32**	**180/100**

Table for recrediting and recognition of ECTS credits, received within the educational program of training of the junior specialist

Components of the normative term of study (240 credits)			**Relevant components of the EP for a reduced period of study (180 credits)**			**Educational components that form the program results and competencies relevant to the EP (240 credits) and ECTS credits received within the previous educational program of junior bachelor (junior specialist), which must be recognized and recredited for admission to part-time study**	
Code	**Name of educational component**	**Credits**	**Code**	**Name of educational component**	**Credits**	**The name of the educational component that generates the relevant program results ***	Credits*
I. General training cycle							
CK1	Foreign language (for professional purposes)	9				Foreign language (for professional purposes)	9
CK2	History of statehood and culture of Ukraine	3	*CK6*	Politology	3		
CK3	Ukrainian language (for professional purposes)	3				Ukrainian language (for professional purposes)	3
CK4	Philosophy	3	*CK4*	Philosophy	3		
CK5	English technical language	5	*CK5*	English technical language	6		
CK6	Discrete Maths	6				Discrete Maths	6
CK7	Higher mathematics	11				Higher mathematics	11
CK8	Physics	8				Physics	8
CK9	Teamwork	5				Teamwork	7
CK10	Probability theory	4	*CK11*	Probability	4		

	and mathematical statistics			theory and mathematical statistics			
CK11	Fundamentals of information technology	6				Fundamentals of information technology	8
CK12	Operating systems and network technologies	7	*CK13*	Operating Systems	5		
CK13	Economics and entrepreneurship	3				Economics and entrepreneurship	4
CK14	Legal support of intellectual property	4				Legal support of intellectual property	4
CK15	System analysis	5	*CK14*	System analysis	4		
II. Professional training cycle							
CK16	Algorithmization and programming	6	*CK27*	Web programming	5		
CK17	Object-oriented programming	6	*CK28*	Information systems database management systems	5		
CK18	Computer graphics and virtual reality technologies	4	*CK23*	Web-technologies	4		
CK19	Circuitry of information systems	5	*CK18*	Circuitry of information systems	5		
CK20	System programming	5	*CK20*	System programming	4		
CK21	Databases (including CP)	9	*CK22*	Databases (including CP)	7		
CK22	Applied programming	6	*CK19*	Applied programming	4		
CK23	Embedded systems	4	*CK24*	Embedded systems	5		
CK24	Information protection technologies	7	*CK21*	Computer networks	4		
			CK25	Cloud technologies	5		
CK25	Information systems design technologies (together with CP)	7	*CK30*	Design of information systems	4		
			CK26	Operations Research	5		
CK26	IT project management (with CP)	6	*CK31*	IT project management	4,5		
CK27	Methods of artificial intelligence	4	*CK32*	Machine learning	4		
CK28	Innovations in IP and technologies	3,5	*CK29*	Intelligent systems	4		
CK29	Fundamentals of labor protection and life safety	3	*CK33*	Fundamentals of labor protection and life safety	3		
CK30	Internship	6	*CK34*	Internship	6		
CK31	Internship on the topic of bachelor's	4,5	*CK35*	Internship on the topic of	4,5		

	paper			bachelor's paper			
CK32	Execution of bachelor's qualification paper	9	*CK36*	Execution of bachelor's qualification [a[er	9		
CK33	Defense of bachelor's paper	3	*CK37*	Defense of bachelor's paper	3		
		180			**120**		60
	Components of selective block 2: **IT projects management**						
B2.1	IT project quality management (together with CP)	8	*B23*	IT project quality management (together with CP)	7		
B2.10	IT project software	3,5					
B2.2	Business analysis of information processes	6	*B22*	Business analysis of information processes	5		
B2.3	Project analysis (together with CP)	6	*B25*	Project analysis	6		
B2.4	Cloud services	4	*B26*	Cloud technologies	6		
B2.5	Decision theory	4	*B27*	Decision theory	6		
B2.6	Methods of business communication	4	*B28*	Methods of business communication	4		
B2.7	ASDF technologies	4	*B29*	ASDF technologies	4		
B2.8	Analytical data warehouses	4,5	*B24*	Analytical data warehouses	5		
B2.9	Calendar and resource planning of IT projects	4	*B21*	Operations Research	5		
	Total per cycle:	**48**		**Total per cycle:**	**48**		
	Selective components of other educational and professional programs						
	Total:	**6**		**Total:**	**6**		
	Total selective components	**60**		**Total selective components**	**60**		
	Total for the normative term of study (credits):	**240**		**Total for a reduced period of study (credits):**	**180**	**Recognized and recredited (credits):**	**60**

* the names of the educational components and the number of credits for individual disciplines may differ from the plan with the standard term of study, provided that they provide the formation of the same competencies, program learning outcomes and the total number of credits of recredited components is 60.

Appendix 2

Changes in the structure and content of the educational program

Subject of changes	2017	2018	2019	2020	2021 draft
Subject area (field of knowledge, specialty, object, goals, theoretical content, methods and technologies, tools and equipment)					
The purpose of the educational program					
The main focus of the educational program					
Features and differences from other OP					
Competences					
Program learning outcomes					
Correspondence matrices of SC, SC, PRN and OK					
Characteristics of information and educational and methodological support					
International credit mobility					
Structural and logical scheme					
List of educational components (disciplines, practices, course and qualification works					
Other					

Appendix 3

Comparative table of EP on similar educational programs

Comparison parameters	EP compared	Educational programs (Ukrainian and foreign) to compare with		
		EP1	EP2	EPn
Higher education institution				
Link to the website of the Free Economic Zone and the page where the description of a similar EP is posted				
Comparison of the focus of EP with similar EP				
Features of EP in comparison with similar EP				
Features of terms of preparation on programs in credits and duration				
Description of differences and features in the sets of competencies and program learning outcomes				
Describe the differences and features in the mandatory EC sets				
Description of differences and features in the selective EC sets				

* Recommended for SMC specialties as a working document