

**THE MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
LVIV POLYTECHNIC NATIONAL UNIVERSITY**

ACCEPTED
Rector of
Lviv Polytechnic
National University

_____ Yu. Bobalo
" ____ " _____ 2022

EDUCATIONAL-PROFESSIONAL PROGRAMME

"SYSTEM DESIGN"

HIGHER EDUCATION LEVEL	<u>The second (Master's) level</u>
HIGHER EDUCATION DEGREE	<u>Master</u>
BRANCH OF KNOWLEDGE	<u>12 Information Technology</u>
SPECIALITY	<u>122 Computer Science</u>

Considered and approved
by Lviv Polytechnic
National University
Scientific Council
" ____ " _____ 2022
Protocol No. ____

LETTER OF AGREEMENT
educational-professional program

Higher education level	The second (Master's) level
Higher education degree	Master
Branch of knowledge	12 Information Technology
Specialty	122 Computer Science

DEVELOPED AND APPROVED

The Scientific and Methodological
Commission of 122 Computer Science
Protocol No. ____
" ____ " _____ 2022

The Head of the Commission
_____ U. Marikutsa

AGREED

The Vice-Rector on Scientific and
Pedagogical of Lviv Polytechnic National
University

_____ O.Davydchak
" ____ " _____ 2022

The Head of the Educational and
Methodological Department

_____ V. Tomyuk
" ____ " _____ 2022

RECOMMENDED

The Scientific and Methodological
Council of the University
Protocol No. ____
" ____ " _____ 2022

The Head of the Council
_____ A. Zagorodniy

The Director of the Educational and
Scientific Institute of Computer Science
and Information Technologies

_____ M. Medykovskyy
" ____ " _____ 2022

PREFACE

Developed by the working group of the Scientific and Methodological Commission of the specialty 122 "Computer Science" of Lviv Polytechnic National University as follows::

- | | |
|-----------------------|--|
| Serhiy Shcherbovskykh | – Guarantor of the Program, Sc.D. Senior Researcher, Professor of the Department of Computer Aided-Design Systems; |
| Mykhailo Lobur | – Sc.D., Professor, Head of the Department of Computer Aided-Design Systems; |
| Mykhailo Melnyk | – Ph.D., Associate Professor of the Department of Computer Aided-Design Systems; |
| Ulyana Marikutsa | – Ph.D., Associate Professor of the Department of Computer Aided-Design Systems; |
| Bokla Nataliia | – Ph.D., Associate Professor of the Department of Computer Aided-Design Systems; |
| Serhiy Kharytonov | – CEO of Jetsoftpro LLC; |
| Oksana Hishchak | – student of the second (master's) level of higher education, student of the group KNSP-11 |

Guarantor of the Program,
Sc.D., Professor of the Department of
Computer-Aided Design Systems

Serhiy Shcherbovskykh

The draft educational and professional program was discussed and approved at the Academic Council of the Scientific and Research Institute of Computer Science and Information Technologies.

Protocol No ____ " ____ " _____ 2022

The Head of the Academic Council of the Institute

M. Medykovsky

APPROVED AND ENTERED INTO FORCE

by order of the Rector of Lviv Polytechnic National University

" ____ " _____ 2022 No _____

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1. Profile of the educational and professional program "System design" in specialty 122 "Computer Science" for the second (master's) level of higher education

I. General characteristics	
Full name of the higher education institution and structural unit	Lviv Polytechnic National University, Department of Computer Aided Design Systems, Institute of Computer Science and Information Technology
Level of higher education	Second (master's) level
Degree in higher education	Master
Branch of knowledge	12 Information technology
Speciality	122 Computer science
Name of the educational programme	System Design
Internet address of the educational programme	http://directory.lpnu.ua/majors/ICSIT/8.122.00.03/19/2022/ua/full
Form of education	Full-time, part-time, distance learning
Educational qualifications	Master's degree in Computer Science with a specialisation in system design
Professional qualifications	
Qualifications in the diploma	Degree of higher education – Master’s degree Specialty – 122 Computer Science Specialization – System Design
Additional requirements for admission rules	No
Availability of accreditation	Accredited by
Cycle/level	NRC of Ukraine - level 7, FQ-EHEA is the second cycle, QF-LLL - level 7
Language(s) of instruction	Ukrainian, English
Description of the subject area	<p><i>Object(s) of study and/or activity:</i> processes of collecting, presenting, processing, storing, transmitting and accessing information in computer systems.</p> <p><i>Learning objectives:</i> to acquire the ability to solve research and/or innovation problems in the field of computer science.</p> <p><i>Theoretical content of the subject area:</i> modern models, methods, algorithms, technologies, processes and methods of obtaining, representing, processing, analyzing, transmitting, and storing data in information and computer systems.</p> <p><i>Methods, techniques, technologies:</i> methods and algorithms for solving theoretical and applied problems of computer science; mathematical and computer modelling, modern programming technologies; methods of collecting, analyzing and consolidating distributed information; technologies and methods of designing, developing and ensuring the quality of information technology components, computer graphics and data visualization</p>

	<p>technologies; knowledge engineering technologies, CASE technologies for modelling and designing IT.</p> <p><i>Tools and equipment:</i> distributed computing systems; computer networks; mobile and cloud technologies, database management systems, operating systems, information systems and technology development tools.</p>
Academic rights of graduates	Obtaining education under an educational program of the third (educational and scientific) level of higher education and obtaining additional qualifications in the adult education system.
Employment of graduates	<p>Professional activity as a professional in the development of mathematical, information and software of computer systems, in the field of information technology, as well as a database and system administrator.</p> <p>Graduates can work in professions according to the National Classification of Occupations DK 003:2010:</p> <p>2131.1 Researchers (computer systems).</p> <p>2131.2 Developers of computer systems.</p> <p>2132.1 Research assistants (programming).</p> <p>2132.2 Computer programmers.</p> <p>2310.2 Other teachers of higher education institutions.</p> <p>2321 Teachers of vocational (vocational-technical) education institutions.</p> <p>2322 Teachers of professional higher education institutions.</p>
Purpose, focus and features of the educational and professional program	
Objective of the program	Training of professionals capable of solving complex system design problems in innovative areas of computer science. In particular, research, analysis, modelling and solving problems of system design of information systems to meet the needs of various industries.
The main focus of the educational and professional program and specialization	<p>The focus is on innovative information technologies, as well as methods and tools for computer learning, pattern recognition and computer vision. Emphasis is placed on the design of semantic Web and Grid networks, as well as on methods of designing multi-agent systems.</p> <p><i>Keywords:</i> system design, innovative computer technologies, computer vision, Web and Grid networks, multi-agent systems.</p>
Features and differences	<p>The educational program has two lines:</p> <p>Line 1: System design</p> <p>The focus is on automating the design of intelligent systems and developing decision support systems.</p> <p>Line 2: Integrated technologies for system design of micro- and nanosystems</p> <p>The emphasis is on the latest methods of designing and manufacturing micro- and nanosystems.</p>
Teaching and assessment of learning outcomes	
Teaching and learning	Teaching and learning is carried out based on the Regulations on the Organization of the Educational Process at Lviv Polytechnic

	<p>National University, approved by Order No. 26-1-10 of 22 January 2019.</p> <p>The educational process at the University is carried out in the following forms: classes, individual tasks, independent work of students, practical training and control measures. Types of classes: lectures, laboratory, practicals, seminars, individual classes and consultations.</p>
Evaluation	<p>Control and evaluation of student learning outcomes is carried out based on the Regulations on the organization and conduct of current and semester control of student learning outcomes, approved by Order No. 27-1-10 of 23 January 2019.</p> <p>The main types of control are current and semester control. Current supervision is carried out during lectures, practicals, laboratory, seminar and individual counselling classes. Semester control is conducted in the form of an exam or test. The assessment of learning outcomes is carried out by a 100-point grading scale, which is converted to the national grading scale:</p> <p>100-88 - certified with an “excellent” grade; 87-71 - certified with a “good” grade; 70-50 - certified with a satisfactory grade; 49 - 26 - not certified; 25-00 - unattested with an unsatisfactory grade.</p>
II. Requirements for the level of education of persons who can start studying in educational programmes of the relevant speciality and their learning outcomes	
	<p>Persons with a bachelor's degree can apply for a master's degree in 122 Computer Science.</p> <p>The program of professional entrance examinations for persons who have obtained the previous level of higher education in other specialties should include verification of the acquisition of special (professional) competencies and learning outcomes defined by the standard of higher education in the specialty 122 Computer Science of the field of knowledge 12 Information Technology for the first (bachelor's) level of higher education.</p>
III. The amount of ECTS credits required to obtain the relevant higher education degree	
	<p>The volume of the educational and professional program is 90 ECTS credits.</p> <p>The minimum amount of ECTS credits allocated for internships is 10 ECTS credits.</p> <p>At least 35% of the volume of the educational program is aimed at ensuring the general and special (professional) competencies defined by this higher education standard.</p>
IV. List of mandatory graduate competencies	
Integral competence	Ability to solve research and/or innovation problems in the field of computer science.
General competences	GC01. Ability to think abstractly, analyze and synthesize. GC02. Ability to apply knowledge in practical situations. GC03. Ability to communicate in the state language both orally

	<p>and in writing.</p> <p>GC04. Ability to communicate in a foreign language.</p> <p>GC05. Ability to learn and master modern knowledge.</p> <p>GC06. Ability to be critical and self-critical.</p> <p>GC07. Ability to generate new ideas (creativity).</p>
<p>Special (professional) competences</p>	<p>SC01. Understanding of the theoretical foundations of computer science.</p> <p>SC02. Ability to formalize the subject area of a particular project in the form of an appropriate information model.</p> <p>SC03. Ability to use mathematical methods to analyze formalized models of a subject area.</p> <p>SC04. Ability to collect and analyze data (including big data) to ensure the quality of project decision-making.</p> <p>SC05. Ability to develop, describe, analyze and optimize architectural solutions for information and computer systems for various purposes.</p> <p>SC06. Ability to apply existing and develop new algorithms for solving problems in the field of computer science.</p> <p>SC07. Ability to develop software by the formulated requirements, taking into account available resources and constraints.</p> <p>SC08. Ability to develop and implement software development projects, including in unpredictable conditions, with unclear requirements the need to apply new strategic approaches, and use software tools to organise teamwork on the project.</p> <p>SC09. Ability to develop and administer databases and knowledge.</p> <p>SC10. Ability to evaluate and ensure the quality of IT projects, information and computer systems for various purposes, apply international standards for assessing the quality of software for information and computer systems, and models for assessing the maturity of information and computer system development processes.</p> <p>SC11. Ability to initiate, plan and implement processes for the development of information and computer systems and software, including its design, analysis, testing, system integration, implementation and maintenance.</p>
<p>Professional competencies of the professional direction</p>	<p>Line 1: System design</p> <p>PC1.1. Ability to apply discrete modelling to the analysis and synthesis of intelligent systems.</p> <p>PC1.2. Ability to create and improve adaptive user interfaces.</p> <p>PC1.3. Ability to develop and apply interactive decision support systems.</p> <p>Line 2: Integrated technologies for system design of micro- and nanosystems</p> <p>PC2.1. Ability to apply modern computer-aided design systems for the development of micro- and nanosystems.</p>

	<p>PC2.2. Ability to model phenomena and processes at the micro and nanoscale.</p> <p>PC2.3. Ability to design microsensors and microactuators taking into account the characteristics of a given physical environment.</p>
V. Normative content of master's training, formulated in terms of learning outcomes	
	<p>LO1. To have specialized conceptual knowledge that includes modern scientific achievements in the field of computer science and is the basis for original thinking and research, critical thinking of problems in the field of computer science and on the border of knowledge areas.</p> <p>LO2. Have specialized skills/abilities to solve problems of computer science required for research and/or innovation activities to develop new knowledge and procedures.</p> <p>LO3. Clearly and unambiguously communicate own knowledge, conclusions and arguments in the field of computer science to specialists and non-specialists, including students.</p> <p>LO4. Manage information technology workflows that are complex, unpredictable and require new strategic approaches.</p> <p>LO5. Evaluate the performance of teams and groups in the field of information technology, and ensure the effectiveness of their activities.</p> <p>LO6. Develop a conceptual model of an information or computer system.</p> <p>LO7. Develop and apply mathematical methods for analysing information models.</p> <p>LO8. Develop mathematical models and methods of data analysis (including big data).</p> <p>LO9. Develop algorithmic and software for data analysis (including big data).</p> <p>PO10. Design architectural solutions for information and computer systems for various purposes.</p> <p>LO11. Create new algorithms for solving problems in the field of computer science, and evaluate their effectiveness and limitations on their application.</p> <p>LO12. Design and maintain databases and knowledge.</p> <p>LO13. Evaluate and ensure the quality of information and computer systems for various purposes.</p> <p>LO14. Test the software.</p> <p>LO15. Identify the needs of potential customers for information processing automation.</p> <p>LO16. Perform research in the field of computer science.</p> <p>LO17. Identify and eliminate problem situations during software operation, and formulate tasks for its modification or reengineering.</p> <p>LO18. Collect, formalize, systematize and analyze the needs and requirements for the information or computer system being</p>

	<p>developed, operated or maintained.</p> <p>LO19. Analyze the current state and global trends in the development of computer science and information technology.</p> <p>Line 1: System design</p> <p>LO1.1. Identify with a given accuracy using applied mathematical packages the structure and parameters of discrete models of intelligent embedded systems based on the description of their hardware and software.</p> <p>LO1.2. To develop prototypes of adaptive user interfaces to ensure human-machine interaction with the information system, which will reduce the duration of initial user training and reduce the number of user errors.</p> <p>LO1.3. Evaluate the adequacy of the models used in an interactive decision support system for a given set of unstructured data, taking into account uncertainty and risks.</p> <p>Line 2: Integrated technologies for system design of micro- and nanosystems</p> <p>LO2.1. Develop complex 3D models of micro- and nanosystems using computer-aided design systems to form a set of design documentation based on the submitted technical specifications.</p> <p>LO2.2. Evaluate, based on mathematical modelling, the potential capabilities and limitations of structures with predetermined electrical or mechanical properties for the creation of new micro- and nanosystems.</p> <p>LO2.3 Evaluate the permissible accuracy and range of application of the designed microsensors and microactuators based on their mathematical models, taking into account the characteristics of a given physical environment.</p>
Resource support for program implementation	
Key characteristics of staffing	<ol style="list-style-type: none"> 1. The proportion of academic staff with an academic degree and/or academic rank is over 60%. 2. The proportion of academic staff with a doctoral degree and/or the academic title of professor is more than 20%. 3. The share of academic staff with work experience in the specialty is more than 20%.
Main characteristics of logistics support	<ol style="list-style-type: none"> 1. Educational infrastructure: <ul style="list-style-type: none"> - sufficient space for the educational process on the premises; - provision of computer workstations, laboratories (laboratory of operating systems, laboratory of computer networks, laboratory of numerical control, laboratory of embedded systems), testing grounds, equipment, and equipment necessary for the implementation of educational programs (Svan SV 111; Vibro analyzer SWAN-958; NVIDIA TESLA Compute Processor K20 PN: C2J97AA; Ploter Epson SureColor z system CISS; Data Cards NI USB-6001 Model: 782604-01; 781050-01 National Instruments multifunction NI PCIe-6361; Opt. Microscope Bresser Biolux LCD 40-1600x; Opt. Microscope Bresser

	<p>Microscope Science TRM 301; Bresser MikroCam 5.0 MP; Bresser Science Mikrocam adapter);</p> <ul style="list-style-type: none"> - more than 30% of classrooms are equipped with multimedia equipment; - providing dormitory accommodation for higher education students who need it. <p>2. Social and domestic infrastructure:</p> <ul style="list-style-type: none"> - Availability of a library, including reading rooms; - availability of a medical centre, catering facilities, an auditorium and concert hall, a gymnasium, a stadium and sports grounds.
<p>Main characteristics of information and methodological support</p>	<p>1. Information support:</p> <ul style="list-style-type: none"> - availability of domestic and foreign professional periodicals in the library of Lviv Polytechnic National University (including electronic versions); - access to databases of periodicals in English of the relevant or related field; - availability of the official website of Lviv Polytechnic National University, which contains basic information about its activities (structure, licenses and accreditation certificates, educational/educational-scientific/publishing/attestation (of researchers) activities, samples of educational documents, accessibility conditions for persons with disabilities and other low-mobility groups to the premises, educational and scientific structural units and their composition, list of academic disciplines, admission rules, contact information); - availability of a page on the official website of Lviv Polytechnic National University in English, which contains basic information about the activities (structure, licences and accreditation certificates, educational/educational and research programmes, samples of educational documents), rules for admission of foreigners and stateless persons, conditions of study and residence of foreigners and stateless persons, contact information. <p>2. Educational and methodological support:</p> <ul style="list-style-type: none"> - availability of all duly approved educational and professional programs and curricula for the training of higher education students; - availability of work programs for all academic disciplines of the curriculum, which include: the program of the discipline, planned learning outcomes, the procedure for assessing learning outcomes, recommended literature (main, auxiliary), and information resources on the Internet; - availability of programs for all types of practical training for each educational program; - availability of methodological materials for the final certification of higher education students;

	- availability of curricula with compulsory study of Ukrainian as a separate discipline "Ukrainian as a foreign language" in the case of training of foreigners and stateless persons.
Academic mobility	
National credit mobility	Based on bilateral agreements between Lviv Polytechnic National University and higher education institutions of Ukraine
International credit mobility	Based on bilateral agreements between Lviv Polytechnic National University and higher education institutions of foreign partner countries
Training of foreign students for higher education	Possible after completing a Ukrainian language course.
VI. Forms of certification of higher education students	
Forms of certification of higher education students	Master's degree students are assessed in the form of a public defense of their qualification work.
Requirements for qualification work (if any)	The qualification work must involve solving a complex research and/or innovation problem in the field of computer science. The qualification work must not contain academic plagiarism, falsification, or fabrication. The qualification work must be posted on the website or in the public repository of Lviv Polytechnic National University. Disclosure of qualification papers containing restricted information should be made to the requirements of the law.
VII. Requirements for the creation of educational programmes of study in a field of knowledge or group of specialities of interdisciplinary educational and research programmes	
	For interdisciplinary educational and scientific programmes, to indicate in the educational qualification of the speciality 122 Computer Science, it is necessary to ensure that applicants achieve the learning outcomes PLO01-PO05, PLO20, PLO21 and acquire special competencies SC01-SC03, SC08, SC10, SC11, DSC1, DSC2.
VIII Requirements for the creation of educational programmes of study in a field of knowledge or group of specialities of interdisciplinary educational and research programmes	
Full name and details of the relevant Professional Standard	There is no professional standard
Features of the Higher Education Standard related to the presence of the Professional Standard	There is no professional standard
IX. Additional requirements for the organisation of the educational process for educational programmes to train specialists for professions for which additional regulation has been introduced	
	No additional regulation has been introduced
X. Additional requirements for the structure of educational programmes necessary for access to professions subject to additional regulation	
	No additional regulation has been introduced

XI. List of regulatory documents on which the Higher Education Standard is based

	<ol style="list-style-type: none"> 1. The Law of Ukraine "On Higher Education" http://zakon4.rada.gov.ua/laws/show/1556-18 2. The Law of Ukraine "On Education" http://zakon5.rada.gov.ua/laws/show/2145-19 3. National Classifier of Ukraine: Classifier of professions DK 003:2010. https://zakon.rada.gov.ua/rada/show/va327609-10 4. 4. National Qualifications Framework http://zakon4.rada.gov.ua/laws/show/1341-2011-п 5. The list of fields of knowledge and specialities in which higher education students are trained, 2015 http://zakon4.rada.gov.ua/laws/show/266-2015-п 6. Guidelines for the development of higher education standards. Approved by the Order of the Ministry of Education and Science of Ukraine of 01.06.2017 No. 600 (as amended by the Order of the Ministry of Education and Science of Ukraine of 30.04.2020 No. 584. https://mon.gov.ua/storage/app/media/vyshcha/naukovo-metodychna_rada/2020-metodrekomentacziyi.docx 7. Order of the Ministry of Education and Science of Ukraine "On Approval of the Requirements for Interdisciplinary Educational (Scientific) Programmes" No. 128 of 01.02.2021 URL: https://zakon.rada.gov.ua/laws/show/z0454-21#Text 8. Standard of higher education in speciality 122 "Computer Science" for the first (bachelor's) level of higher education. URL: https://mon.gov.ua/storage/app/media/vishcha-osvita/zatverdzeni%20standarty/2019/07/12/122-kompyut.nauk.bakalavr-1.pdf
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2. Distribution of the content of the educational and professional programme by groups of components and training cycles

No	Preparation Cycle	The volume of the academic load of a higher education student (credits/%)		
		Mandatory components of the educational and professional program	Selective components of the educational and professional program	Total for the entire period of study
1.	General training cycle	3/3,3	3/3,3	6/6,7
2.	Professional training cycle	62/68,9	22/24,4	84/93,3
Total for the entire period of study		65/72,2	25/27,8	90/100

3. List of components of the educational and professional program

Code	Name of the component of the educational and professional program	The volume of the component in credits ECTS	The form final control
Mandatory components of the educational and professional program			
I. General training cycle			
MC1	Information marketing and management	3	Examination
Total per cycle:		3	
II. The cycle of professional training			
MC2	Innovative information technologies (together with CR)	9	Examination
MC3	Methods and tools for computer-based learning	5	Examination
MC4	Professional and civilian security	3	Differential credit
MC5	Pattern recognition and computer vision	5	Examination
MC6	Semantic Web- and Grid-networks	5	Examination
MC7	Methods of designing multi-agent systems	5	Examination
MC8	Practice on the topic of the master's thesis	9	Differential credit
MC9	Completing a master's thesis	16,5	
MC10	Defense of master's thesis	4,5	
Total per cycle:		62	
Together, the components are mandatory:		65	
Selective components of the educational and professional program			
I. General training cycle			
Total per cycle:		3	
II. The cycle of professional training			
Line 1: System design			
EC1.1	Automation of design of intelligent embedded systems	5	Examination
EC1.2	Methods of building an intelligent interface for utility in computer-aided design (together with the CR)	7	Examination
EC1.3	Decision support systems in computer-aided design	5	Examination
Total per cycle:		17	
Line 2: Integrated technologies for system design of micro- and nanosystems			
EC2.1	Advanced design and manufacturing methods micro- and nanosystems	5	Examination
EC2.2	Advanced micro- and nanotechnology	5	Examination
EC2.3	Advanced design of microsensors and microactuators (together with CR)	7	Examination
Total per cycle:		17	
Elective components of other educational and professional programs			
Total:		5	
Together, the selected components:		25	
Together for the educational and professional program:		90	

4. Matrix of correspondence of program competencies to the educational components of the educational program “System Design” in the specialty 122 “Computer Science”
Line 1: “System design”

No	MC1	MC2	MC3	MC4	MC5	MC6	MC7	MC8	MC9	MC10	EC1.1	EC1.2	EC1.3
GC01	+	+	+	+	+	+	+	+	+	+	+	+	+
GC02	+	+	+	+	+	+	+	+	+	+	+	+	+
GC03	+	+	+	+	+	+	+	+	+	+	+	+	+
GC04	+								+	+			
GC05	+	+	+	+	+	+	+	+	+	+	+	+	+
GC06	+							+	+	+			
GC07	+	+	+	+	+	+	+	+	+	+	+	+	+
SC01	+	+	+		+	+	+	+	+	+	+	+	+
SC02	+	+			+			+	+	+			
SC03	+	+	+	+	+	+	+	+	+	+	+	+	+
SC04					+			+	+	+	+		
SC05		+					+		+	+			
SC06			+						+	+			
SC07		+							+	+			+
SC08		+						+	+	+			
SC09						+			+	+			
SC10	+	+			+		+	+	+	+		+	+
SC11	+	+	+		+	+	+	+	+	+	+	+	+
PC1.1									+	+	+		
PC1.2									+	+		+	
PC1.3									+	+			+

5. Matrix of correspondence of program competencies to the educational components of the educational program “System Design” in the speciality 122 “Computer Science”.

Line 2: “Integrated technologies of system design of micro- and nanosystems”

№	MC1	MC2	MC3	MC4	MC5	MC6	MC7	MC8	MC9	MC10	EC2.1	EC2.2	EC2.3
GC01	+	+	+	+	+	+	+	+	+	+	+	+	+
GC02	+	+	+	+	+	+	+	+	+	+	+	+	+
GC03	+	+	+	+	+	+	+	+	+	+	+	+	+
GC04	+								+	+			
GC05	+	+	+	+	+	+	+	+	+	+	+	+	+
GC06	+							+	+	+			
GC07	+	+	+	+	+	+	+	+	+	+	+	+	+
SC01	+	+	+		+	+	+	+	+	+	+	+	+
SC02	+	+			+			+	+	+			
SC03	+	+	+	+	+	+	+	+	+	+	+	+	+
SC04					+			+	+	+		+	
SC05		+					+		+	+			
SC06			+						+	+			
SC07		+							+	+			+
SC08		+						+	+	+			
SC09						+			+	+			
SC10	+	+			+		+	+	+	+	+		+
SC11	+	+	+		+	+	+	+	+	+	+	+	+
PC1.1									+	+		+	
PC1.2									+	+	+		
PC1.3									+	+		+	+

**6. Matrix of ensuring the program learning outcomes with the relevant components of the educational program “System Design” in the specialty 122 “Computer Science”.
Line 1: "System design"**

№	MC1	MC2	MC3	MC4	MC5	MC6	MC7	MC8	MC9	MC10	EC1.1	EC1.2	EC1.3
LO1	+	+	+		+	+	+	+	+	+	+	+	+
LO2	+	+	+		+	+	+	+	+	+	+	+	+
LO3								+	+	+			
LO4							+			+			
LO5	+								+	+			
LO6		+							+	+			
LO7			+						+	+			
LO8									+	+	+		
LO9		+							+	+			
LO10							+		+	+			
LO11			+						+	+			
LO12						+			+	+			
LO13									+	+		+	
LO14				+					+	+			+
LO15	+								+	+			
LO16						+		+	+	+			
LO17		+						+	+	+			
LO18					+			+	+	+			
LO19		+			+			+	+	+			
LO1.1									+	+	+		
LO1.2									+	+		+	
LO1.3									+	+			+

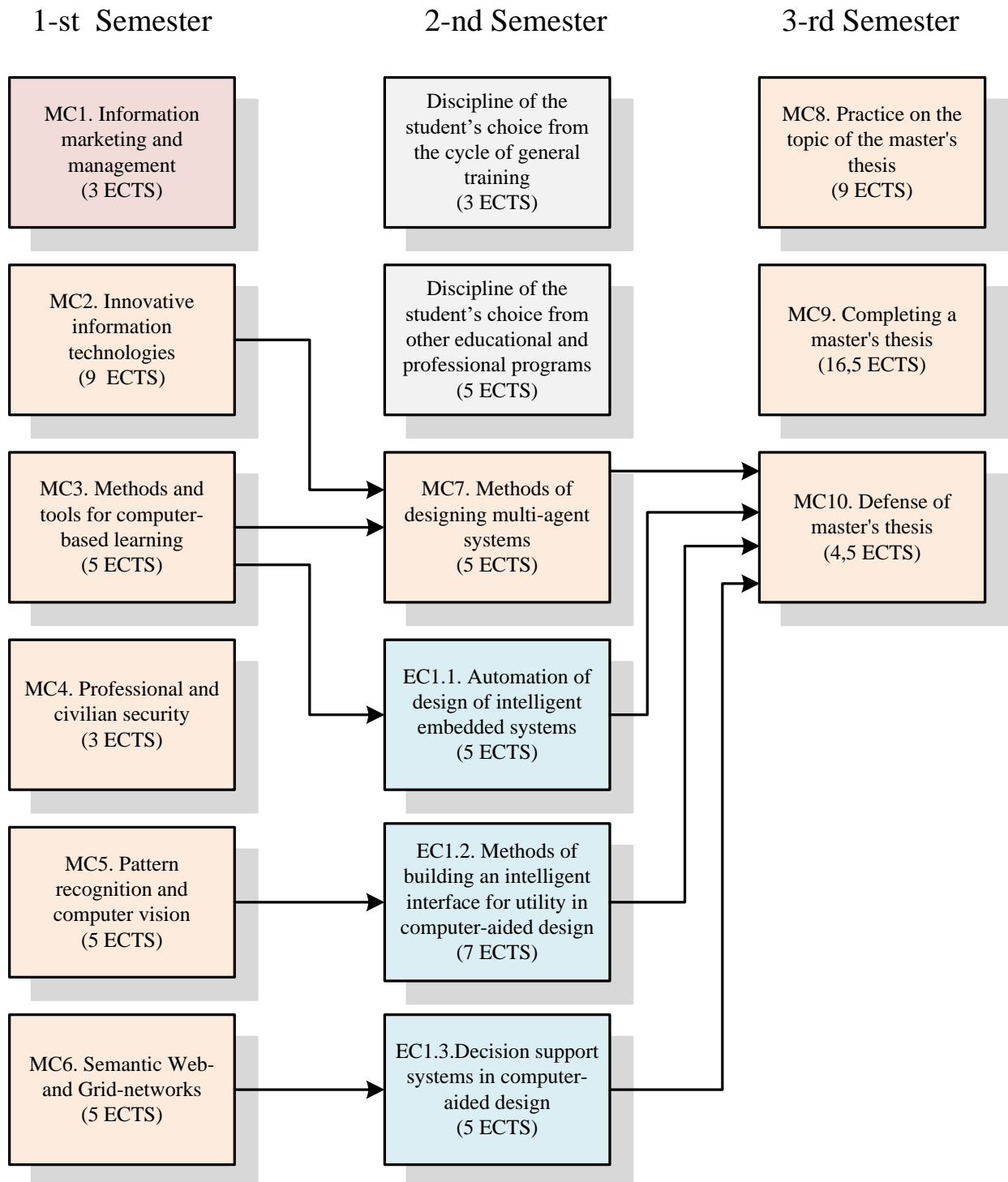
7. Matrix of ensuring the program learning outcomes with the relevant components of the educational program "System Design" in the specialty 122 "Computer Science".

Line 2: "Integrated technologies of system design of micro- and nanosystems"

№	MC1	MC2	MC3	MC4	MC5	MC6	MC7	MC8	MC9	MC10	EC2.1	EC2.2	EC2.3
LO1	+	+	+		+	+	+	+	+	+	+	+	+
LO2	+	+	+		+	+	+	+	+	+	+	+	+
LO3								+	+	+			
LO4							+			+			
LO5	+								+	+			
LO6		+							+	+			
LO7			+						+	+			
LO8									+	+		+	
LO9		+							+	+			
LO10							+		+	+			
LO11			+						+	+			
LO12						+			+	+			
LO13									+	+	+		
LO14				+					+	+			+
LO15	+								+	+			
LO16						+		+	+	+			
LO17		+						+	+	+		+	
LO18					+			+	+	+			
LO19		+			+			+	+	+			
LO2.1									+	+	+		
LO2.2									+	+		+	
LO2.3									+	+			+

8. Structural and logical diagram of the educational and professional program “System Design” in the specialty 122 “Computer Science”.

Line 1: “System design”



**9. Structural and logical diagram of the educational and professional program
 “System Design” in specialty 122 “Computer Science”.
 Line 2: “Integrated technologies of system design of micro- and nanosystems”**

