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

ACCEPTED
Rector of
Lviv Polytechnic
National University
_____ Yu. Bobalo
"26" 05 2020

EDUCATIONAL-PROFESSIONAL PROGRAM

"SYSTEM DESIGN"

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

Considered and approved
by Lviv Polytechnic
National University
Scientific Council
"26" 05 2020
Protocol No. 63

Lviv 2020

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. 6
"16" 04 2020

The Head of the Commission
_____ U. Marikutsa

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

_____ O.Davydchak
"20" 05 2020

The Head of the Educational and Methodological Department

_____ V. Sviridov
"20" 05 2020

RECOMMENDED
The Scientific and Methodological Council of the University
Protocol No. 48
"20" 05 2020

The Head of the Council
_____ A. Zagorodniy

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

_____ M. Medykovskyy
"16" 04 2020

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., Associate Professor of the Department of Computer Aided-Design Systems;
Mykhailo Lobur	–	Sc.D., Professor, Head of the Department of Computer Aided-Design Systems;
Petro Kosobuskyy	–	Sc.D., Professor, Professor of the Department of Computer Aided-Design Systems;
Mykhailo Melnyk	–	D., Associate Professor of the Department of Computer Aided-Design Systems;
Ulyana Marikutsa	–	D., Associate Professor of the Department of Computer Aided-Design Systems;
Bokla Nataliia	–	D., Associate Professor of the Department of Computer Aided-Design Systems;
Serhiy Kharitonov	–	The CEO of Jetsoftpro LLC;
Roman Voznyak	–	student of the second (master's) level of higher education, student of the group KNSP-11

Guarantor of the Program,
Sc.D., Associate 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 ___ "___" _____ 2020

The Head of the Academic Council of the Institute M. Medykovskyy

APPROVED AND ENTERED INTO FORCE
by order of the Rector of Lviv Polytechnic National University
"02" 06 2020, No 262-1-10

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

1 - General information	
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 of higher education	Master
Field of expertise	12 Information technology
Specialty.	122 Computer science
Name of the educational program	System design System Design
Internet address of the educational program	http://directory.lpnu.ua/majors
Restrictions on forms of education	Full-time, part-time (distance)
Educational qualifications	Master's degree in Computer Science with a specialisation in system design
Qualifications in the diploma	Degree of higher education – Master's degree Specialty - 122 Computer Science Educational program - System design
The amount of credits under the European Credit Transfer and Accumulation System required to obtain the relevant higher education degree	- on the basis of a bachelor's degree is 90 ECTS credits. At least 35% of the curriculum is aimed at ensuring general and special (professional) competencies in the specialty.
Availability of accreditation	Accredited by
Cycle/level	NRC of Ukraine - level 7, FQ-EHEA is the second cycle, QF-LLL - level 7
Background.	Bachelor's degree is required
Language(s) of instruction	Ukrainian English
Basic concepts and their definitions	The program uses basic concepts and their definitions in accordance with the Law of Ukraine "On Higher Education"
2 - Objective of the educational 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.

3 - Characteristics of the educational program	
Description of the subject area	*Object(s) of study and/or activity:* - mathematical, information, simulation models of real phenomena, objects, systems and processes, subject areas, data and knowledge representation; - Methods and technologies for obtaining, storing, processing, transmitting and using information, data mining and decision-making; - theory, analysis, development, performance evaluation, algorithm implementation, high-performance computing, including parallel computing and big data. *Learning objectives*: training of specialists capable of conducting theoretical and experimental research in the field of computer science; applying mathematical methods and algorithmic principles in modelling, designing, developing and maintaining information technologies; developing, implementing and maintaining intelligent systems for analyzing and processing data of organizational, technical, natural and socio-economic systems. *Theoretical content of the subject area*: modern models, methods, algorithms, technologies, processes and methods of obtaining, representing, processing, analyzing, transmitting, storing data in information systems. *Methods, techniques and technologies*: mathematical models, methods and algorithms for solving theoretical and applied problems arising in the development of IT; modern technologies and programming platforms; methods of collecting, analyzing and consolidating distributed information; technologies and methods of designing, developing and ensuring the quality of IT components; computer graphics and data visualization technologies; knowledge engineering technologies, CASE technologies for modelling and designing IT; *Tools and equipment*: distributed computing systems; computer networks; mobile and cloud technologies, database management systems, operating systems.
Main focus of the educational program and specialization	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. *Keywords*: system design, innovative computer technologies, computer vision, Web and Grid networks, multi-agent systems.

Features and differences	There are two professional lines: **Line 1: System design.** The focus is on automating the design of intelligent systems and developing decision support systems. **Line 2: Integrated system design technologies of micro- and nanosystems** The emphasis is on the latest methods of designing and manufacturing micro- and nanosystems.
4 - Suitability of graduates of the educational program for employment and further study	
Suitability for employment	Graduates can work in professions according to the National Classification of Occupations DK 003:2010: 213 Professionals in the field of computing (computerisation): 2131 Professionals in the field of computer systems: 2131.1 Junior researcher (computer systems); 2131.1 Researcher (computer systems). 2131.2 Developers of computer systems: 2131.2 Database administrator; 2131.2 Data Administrator; 2131.2 Access administrator; 2131.2 Access administrator (group); 2131.2 Task administrator; 2131.2 System administrator; 2131.2 Computer systems analyst; 2131.2 Computer communications analyst; 2131.2 Computer data bank analyst; 2131.2 Operational and application software analyst ; 231 Teachers of universities and higher education institutions: 2310 Lecturer at universities and higher education institutions.
Further training	Opportunity to study at the third (educational and scientific) level of higher education. Acquisition of additional qualifications in the postgraduate education system
5 - Teaching and assessment	
Teaching and learning	Teaching and learning is carried out on the basis of the Regulations on the Organization of the Educational Process at Lviv Polytechnic National University, approved by Order No. 26-1-10 of 22 January 2019. 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, practical, seminars, individual classes and consultations.
Evaluation	Monitoring and evaluation of student learning outcomes is carried out on the basis of the Regulations on the organisation and conduct of current and semester monitoring of student learning outcomes, approved by Order No. 27-1-10 of 23 January 2019.

	The main types of control are current and semester control. Current control is carried out during lectures, practical, laboratory, seminar and individual consultative classes. Semester control is carried out in the form of an exam or test. The assessment of learning outcomes is carried out in accordance with a 100-point grading scale, which is converted to the national grading scale: 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.
6 - Program competences	
Integral competence (IC)	IC. The ability to solve complex specialized tasks and practical problems in the field of computer science or in the process of studying, which involves the application of theories and methods of information technology and is characterized by complexity and uncertainty of conditions.
General competences (GC)	GC1. Ability to think abstractly, analyze and synthesize. GC2. Ability to apply knowledge in practical situations. GC3. Ability to communicate in the state language both orally and in writing. GC4. Ability to learn and master modern knowledge. GC5. Ability to search, to process and to analyze information from various sources. GC6. Ability to generate new ideas (creativity). GC7. Ability to work in a team. GC8. Ability to be critical and self-critical. GC9. Ability to make informed decisions. GC10. Ability to assess and ensure the quality of work performed.
Special (professional, subject) competences (SC)	SC1. Ability to manage information system resources. SC2. Ability to perform text mining. SC3. Ability to perform content- and context-oriented analysis of user profiles in social networks. SC4. Ability to extract web content, web structures and analyze the use of web resources. SC5. Ability to solve problems of classification, clustering and recognition using computer learning methods. SC6. Ability to develop and improve algorithms for k-nearest neighbors, support vectors, decision trees and regression analysis. SC7. Ability to create safe working and living conditions, ensure civil protection and technological security of information systems. SC8. Ability to solve problems of detection, tracking and classification of objects using computer vision methods and

	algorithms. SC9. Ability to perform preliminary digital image processing to apply methods and algorithms for pattern recognition. SC10. Ability to create and modify semantic Web and Grid networks. SC11. Ability to build an ontology for a given subject area. SC12. Ability to solve problems of information retrieval and coordination based on the use of multi-agent systems. SC13. Ability to use the principles of reactivity, proactivity and sociality to create intelligent agents.
Professional competences of the professional direction (PCC)	**Line 1: System design** PC1.1. Ability to apply discrete modelling to the analysis and synthesis of intelligent systems. PC1.2. Ability to identify the parameters and structure of a discrete model. PC1.3. Ability to create and improve adaptive user interfaces. PC1.4. Ability to technically and organisationally support the collection of data to create time-based user behavioural models. PC1.5. Ability to develop and apply interactive decision support systems. PC1.6. Ability to create new mathematical models to improve the decision support system. **Line 2: Integrated system design technologies of micro- and nanosystems** PC2.1. Ability to apply modern computer-aided design systems for the development of micro- and nanosystems. PC2.2. Ability to prepare a set of design documentation for the manufacture of a prototype micro- or nanosystem. PC2.3. Ability to model phenomena and processes at the micro and nanoscale. PC2.4. Ability to design structures with predetermined electrical and mechanical properties. PC2.5. Design microsensors and microactuators to meet the characteristics of a given physical environment. PC2.6. Ability to develop highly adequate mathematical models of microsensors and microactuators.
7 - Program learning outcomes	
Program learning outcomes (LO)	LO1. Student able to select team members and distribute responsibilities among them to synergize group task performance. LO2. Student able to apply principles, strategies, and procedures for critical thinking to solve non-trivial practical problems to make informed, independent decisions. LO3. Student able to speak (Ukrainian, English) at a high level by using professional terminology and understanding the context to quickly, unambiguously, and concisely express an

	opinion. LO4. Student is able to assess the content and scope of resource management tasks for information systems at all stages of their life cycle based on the basic principles of marketing and management. LO5. Student is able to evaluate the effectiveness of information retrieval and categorization of texts from the collection of relational type, unstructured type, web data, and Big Data based on models and text mining methods. LO6. The student is able to evaluate the accuracy of predictions and recommendations obtained based on content- and context-oriented analysis of user profiles from social networks. LO7. The student is able to choose methods and models for Web Content Mining, Web Structure Mining, and Web Usage Mining provide specialized or personalized information retrieval and analysis on the Internet. LO8. The student is able to evaluate the accuracy of the analysis of a given data set to solve classification, clustering, and recognition problems based on the methods of k-nearest neighbors, reference vectors, decision tree, and regression analysis. LO9. The student is able to develop algorithms for implementing k-nearest neighbor methods, reference vectors, decision trees, and regression analysis, which provide the specified accuracy for solving classification, clustering, and recognition problems for given datasets. L10. The student is able to assess the adequacy of the proposed recommendations for creating and maintaining safe working and living conditions, ensuring civil protection and artificial safety, and responding to emergencies and eliminating their consequences for a given information system. LO11. Student is able to develop new methods and algorithms for pattern recognition and computer vision to detect, track, and classify objects based on digital image processing. LO12. The student is able to evaluate the accuracy and speed of pattern recognition and computer vision algorithms for specified object detection, tracking, or classification problems based on defined test image sets. LO13. Student is able to estimate the time required to create a semantic network that describes the ontology of the subject area using specialized software. LO14. Student is able to develop new structurally complex semantic networks that create an ontology of a given subject area based on the intellectual analysis of poorly structured data in specialized software.

	LO15. The student is able to develop new architectures of multi-agent systems based on game theory and the method of auctions from the given intelligent agents, which will increase the efficiency of solving information retrieval and coordination problems. LO16. Student is able to develop specialized intelligent agents based on the principles of reactivity, proactivity, and sociability to improve the architecture of multi-agent systems. **Line 1: System design** LO1.1. The student is able to identify with a given accuracy using applied mathematical packages, the structure, and parameters of discrete models of intelligent embedded systems based on their hardware and software description. LO1.2. The student is able to assess the adequacy of a discrete model of an intelligent embedded system, built based on identified structure and parameters, by given diagrams of the characteristics. LO1.3. Student is able to develop prototypes of an adaptive user interface to ensure human-machine interaction with the information system reduces the duration of the initial user training and reduces the number of user errors. LO1.4. Student is able to assess the adequacy of time user behavior models to create a given adaptive user interface based on focus areas by types, forms, and modes of interaction. LO1.5. Student is able to assess the adequacy of models used in an interactive decision support system for a given set of unstructured data and consider uncertainties and risks. LO1.6. Student is able to develop interactive automated systems designed to support effective technical and management decisions based on artificial intelligence and simulation techniques. **Line 2: Integrated system design technologies of micro- and nanosystems** LO2.1. Student is able to develop complex 3D models of micro/nanosystems using computer-aided design systems to form a set of design documentation based on the submitted technical task. LO2.2. The student is able to evaluate the completeness and quality of preparation of a set of design documentation for producing a prototype of a given micro/nanosystem, which is developed by its 3D modelling in a given computer-aided design system. LO2.3. Student is able to evaluate the potential and limitations of structures with predetermined electrical or mechanical properties to create new micro/nanosystems based on mathematical modelling.

	LO2.4. The student is able to develop a deep understanding of phenomena and processes at the micro and nanoscale, adequate mathematical models for structures with predetermined electrical or mechanical properties. LO2.5. The student is able to evaluate the allowable accuracy and range of application of designed microsensors and microactuators based on their mathematical models, taking into account the characteristics of a given physical environment. LO2.6. Student is able to develop new mathematical models for microsensors and microactuators using software packages designed for engineering calculations, analysis, and simulation of physical processes that will adequately consider the features and conditions of use of such devices.
8 - Resource support for program implementation	
Key characteristics of staffing	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	1. Educational infrastructure: - sufficient space for the educational process in 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, 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 Microscope Science TRM 301; Bresser MikroCam 5.0 MP; Bresser Science Mikrocam adapter); - more than 30% of classrooms are equipped with multimedia equipment; - providing dormitory accommodation for higher education students who need it. 2. Social and domestic infrastructure: - availability of a library, including reading rooms; - availability of a medical center, catering facilities, an assembly and concert hall, a gymnasium, a stadium and sports grounds.
Main characteristics of information and methodological support	1. Information support: - availability of domestic and foreign professional periodicals of the relevant or related special profile in the library of Lviv

	Polytechnic National University (including in electronic form); - 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/certification (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). - availability of a page on the official website of Lviv Polytechnic National University in English, which contains basic information about the activities (structure, licenses and accreditation certificates, educational/educational and research programs, samples of educational documents), rules for admission of foreigners and stateless persons, conditions of study and residence of foreigners and stateless persons, contact information. 2. Educational and methodological support: - availability of all duly approved educational and professional programs and curricula for which we train higher education applicants; - 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), 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 mandatory study of the Ukrainian language as a separate discipline "Ukrainian as a foreign language" in the case of training of foreigners and stateless persons.
9 - Academic mobility	
National credit mobility	On the basis of bilateral agreements between Lviv Polytechnic National University and higher education institutions of Ukraine
International credit mobility	On the basis of bilateral agreements between Lviv Polytechnic National University and higher education institutions of foreign partner countries
Training of foreign higher education students	Possible after completing a Ukrainian language course.

2. Distribution of the content of the educational and professional program 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 Technology (together with CP)	9	Examination
MC3	Methods and Tools for Machine Learning	5	Examination
MC4	Professional and Civil Security	3	Examination
MC5	Pattern Recognition and Computer Vision	5	Examination
MC6	Semantic Web and Grid Networks	5	Examination
MC7	Methods of Designing Multiagent Systems	5	Examination
MC8	Internship on Master Thesis	9	Examination
MC9	Preparation of Master Thesis	16,5	
MC10	Defense of Master Thesis	4,5	
	Total per cycle:	**62**	
	Together, the components are mandatory:	**65**	
Selective components of the educational program			
I. General training cycle			
	Total per cycle:	**3**	
II. The cycle of professional training			
Line 1: System design			
EC1.1	Design Automation for Embedded Systems	5	Examination
EC1.2	Computer-Aided Design for User Interfaces (together with the CP)	7	Examination
EC1.3	Computer-Aided Design for Decision Support Systems	5	Examination
	Total per cycle:	**17**	
Line 2: Integrated technologies for system design of micro- and nanosystems			
EC2.1	Progressive Methods for Design and Production of Micro/Nano Systems	5	Examination
EC2.2	Progressive Micro/Nano Technologies	5	Examination
EC2.3	Extended Design of Microsensors and Microactuators (together with CP)	7	Examination
	Total per cycle:	**17**	
Elective components of other educational programs			
	Total:	**5**	
	Together, the selected components:	**25**	
	Together for the educational and professional program:	**90**	

4. Form of certification of higher education students

Forms of certification of higher education students	Attestation is carried out in the form of a public defense of the qualification work.
Requirements for qualification work	The qualification work must include theoretical, systematic, technical or experimental research of a complex specialized task or practical problem in the field of computer science, which is characterized by complexity and uncertainty of conditions and requires the application of theories and methods of information technology. The qualification work must not contain academic plagiarism, falsification and fabrication. The qualification work must be posted on the website or in the repository of Lviv Polytechnic National University.

5. Matrix of correspondence of program competences 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
IC	+	+	+	+	+	+	+	+	+	+	+	+	+
GC1	+	+	+	+	+	+	+	+	+	+	+	+	+
GC2	+	+	+	+	+	+	+	+	+	+	+	+	+
GC3	+	+	+	+	+	+	+	+	+	+	+	+	+
GC4	+	+	+	+	+	+	+	+	+	+	+	+	+
GC5	+	+	+		+	+	+	+	+	+	+	+	+
GC6	+	+	+	+	+	+	+	+	+	+	+	+	+
GC7	+	+	+	+	+	+	+				+	+	+
GC8	+	+	+	+	+	+	+	+	+	+	+	+	+
GC9	+	+	+	+	+	+	+	+	+	+	+	+	+
GC10	+	+	+	+	+	+	+	+	+	+	+	+	+
SC1	+								+	+			
SC2		+						+	+	+			
SC3		+						+	+	+			
SC4		+						+	+	+			
SC5			+						+	+			
SC6			+					+	+	+			
SC7				+				+	+	+			
SC8					+			+	+	+			
SC9					+			+	+	+			
SC10						+		+	+	+			
SC11						+		+	+	+			
SC12							+	+	+	+			
SC13							+	+	+	+			
PC1.1								+	+	+	+		
PC1.2								+	+	+	+		
PC1.3								+	+	+		+	
PC1.4								+	+	+		+	
PC1.5								+	+	+			+
PC1.6								+	+	+			+

6. Matrix of correspondence of program competences to the educational components of the educational program "System Design" in the specialty 122 "Computer Science".

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

No	MC1	MC2	MC3	MC4	MC5	MC6	MC7	MC8	MC9	MC10	EC2.1	EC2.2	EC2.3
IC	+	+	+	+	+	+	+	+	+	+	+	+	+
GC1	+	+	+	+	+	+	+	+	+	+	+	+	+
GC2	+	+	+	+	+	+	+	+	+	+	+	+	+
GC3	+	+	+	+	+	+	+	+	+	+	+	+	+
GC4	+	+	+	+	+	+	+	+	+	+	+	+	+
GC5	+	+	+		+	+	+	+	+	+	+	+	+
GC6	+	+	+	+	+	+	+	+	+	+	+	+	+
GC7	+	+	+	+	+	+	+				+	+	+
GC8	+	+	+	+	+	+	+	+	+	+	+	+	+
GC9	+	+	+	+	+	+	+	+	+	+	+	+	+
GC10	+	+	+	+	+	+	+	+	+	+	+	+	+
SC1	+								+	+			
SC2		+						+	+	+			
SC3		+						+	+	+			
SC4		+						+	+	+			
SC5			+						+	+			
SC6			+					+	+	+			
SC7				+				+	+	+			
SC8					+			+	+	+			
SC9					+			+	+	+			
SC10						+		+	+	+			
SC11						+		+	+	+			
SC12							+	+	+	+			
SC13							+	+	+	+			
PC2.1								+	+	+	+		
PC2.2								+	+	+	+		
PC2.3								+	+	+		+	
PC2.4								+	+	+		+	
PC2.5								+	+	+			+
PC2.6								+	+	+			+

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 1: "System design"

No	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							+	+	+	+			
LO1.1								+	+	+	+		
LO1.2								+	+	+	+		
LO1.3								+	+	+		+	
LO1.4								+	+	+		+	
LO1.5								+	+	+			+
LO1.6								+	+	+			+

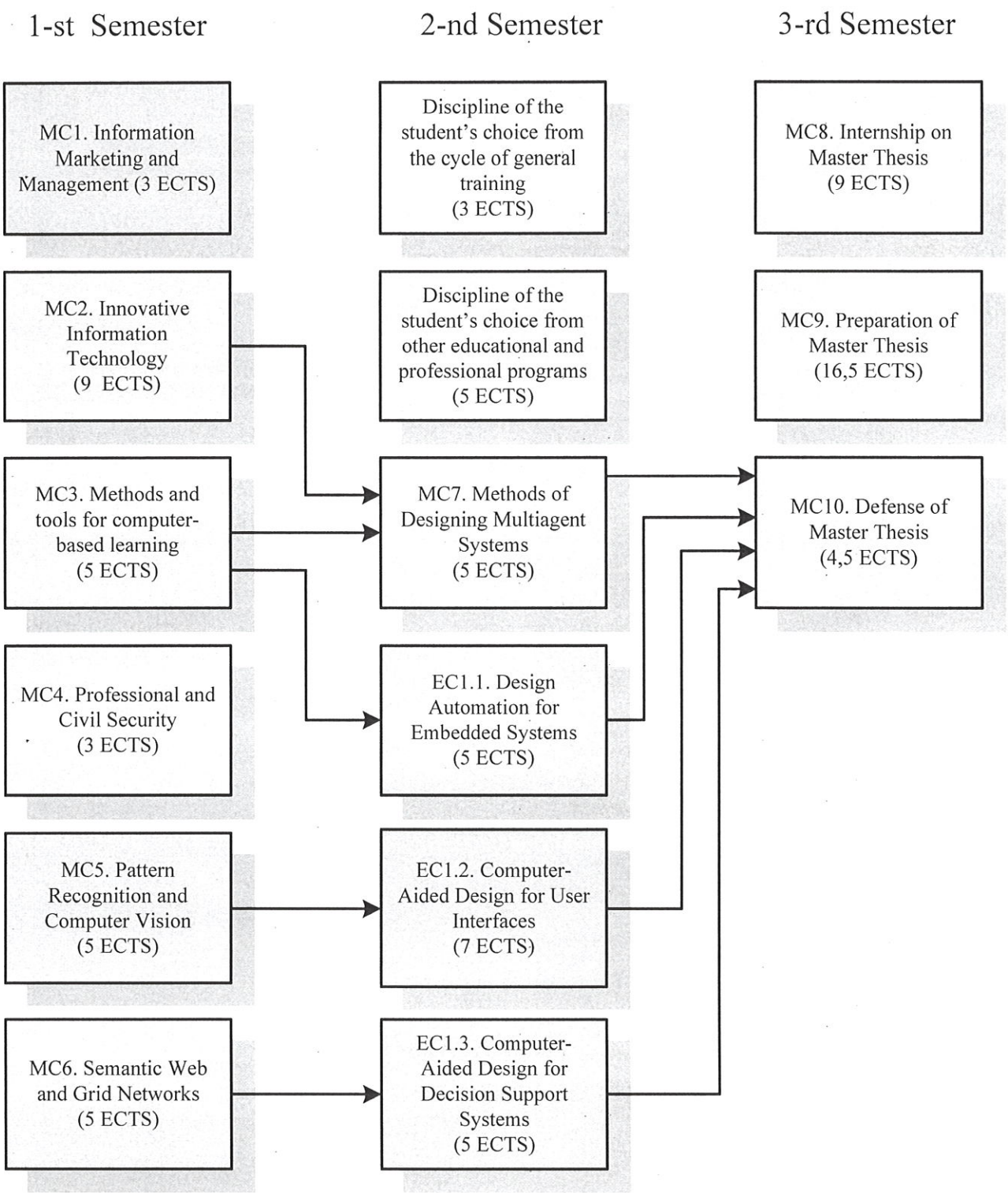
8. Matrix of ensuring the program learning outcomes with the relevant components of the educational program "System Design" in the specialty 122 "Computer Science".

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

No	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							+	+	+	+			
LO2.1								+	+	+	+		
LO2.2								+	+	+	+		
LO2.3								+	+	+		+	
LO2.4								+	+	+		+	
LO2.5								+	+	+			+
LO2.6								+	+	+			+

9. Structural and logical diagram of the educational and professional program "System Design" in the specialty 122 "Computer Science".

Line 1: "System design"



10. 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"