MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
LVIV POLYTECHNIC NATIONAL UNIVERSITY

APPROVED BY
Acting of the rector of Lviv Polytechnic National University
_____ /Yuriy BOBALO/
«11» 03 2025

EDUCATIONAL AND PROFESSIONAL PROGRAM

«ELECTRONICS»

LEVEL OF HIGHER EDUCATION	Second (master's) level
DEGREE OF HIGHER EDUCATION	Master
FIELD OF KNOWLEDGE	G Engineering, manufacturing and construction
SPECIALTY	G5 Electronics, electronic communications, instrument engineering and radio engineering

Considered and approved
at a meeting of the Academic Council of
Lviv Polytechnic National University
«25» 02 2025
Protocol № 20

Lviv 2025

LETTER OF AGREEMENT
educational and professional program

Level of higher education	The second (master's) level
Degree in higher education	Master
Doctor of Philosophy	G Engineering, manufacturing and construction
Specialty	G5 Electronics, electronic communications, instrument engineering and radio engineering

DEVELOPED AND APPROVED
Scientific and methodical commission of the specialty G5 Electronics, electronic communications, instrument engineering and radio engineering
Protocol No. 1
from «14» 02 2025

Head of the SMC of the specialty G5
_____ Iryna KREMER

AGREED
Vice-Rector for Graduate Education of the Lviv Polytechnic National University
_____ Oleh DAVYDCHAK
«19» 02 2025

Head of the Educational and Methodological Department of the University
_____ Vasyl TOM'YUK
«19» 02 2025

RECOMMENDED
Scientific and methodological council of the university
Protocol No. 85
from «20» 02 2025
The head of the SMC of the university
_____ Anatoly ZAHORODNYI

Director of the Educational and Scientific Institute of Information and Communication Technologies and Electronic Engineering
_____ ~~Leonid OZIRKOVSKYI~~
«19» 02 2025

PREFACE

Developed in accordance with the Standard of Higher Education of Ukraine of the second (master's) level, field of knowledge - 17 Electronics, Automation and Electronic Communications, specialty - 171 Electronics, approved and enacted by the order of the Ministry of Education and Science of Ukraine dated 30.04.2020 № 580.

Developed by the working group of the Scientific and Methodological Commission of the specialty G5 Electronics, electronic communications, instrument engineering and radio engineering, educational and professional program "Electronics" of Lviv Polytechnic National University, consisting of:

Iryna YAREMCHUK	- Guarantor of the educational and professional program, Ph.D., professor, head of the Department of electronic engineering
Pavlo STAKHIRA	- Ph.D., professor, professor of the Department of Electronic Engineering
Zinovii MYKYTYUK	- Ph.D.-M.Sc., professor, professor of the Department of Electronic Engineering
Hryhoriy BARYLO	- Ph.D., professor, professor of the Department of Electronic Engineering
Olga SHYMCHYSHYN	- Ph.D., Associate Professor, Associate Professor of the Department of Electronic Engineering
Iryna KREMER	- Ph.D., Associate Professor, Deputy Director of the Institute of Information and Communication Technologies and Electronic Engineering
Halyna PETROVSKA	- representative of the company "Sparing-Wist Center»
Andriana KUSHNIRENKO	- community relations senior specialist of the company Renesas Electronics
Oleksandr ILYIN	- holder of higher education with the degree of Doctor of Philosophy, postgraduate student in the 3rd year of studies in the specialty 171 "Electronics"
Artem STETSYNA	- master's student in 171 "Electronics" specialty
Ruslan TIKHOVETSKY	- master's student in 171 "Electronics" specialty

Guarantor of the educational program  Iryna YAREMCHUK

The project of the educational and scientific program was discussed and approved at the meeting of the Academic Council of the Educational and Scientific Institute of Information and Communication Technologies and Electronic Engineering

Protocol No. 6 of «20» 02 2025 year.

Chairman of the Scientific Council of ICTE _____ Leonid OZIRKOVSKYI

The project of the educational and scientific program was discussed and approved at the meeting of the NMR of the Educational and Scientific Institute of Information and Communication Technologies and Electronic Engineering

Protocol No. 6 of «19» 02 2025 year.

Head of NMR ICTE _____ Mykola KAIDAN

APPROVED AND ENACTED by order acting of the rector of the Lviv Polytechnic National University.

from «11» 03 2025 No. 146-1-10.

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1. Profile of the Master's program in G5 Electronics, electronic communications, instrument engineering and radio engineering

1 - General information	
Full name of Higher education institution and faculty/institute	Lviv Polytechnic National University, Department of Electronic Engineering, Institute of Information and Communication Technologies and Electronic Engineering
Higher education level	Second (master's) degree
Higher education degree	Master
Field of knowledge	G Engineering, manufacturing and construction
Specialty.	G5 Electronics, electronic communications, instrument engineering and radio engineering
Name of the educational program	Electronics
URL of the educational program	https://lpnu.ua/osvita/pro-osvitni-programy/drugyi-riven-vyshchoi-osvity
Forms of education	full-time, part-time (distance)
Higher education qualification title	Master's degree in G5 Electronics, electronic communications, instrument engineering and radio engineering
Qualification in the diploma	Degree of higher education - Master's degree Specialty - G5 Electronics, electronic communications, instrument engineering and radio engineering Educational program - Electronics
Description of the subject area	**Objects of study** and activity: physical processes and phenomena, algorithms and control systems, circuitry and software solutions that are the basis for the functioning of electronic components, devices and systems. **Learning objectives:** to acquire the competencies necessary to solve complex problems and issues in the field of electronics, including through research and innovation. **Theoretical content of the subject area:** fundamental principles, concepts of construction, modelling, optimisation of modern electronic components and systems. **Methods, techniques and technologies** for measuring and modelling the characteristics of electronic components, devices, devices, systems; planning experiments and processing their results; justification of circuitry and software solutions; modern multimedia, computer and information technologies, electronic industry technologies. **Tools and equipment:** electronic components, instruments, devices and systems, control and measuring equipment, control and regulation systems, power electronic systems, plasma and photon pulse devices, vacuum, microwave, laser and optoelectronic equipment, information display and recording systems, computer and microprocessor equipment, specialised software.
Academic rights of graduates	**The Master's degree in electronics, electronic communications, instrument engineering and radio engineering** has the right to continue his studies at the third educational and scientific level of

	higher education and to obtain additional qualifications in the adult education system.
The amount of credits under the European Credit Transfer and Accumulation System required to obtain the relevant higher education degree	The volume of the educational and professional program is 90 ECTS credits, the duration of study is 1 year 4 months. For educational and professional programs, the minimum amount of ECTS credits intended for practice is 10 ECTS credits. At least 35% of the volume of the educational program should be aimed at ensuring the learning outcomes, general and special (professional) competencies in the specialty defined by the higher education standard.
Availability of accreditation	Accredited
Education cycle, level of HE	NQF of Ukraine - 7 level QF-EHEA – 2 cycle EQF-LLL – 7 level
Prerequisites	Bachelor Degree
Language (s) of instruction	Ukrainian
Key concepts and their definitions	The program uses the key concepts and their definitions in accordance with the Law of Ukraine "On Higher Education" and the Standard of Higher Education of Ukraine of the second (master's) level, field of knowledge G Engineering, manufacturing and construction, specialty G5 Electronics, electronic communications, instrument engineering and radio engineering.
2 - Educational programme purpose	
	To provide theoretical knowledge and practical skills sufficient for the successful performance of professional duties in the specialty G5 Electronics, electronic communications, instrument engineering and radio engineering and to prepare students for further employment in the chosen specialty.
3 - Educational program characteristics	
Educational program orientation	The educational and professional program is based on the known rules and results of modern scientific research in the field of electronics and electrical engineering, within which further professional and scientific career is possible.
Main focus of the educational program	General education and practical training in the field of electronics, in particular, the training of graduates capable of analyzing, forecasting, and making decisions in the development, implementation, and maintenance of electronic devices and equipment for various purposes.
Features and distinctions	The characteristics of the educational and professional program are thorough training of students in the field of design of electronic devices and systems, systems of automated design, modern information and computer technologies, automation of measurement and diagnostics of electronic devices and systems, software-controlled hardware of electronic devices, as well as orientation to relevant aspects of the specialty, within which further scientific career is possible; favorable conditions for attracting students to scientific schools of the department, domestic and international scientific projects; use of new scientific knowledge in the educational process. The objectives of the ED reflect the trends in the development of the specialty, since electronics is a leading and promising direction in science, technology and production, which is developing very rapidly all over the world, including physical processes and phenomena,

	algorithms and control systems, circuit and software solutions, which are the basis of functioning electronic components, devices and systems. The importance of the training of specialists in the field of electronic design is determined by the fact that only in the Western region of Ukraine there are a number of companies working in the field of electronic equipment and its applications, which are potential customers for the training of highly qualified specialists.
4 – Eligibilityof graduates for employment and further study	
Eligibility for employment	Employment in positions in various fields of activity, in particular: production, repair, maintenance, computer modeling and research of materials, elements and devices of electronic systems; implementation of modern energy-efficient technologies, design of means of automation of electronic systems.
Further study	The Master in Electronics has the right to continue his studies at the third educational and scientific level of higher education and to obtain additional qualifications in the adult education system.
5 – Teaching and assessment	
Teaching and studying	Combination of lectures, practical classes, consultations, independent work on problem solving; (with the involvement of a virtual learning environment) implementation of projects, laboratory work, consultations with teachers, preparation of a master's thesis.
Assessment	Exams, assessments, current control, defense of course projects (theses), defense of a qualifying master's thesis.
6 – Programme competencies	
Integral competence (INT)	The ability to solve complex specialised tasks and practical problems of professional activity in the field of electronics and/or in the process of study, which involves research and/or innovation in the field of electronics and is characterised by complexity and uncertainty of conditions and requirements.
General competencies	3K1. Ability to abstract thinking, analysis and synthesis. 3K2. Ability to communicate in the state language both orally and in writing. 3K3. Ability to communicate in foreign languages both orally and in writing. 3K4. Ability to conduct research at the appropriate level. 3K5. Ability to search, process and analyze information from various sources. 3K6. Ability to generate new ideas (creativity). 3K7. Ability to interpersonal interaction. 3K8. Ability to communicate with representatives of other professional groups of different levels (with experts from other fields of knowledge / types of economic activity).
Professional competencies	CK1. Ability to assess the level of existing technologies of the electronic industry in the field of professional activity, the effectiveness of technical solutions. CK2. Ability to plan and implement innovative projects in the field of electronics, protect intellectual property rights. CK3. Ability to systematically solve problems of development, analysis, calculation, modeling of electronic devices, components, devices and systems for various purposes. CK4. Ability to use information, computer and multimedia technologies, methods of modeling, intellectualization, artificial

	intelligence, experimental methods for research and analysis of processes in electronic devices, components, devices and systems. CK5. Ability to ensure the efficiency and quality of measurements in electronic devices, components, devices and systems. CK6. Ability to find the necessary information with the help of modern information resources, analyze and evaluate it. CK7. Ability to solve problems of processing and displaying information in modern electronic devices, devices and systems. CK8. Ability to assess problem situations and shortcomings in the development, design, commissioning, functioning and operation of electronic devices, appliances and systems, to formulate proposals for solving problems. CK9. Ability to take into account in design and technological, engineering and scientific and technical solutions requirements for safety of life, protection of intellectual property, energy efficiency and environmental friendliness.
Professional competencies of a professional direction (FCS)	**Line 1. Electronic devices and devices:** 1.1. The ability to select components and means of electronic equipment to perform specified functions. 1.2. Ability to solve problems of optimization and updating of electronic means of automation, collection, processing, transmission, storage and display of information. 1.3. Ability to calculate and design structures and devices of electronic equipment. 1.4. Ability to develop technologies for creation of materials with predetermined properties and directed modification of their properties. **Line 2. Optoelectronic devices:** 2.1. Ability to reasonably select and use existing methods of signal processing and analysis in optoelectronic systems. 2.2. Ability to use optoelectronic devices and systems to obtain, store, and transmit information and to analyze data from natural and numerical experiments. 2.3. Ability to use modern engineering and mathematical packages to create information technologies for optoelectronic devices and systems. 2.4. Ability to apply modeling methods in the design of elements and units of optoelectronic devices.
7 – Programme learning outcomes	
P1. Implement projects to modernize production and technology in the field of electronics, implement the latest information and communication technologies, multimedia means.	
P2. Model and experimentally study phenomena and processes in electronic devices,appliances and systems, in technologies of the electronic industry.	
P3. Collaborate with the customer during the formulation of the terms of reference and discussion of technical solutions and results of projects, to lead a reasoned professional and scientific discussion.	
P4. Develop low-waste, energy-saving and environmentally friendly technologies, taking into account the requirements of safety of human life, rational use of raw materials, energy and other resources.	
P5. Ensure energy and economic efficiency of development, production and operation of electronic equipment.	
P6. Ensure the professional development of team members, taking into account the world-class scientific and engineering achievements in the development and operation of electronic systems.	

P7. Carry out information and scientific research using scientific, technical and reference literature, databases and knowledge, other sources of information; critically comprehend and interpret existing knowledge and data, form directions of research and development taking into account domestic and foreign experience.	
P8. Carry out and coordinate the development, selection, use and modernization of the necessary equipment, tools and methods during the organization of the production process, taking into account technical and technological capabilities, modern scienceintensive methods, tools and technical solutions.	
P9. Coordinate the work of teams of researchers in the field of research, design, development, analysis, calculation, modeling, production and testing of electronic components, devices and systems, taking into account the requirements of civil and moral values, human rights and freedoms, the rule of law.	
P10. Choose the best research methods, modify, adapt and develop new methods.	
P11. Analyze technical and economic indicators, reliability, ergonomics, patent purity, market needs, investment climate and compliance of design solutions, research and development with certain goals and norms of the legislation of Ukraine.	
P12. Generalize modern scientific knowledge in the field of electronics and apply them to solve complex scientific and technical problems, bringing the obtained solutions to the level of competitive developments, implementation of results in business projects.	
P13. Organize and manage research, innovation and investment activities, business projects and production processes taking into account technical, technological and economic factors.	
Line 1. Electronic devices and equipment. P14.1. Apply acquired knowledge and understanding to identify, formulate and solve problems in the design of electronic devices using known methods. P14.2. Use general and specialised control, measuring and test equipment, and calculate the results of experiments. P14.3. Apply knowledge of technical characteristics, physical and technological features in creation and improvement of electronic devices. P14.4. Make calculations of predicted parameters and characteristics of electronic devices according to given algorithms.	
Line 2. Optoelectronic devices: P15.1. Ability to use databases, mathematics, and software for data processing and computer modeling of optoelectronic systems. P15.2. Ability to use automated design systems for the development of optoelectronic devices and systems. P15.3. Carry out technical and economic justification of the production of optoelectronic devices and materials for optoelectronic purposes, understand theoretical and practical approaches to the creation and management of optoelectronic devices. P15.4. Plan, organize, direct and control systems and processes in the field of optoelectronics engineering.	
Communication (K)	1. Ability to communicate, including oral and written communication in Ukrainian and foreign languages (English, German, Italian, French, Spanish); 2. Ability to use various methods, including modern information technologies, for effective communication at professional and social levels.
Autonomy and responsibility (AB)	1. Ability to adapt to new situations and make appropriate decisions; 2. The ability to recognize the need for lifelong learning in order to deepen acquired professional knowledge and to acquire new knowledge;

	3. Ability to take responsibility for the work performed, to make independent decisions, to achieve the set goal in compliance with the requirements of professional ethics; 4. The ability to demonstrate an understanding of basic environmental, health and safety principles and their application.
8 – Resource provision for programmeimplementation	
Human Resources Basic Characteristics	80% of scientific and pedagogical workers engaged in the teaching of professional disciplines in the specialty G5 Electronics, electronic communications, instrument engineering and radio engineering have scientific degrees and scientific titles, with practical experience in the specialty 40%.
Main features of material and technical support	Modern equipment and electronic components of leading companies, in particular, STMicroelectronics, Ajax, Renesas Electronics, Analog Devices, etc. UVR-3M - device for creation of organic structures, VUP-5M - deposition of metal contacts, 4145A - semiconductor parameter analyzer - complex for measurement of electrophysical characteristics of LEDs and transistors.
Main characteristics of informational and methodological support	Use of the author's research and teaching staff developments in the virtual learning environment of the Lviv Polytechnic National University.
9 – Academic mobility	
National credit mobility	Based on bilateral agreements between Lviv National Polytechnic and Ukrainian universities.
International credit mobility	Based on bilateral agreements between Lviv National Polytechnic University and higher education institutions of foreign partner countries.
Study of Foreign applicants of HE	It is possible, after studying the Ukrainian language course.

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

No	Training cycle	The volume of the educational load of the student of higher education (credits / %)		
		Mandatory Components of the Educational and Professional Program	Elective Components of the Educational and Professional Program	Total for entire study period
1	2	3	4	5
1.	General training cycle	6/6,6	3/3,4	9/10
2.	Professional training cycle	61/67,8	20/22,2	81/90
Total for entire study period		67/74,4	23/25,6	90/100

3. List of components of the educational and professional program

Code	The name of the component of the education program	ECTS credits	Final control measure form
1	2	3	4
MANDATORY COMPONENTS OF THE SPECIALTY			
I. General Training Cycle			
CK1.1	Economics and Enterprise Management	3	differentiated credit
CK1.2	Foreign Language for a Professional Purpose	3	differentiated credit
	Total per cycle:	**6**	
II. Cycle of professional training			
CK2.1	Desingn of Electronic Devices and Systems (together with CP)	8	exam
CK2.2	Computer-Aided Design Systems (together with CP)	8	exam
CK2.3	Modern Information and Computer Technologies	5	exam
CK2.4	Microcircuitry	7	exam
CK2.5	Occupational and Civil Safety	3	differentiated credit
CK2.6	Master's Thesis Internship	12	differentiated credit
CK2.7	Master's Thesis Preparation	13,5	
CK2.8	Master's Thesis Defence	4,5	
	Total per cycle:	**61**	
	Together, the components are mandatory:	**67**	
SELECTIVE COMPONENTS OF THE EDUCATIONAL AND PROFESSIONAL PROGRAM			
I. General Training Cycle			
	Всього за цикл:	**3**	differentiated credit
II. Cycle of professional training			
Elective Line Components 1: Electronic devices and equipments			
ВБ1.1	Automation of Measurements and Diagnostics of Electronic Devices and Systems	7	exam
ВБ1.2	Software-Controlled Hardware of Electronic Equipment	4	differentiated credit
ВБ1.3	Physical and Chemical Processes in Microelectronics	4	differentiated credit
Elective Line Components 2: Optoelectronic Devices			
ВБ2.1	Optoelectronic devices and systems	7	exam
ВБ2.2	Design of elements and nodes of optoelectronic devices and systems	4	differentiated credit
ВБ2.3	Embedded software and hardware to control optoelectronic systems	4	differentiated credit
	Total per cycle:	**15**	
Elective components of other educational and professional programs			
	Total:	**5**	exam
	Selective components together:	**23**	
	Together for the educational and professional program:	**90**	

4. Form of certification of higher education applicants

Forms of certification of applicants of higher education	Certification of graduates of specialty G5 Electronics, electronic communications, instrument engineering and radio engineering is carried out in the form of public defense of the qualification work
Qualifying work requirements	The qualifying work should solve a complex problem in the field of electronics that requires research and/or innovation. The qualification work must not contain academic plagiarism, fabrication and falsification. The qualification work must be published on the official website of the Lviv Polytechnic National University or the Institute of Telecommunications, Radio-Electronics and Electronic Engineering before the defense. In accordance with the requirements of current legislation, qualification works containing restricted information are published.

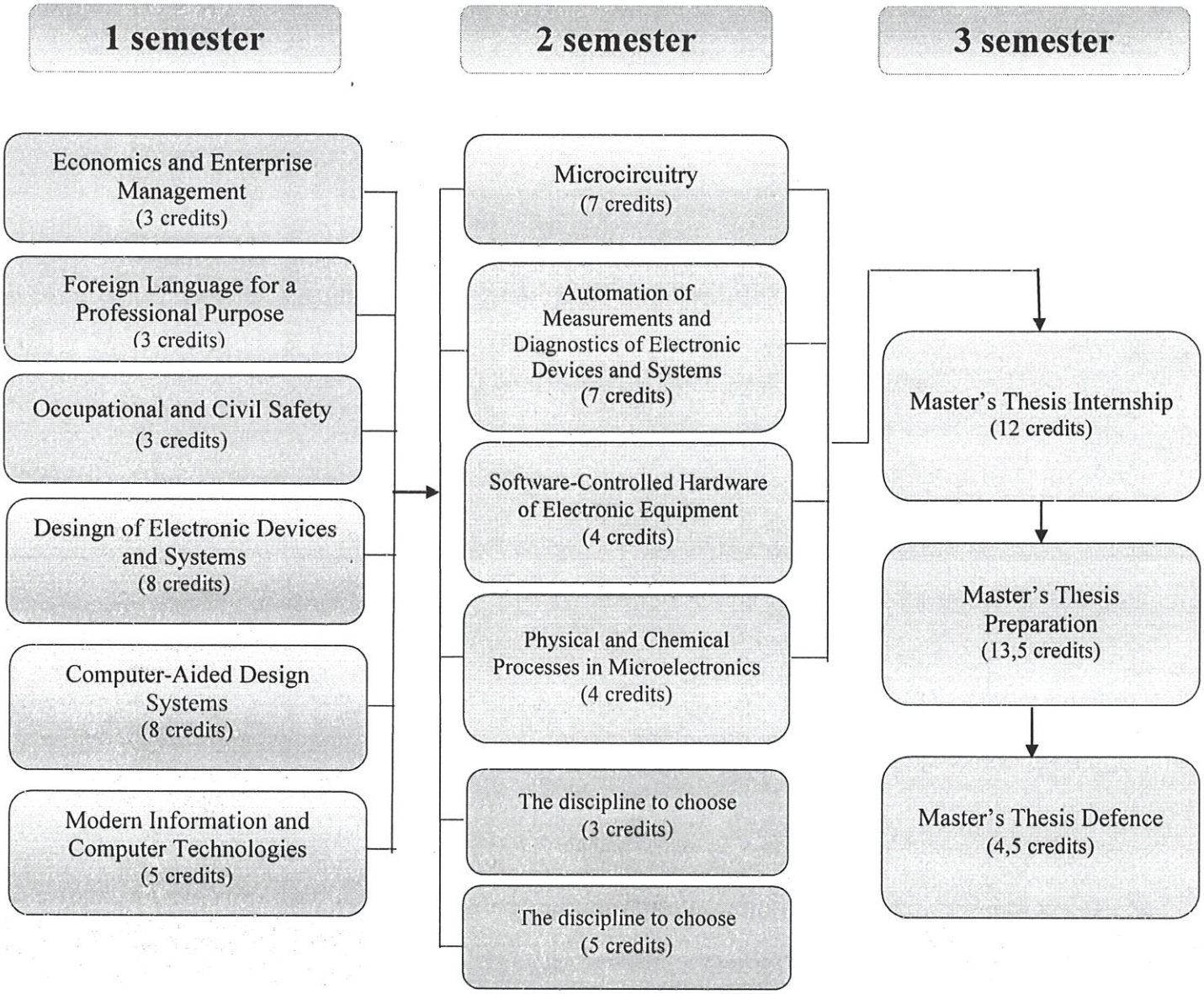
5. Program Competencies Correspondence Matrix educational components of the master's degree from specialization G5 Electronics, electronic communications, instrument engineering and radio engineering

CODE	General competences									Professional competencies									Professional competencies of a professional direction							
	ІНТ	ЗК1	ЗК2	ЗК3	ЗК4	ЗК5	ЗК6	ЗК7	ЗК8	СК1	СК2	СК3	СК4	СК5	СК6	СК7	СК8	СК9	ФКС1.1	ФКС1.2	ФКС1.3	ФКС1.4	ФКС2.1	ФКС2.2	ФКС2.3	ФКС2.4
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
СК1.1								•	•	•							•									
СК1.2				•					•																	
СК2.1		•				•			•		•		•	•		•										
СК2.2		•			•	•			•	•					•		•									
СК2.3		•				•	•						•		•											
СК2.4		•			•				•			•				•	•									
СК2.5						•																				
СК2.6	•		•		•			•	•						•			•								
СК2.7	•	•				•	•	•		•		•	•		•			•								
СК2.8	•		•	•							•															
ВБ1.1																			•			•		•		•
ВБ1.2																				•	•			•		•
ВБ1.3																				•		•	•		•	
ВБ2.1																			•			•		•		•
ВБ2.2																				•	•			•		•
ВБ2.3																				•		•	•		•	

6. Program Learning Outcomes Delivery Matrix
relevant components of the master's program from specialization
G5 Electronics, electronic communications, instrument engineering and radio engineering

Programme learning outcomes	Mandatory components of the specialty										Components of the elective line of the specialty					
	СК1.1	СК1.2	СК2.1	СК2.2	СК2.3	СК2.4	СК2.5	СК2.6	СК2.7	СК2.8	ВБ1.1	ВБ1.2	ВБ1.3	ВБ2.1	ВБ2.2	ВБ2.3
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
P1	•			•	•	•			•							
P2			•	•	•	•		•	•							
P3	•	•	•	•		•		•	•	•						
P4	•		•	•	•	•	•	•	•	•						
P5			•					•	•	•						
P6	•	•		•				•	•	•						
P7		•	•	•	•	•	•	•	•	•						
P8	•		•	•	•	•			•	•						
P9	•	•	•	•	•	•		•	•	•						
P10	•		•	•	•	•		•	•							
P11	•		•	•	•	•		•	•	•						
P12	•		•	•	•	•	•	•	•							
P13	•	•		•	•	•		•	•	•						
P14.1											•		•			
P14.2												•				
P14.3											•					
P14.4												•	•			
P15.1														•		•
P15.2															•	
P15.3															•	•
P15.4														•		
K1	•							•	•	•						
K2	•	•	•	•		•		•		•						
AB1			•	•	•	•			•							
AB2	•			•		•			•							
AB3			•	•	•		•	•	•							
AB4	•			•	•	•			•							

7. Structure and Logic of the Educational and Professional Master's Degree Course in Specialization G5 Electronics, electronic communications, instrument engineering and radio engineering for the line «Electronic devices and equipment»



8. Structure and Logic of the Educational and Professional Master's Degree Course in Specialization G5 Electronics, electronic communications, instrument engineering and radio engineering for the line «Optoelectronic Devices»