

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
SUMY STATE UNIVERSITY**

EDUCATIONAL AND PROFESSIONAL PROGRAM

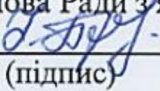
Electronic Systems

Level of Higher Education	Second (Master's) Level
Field of Knowledge	G — Engineering, Manufacturing and Constructio
Specialty / Interdisciplinary Subject Area	G5 — Electronics, Electronic Communications, Instrumentation, and Radio Engineering
Specialization	
Qualification	Master of Electronics

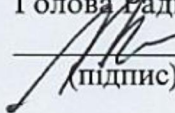

Затверджено зі змінами рішенням вченої ради
Протокол від 20 лютого 2025 р. № 9
Голова вченої ради Анатолій ВАСИЛЬЄВ
(підпис)
Суми 2025 р.

ЛИСТ ПОГОДЖЕННЯ
освітньої програми

Освітня програма обговорена та схвалена на засіданні Ради із забезпечення якості вищої освіти інституту (факультету) електроніки та інформаційних технологій.

Протокол № 4 від 17 02 2025р.
Голова Ради з якості інституту (факультету)
 Ірина ПАЗУХА
(підпис)

Освітня програма обговорена та схвалена на засіданні Ради із забезпечення якості вищої освіти Сумського державного університету.

Протокол № 4 від 18 02 2025р.
Голова Ради з якості СумДУ
 Анатолій ВАСИЛЬЄВ
(підпис)

ПЕРЕДМОВА

Міністерство освіти і науки України. Стандарт вищої освіти. Другий (магістерський) рівень вищої освіти. Ступінь "магістр". Галузь знань: 17 "Електроніка та телекомунікації", спеціальність: 171 "Електроніка". Затверджено та введено в дію наказом МОН України від 30.04.2020 р. № 580.

Розроблено робочою проектною групою у складі:

Прізвище, ім'я, по батькові		Науковий ступінь, шифр та назва наукової спеціальності	Вчене звання (за кафедрою)	Посада та назва підрозділу (за основним місцем роботи)
Керівник робочої проектної групи (гарант освітньої програми):	1. Опанасюк Анатолій Сергійович	Доктор фіз.-мат. наук, 01.04.01 – фізика приладів, елементів і систем	Професор (за кафедрою електроніки і комп'ютерної техніки)	Завідувач кафедри електроніки і комп'ютерної техніки
	2. Зубань Юрій Олександрович	Кандидат техн. наук, 05.13.06 – автоматизовані системи управління та прогресивні інформаційні технології	Доцент (за кафедрою електроніки і комп'ютерної техніки)	Доцент кафедри електроніки і комп'ютерної техніки
	3. Доброжан Олександр Анатолійович	Кандидат фіз.-мат. наук, 01.04.01 – фізика приладів, елементів і систем	Доцент (за кафедрою електроніки і комп'ютерної техніки)	Доцент кафедри електроніки і комп'ютерної техніки
	4. Пономарьов Олександр Георгійович (стейкхолдер)	Доктор фіз.-мат. наук, 01.04.20 – фізика пучків заряджених частинок	Професор зі спеціальності	Завідувач відділу фізики пучків заряджених частинок Інституту прикладної фізики НАН України
	5. Лопатін Дмитро Олександрович (стейкхолдер)			Магістр, академічна група ЕС.м-31
Члени робочої проектної групи:				

Зовнішні рецензенти:

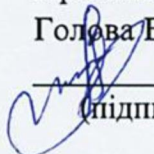
Прізвище, ім'я, по батькові	Науковий ступінь, шифр та назва наукової спеціальності	Вчене звання (за кафедрою)	Посада та назва підрозділу (за основним місцем роботи)

Бондаренко Ігор Миколайович	Доктор фіз.-мат. наук, 01.04.01 – фізика приладів, елементів і систем	Професор (за кафедрою мікроелектроніки, електронних приладів та пристроїв)	Завідувач кафедри мікроелектроніки, електронних приладів та пристроїв Харківського національного університету радіоелектроніки
Чертов Сергій Іванович			Начальник цеху транспортної мережі Сумської філії АТ "Укртелеком"

Освітня програма обговорена та схвалена на засіданні Експертної ради роботодавців зі спеціальності G5 Електроніка, електронні комунікації, приладобудування та радіотехніка.

Протокол № 2 від 29.01.2025 р.

Голова Експертної ради роботодавців зі спеціальності

 Олександр ПОНОМАРЬОВ
(підпис)

Термін перегляду освітньої програми 1 раз на рік.

Ця освітня програма не може бути повністю або частково відтворена, тиражована та розповсюджена без дозволу Сумського державного університету.

1. Profile of the Educational Program

1.1 General Information
Full Name of the Higher Education Institution
Sumy State University
Full Name of the Structural Subdivision
Faculty of Electronics and Information Technologies, Department of Electronics and Computer Engineering
Degree of Higher Education and Qualification Title
Master of Electronics
Official Name of the Educational Program
Electronic Systems
Type of Diploma and Program Volume
Master's diploma, single degree, 90 ECTS credits, duration of study — 1 year and 4 months
Forms and Duration of Study
Full-time study — 1 year and 4 months. Part-time study — 1 year and 4 months.
Cycle / Level of Higher Education
Second (Master's) level of higher education; NQF of Ukraine — Level 7; FQ-EHEA — Second cycle; QF-LLL — Level 7.
Requirements for the level of education of persons who may begin studies under the program
Bachelor's degree
Language(s) of instruction
Ukrainian
Availability of accreditation
National Agency for Higher Education Quality Assurance. Accreditation certificate of the educational program – No. 9648 dated 11.12.2024. Valid until 01.07.2030.
Internet address for permanent placement of the educational program description:
https://op.sumdu.edu.ua/
1.2 Purpose of the Educational Program
Description

The program is developed in accordance with the mission and strategy of the university. It is aimed at providing students with advanced theoretical and practical knowledge, skills and understanding in the field of information and power electronics, electronic control and automation systems, including distributed architecture, which will give them the opportunity to effectively implement informatization and automation of all sectors of society — industry and education, commercial and business activities — through the design and programming of electronic equipment, maintenance, adjustment and repair of various electronic systems, including those based on computer technology, embedded, mobile and distributed systems, and the implementation of advanced information technologies as part of electronic systems and devices.

1.3 Characteristics of the Educational Program

Subject area of the educational program

Objects of study and activity — physical processes and phenomena, algorithms and control systems, circuit and software solutions that form the basis of the functioning of electronic components, devices and systems. Learning objectives — acquisition of competencies necessary for solving complex tasks and problems in the field of electronics, including through conducting research and implementing innovations. Theoretical content of the subject area — fundamental principles, concepts of construction, modeling and optimization of modern electronic components and systems. Methods, methodologies and technologies — measurement and modeling of the characteristics of electronic components, devices, instruments, systems; experimental planning and processing of results; justification of circuit and software solutions; modern multimedia, computer and information technologies; technologies of the electronic industry. Tools and equipment — electronic components, devices, instruments and systems; control and measuring equipment; control and regulation systems; power supply of electronic equipment; information display and recording; computer and microprocessor equipment; specialized software..

Type of educational program and its orientation

Educational and professional. Emphasis on construction, circuit design, programming and development of electronic systems for information acquisition, transmission, control, processing and display, which are mobile, embedded and distributed in nature, and on the implementation of advanced information technologies in electronics.

Main focus of the educational program and its features

General education in the field of electronics, electronic devices and systems, including embedded, mobile and distributed architectures. The program is based on well-known and modern scientific results and relevant practical experience in the field of information and power electronics, electronic systems and devices, including programmable ones. The focus of the program, which distinguishes it from other programs, lies in the integration of electronics and information technologies, circuit and software implementation of information technologies based on designed electronic systems. The program is oriented toward current specializations: embedded, mobile and distributed electronic systems, within which further professional and scientific careers are possible in the fields of electronics, telecommunications, informatics, computer engineering, software engineering, and cybersecurity. Keywords: information electronics, circuit design, distributed architecture, embedded systems.

1.4 Employability of Graduates and Opportunities for Further Learning

Employability

""Engineers in the field of electronics and telecommunications: Electronics Engineer; Information and Telecommunication Systems Engineer; Electronics Engineer for Non-traditional and Renewable Energy Production Systems; Sound Recording Engineer; Design Engineer (Electronics)", occupation code according to the National Classifier — 2144.2.
Further Learning
A Master of Electronics has the right to continue studies at the third educational and scientific level of higher education and to obtain additional qualifications in the system of adult education.
1.5 Teaching and Assessment
Teaching and Learning
Student-centered learning, problem-based learning, learning through pre-diploma practice, research-based learning. Teaching is carried out in the form of: lectures, multimedia and interactive lectures, seminar and practical classes, course projects, laboratory works, consultations, and online classes using Google Meet, MS Teams, Zoom and Google Classroom services. Independent work with the possibility of consultations, e-learning for separate educational components, blended learning in MIX SumDU, work with SumDU OCW collections, as well as self-learning through massive open online course materials, is also provided. The following teaching methods are applied: Verbal methods (interactive lectures, discussion lectures, educational discussions, problem-search method); Visual methods (illustration method, demonstration method); Practical methods (project method, analysis of specific situations (case-study), performing inventive and research tasks).
Assessment
The educational program provides formative (written and oral comments and instructions from teachers during the learning process, development of self-assessment skills, involving students in assessing each other's work) and summative (written exams in academic disciplines, assessment of current work during the study of separate educational components (presentations, testing), defense of the pre-diploma practice report, defense of course projects, public defense of the qualification work) assessment.
1.6 Program Competences
Integral Competence
The ability to solve complex specialized tasks and practical problems of professional activity in the field of electronics and/or in the learning process, which involves conducting research and/or implementing innovations in the field of electronics and is characterized by complexity and uncertainty of conditions and requirements.
General Competences (GC)
GC1. Ability for abstract thinking, analysis and synthesis.
GC2. Ability to communicate in the state language both orally and in writing.
GC3. Ability to communicate in a foreign language.
GC4. Ability to conduct research at the appropriate level.
GC5. Ability to search, process and analyze information from various sources.

GC6. Ability to generate new ideas (creativity).
GC7. Interpersonal interaction skills.
GC8. Ability to communicate with representatives of other professional groups of different levels (with experts from other fields of knowledge/types of economic activity).
Professional Competences (PC) of the Specialty
Фахові компетентності зі спеціальності:
PC1. Ability to assess the level of existing technologies of the electronic industry in the field of professional activity, and the effectiveness of technical solutions.
PC2. Ability to plan and implement innovative projects in the field of electronics, to protect intellectual property rights.
PC3. Ability for systematic solving of tasks of development, analysis, calculation, modeling of electronic components, devices and systems for various purposes.
PC4. Ability to use information, computer and multimedia technologies, modeling methods, intellectualization, artificial intelligence, experimental methods for studying and analyzing processes in electronic components, devices and systems.
PC5. Ability to ensure the efficiency and quality of measurements in electronic components, devices and systems.
PC6. Ability to find the necessary information using modern information resources, analyze and evaluate it.
PC7. Ability to solve tasks of processing and displaying information in modern electronic devices and systems.
PC8. Ability to assess problem situations in the field of development, design, adjustment, functioning and operation of electronic components, devices and systems, and to formulate proposals for solving problems.
PC9. Ability to take into account in design-technological, engineering and scientific-technical solutions the requirements regarding life safety, protection of intellectual property, energy efficiency and environmental friendliness.
PC10. Ability to develop a specialized element base, implement and use modern electronic, computer and information and communication technologies, computer tools for engineering and scientific research, calculations, processing and analysis of experimental data, modeling and optimization.
PC11. Ability to create, debug and maintain system and application software using modern computer technologies and development tools for electronic systems, including embedded, mobile and distributed architectures.
PC12. Ability to design, construct, modernize and maintain modern information and power electronic equipment, microprocessor and microcontroller devices, electronic systems and their components, including embedded, mobile and distributed architectures.
Program Learning Outcomes (PLO)
Description

Program learning outcomes of the specialty:
PLO1. Implement projects for modernization of production and technologies in the field of electronics, introduction of advanced information, communication and multimedia technologies.
PLO2. Model and experimentally study objects and processes in electronics and electronic industry technologies.
PLO3. Cooperate with the customer in formulating the technical task and discussing technical solutions and project implementation results; conduct reasoned professional and scientific discussions.
PLO4. Develop low-waste, energy-saving and environmentally friendly technologies taking into account the requirements of human life safety and rational use of raw materials, energy and other resources.
PLO5. Ensure energy and economic efficiency of development, production and operation of electronic equipment.
PLO6. Ensure professional development of team members taking into account the global level of scientific and engineering achievements in the field of development and operation of electronic components, devices and systems.
PLO7. Conduct information and scientific searches using scientific, technical and reference literature, databases and knowledge, and other information sources; critically comprehend and interpret existing knowledge and data; determine directions of research and development taking into account domestic and foreign experience.
PLO8. Carry out and coordinate development, selection, use and modernization of the necessary equipment, tools and methods when organizing the production process, taking into account technical and technological capabilities, modern high-tech methods, means and technical solutions.
PLO9. Coordinate the work of teams of performers in the field of scientific research, design, development, analysis, calculation, modeling, production and testing of electronic components, devices and systems, taking into account the requirements of adherence to civil and moral values, human rights and freedoms, and the rule of law.
PLO10. Choose optimal research methods, modify, adapt and develop new methods.
PLO11. Analyze technical and economic indicators, reliability, ergonomics, patent purity, market needs, investment climate, and compliance of design decisions, scientific and experimental developments with the defined goals and legislation of Ukraine.
PLO12. Summarize modern scientific knowledge in the field of electronics and apply it to solve complex scientific and technical tasks, bring the obtained solutions to the level of competitive developments, and implement results in business projects.
PLO13. Organize and manage research, innovation and investment activities, business projects and production processes, taking into account technical, technological and economic factors.
PLO14. Study informational and physical processes in information and power electronics, electronic devices and systems, including distributed ones, using modern software tools for modeling and automation of engineering calculations, planning and conducting scientific experiments with processing and analysis of results.
PLO15. Be able to design, evaluate, debug and implement into production electronic devices and systems, adjust and modernize developments, ensuring their circuit and structural implementation taking into account the requirements of reliability, cost-effectiveness, environmental friendliness and energy saving.

PLO16. Be able to design, develop, modify and debug system and application software for programmable electronic systems based on microprocessors and microcontrollers, including distributed ones.

1.8 Resource Support for Program Implementation

Staffing Support

The main teaching staff of the educational program consists of the academic staff of the Department of Electronics and Computer Engineering, and the Department of Electronics, General and Applied Physics of the Faculty of Electronics and Information Technologies. The academic staff of the Faculty of Foreign Philology and Social Communications is also involved in teaching individual courses according to their competence and experience. The lecturers teaching within the program are active and recognized scientists who publish their works in domestic and international scientific journals, and who possess appropriate professional competence and experience in teaching, scientific research, and pedagogical activity. The practice-oriented nature of the educational program provides for extensive participation of specialists and practitioners from enterprises and IT companies, including LLC “ESP ‘Preobrazovatel’”, PJSC “Sumyoblenergo”, LLC “SIPROKS”, Sumy branch of JSC “Ukrtelecom”, LLC “PRIMEFORT”, LLC “Telesvit”, which correspond to the program’s field. Competent high-level experts are also involved in teaching, which strengthens the synergistic link between theoretical and practical training. The support group, the head of the working project group, and the teaching staff who provide training in the specialty and implementation of the educational program meet the requirements defined by the Licensing Conditions for educational activities of educational institutions.

Material and Technical Support

The educational process within the educational program takes place in classrooms and laboratories equipped with audiovisual equipment and the necessary technical means. In the educational and scientific work of the program, 83 technical devices are used, including 18 computers, 45 laboratory stands, 5 sets of CISCO network equipment, 15 oscilloscopes, as well as specialized professional equipment such as a Voltera V-One PCB printer, Ossila automated system for measuring current-voltage characteristics of solar cells, Specord 210 Plus AnalytikJena spectrophotometer, and Linseis HCS 1 Hall measurement system. Educational classes are held in 17 computer laboratories equipped with licensed Microsoft operating systems and application software packages from Microsoft, Autodesk, Intel, Dassault Systèmes, Altium, Delcam, Siemens, MathWorks AdAstra, etc. The material and technical facilities of enterprises are also used in the educational process: NICMAS Concern, LLC “ESP ‘Preobrazovatel’”, Sumy branch of JSC “Ukrtelecom”, which host branches of the graduating department.

Information and Educational-Methodical Support

Sumy State University has a high-tech library and information system that provides a high level of informational and methodological support for all categories of users. Access to all components of the university's library and information system is provided through a single library card. Students of the educational program have access to databases such as Scopus, Uran, ElibUkr, LigaZakon, Leonorm, and the Informatio Consortium. Access to all library databases is provided within the university's internal network. Students also use methodological materials prepared by teachers: textbooks, lecture presentations, lecture notes, methodological guidelines for practical, laboratory, and seminar classes, and individual assignments. Methodological materials can be provided both in printed and electronic form. The methodological materials are periodically updated and adapted to the goals of the educational program. The university's e-learning system provides access to materials in Ukrainian and English for the disciplines of the "Electronic Systems" educational program. For remote access to educational and methodological materials, the OCW Sumy State University platform has been developed. The platform allows integration of materials from distance courses, the Lectur'ED constructor for collaborative work on electronic educational resources, materials of the electronic library catalog, the repository, and links to external educational resources. For informational support of scientific research and student learning, the Libguide electronic service is used, which consolidates information sources in accordance with the directions of scientific activity. It contains thematic manuals on academic integrity, academic writing, scientific publication, and a categorized selection of literature by faculties and specialties. On the Libguide service page for the specialty G5 "Electronics, Electronic Communications, Instrumentation and Radio Engineering", quick access is provided to the catalog of periodicals, recommended educational and methodological literature, links to useful resources, open information databases and literature, and online courses.

1.9 Academic Mobility

Internal Academic Mobility

Based on bilateral agreements between Sumy State University and more than 10 universities of Ukraine. The basic among them are: National University "Chernihiv Polytechnic" (agreement No. 01.01-2021M/0025 dated 14.09.2021); National Aviation University (agreement No. 54-2021M/0011 dated 18.05.2021); Zaporizhzhia National University (agreement No. 53-2021M/0036 dated 23.12.2021); National University "Lviv Polytechnic" (agreement No. 54.16-2021M/0007.1 dated 07.04.2021).

International Academic Mobility

Based on bilateral agreements between Sumy State University and foreign higher education institutions, among which the basic for the educational program are: Institute of Tele- and Radiotechnologies in Warsaw (Poland, agreement dated 28.03.2017); University Savoie Mont Blanc (France, agreement dated 20.02.2017); University of Koblenz-Landau (Germany, agreement dated 06.04.2017); Slovak University of Technology (Bratislava, Slovakia, agreement dated 01.08.2024).

Education of Foreign Students

Possible after completion of a Ukrainian language course.

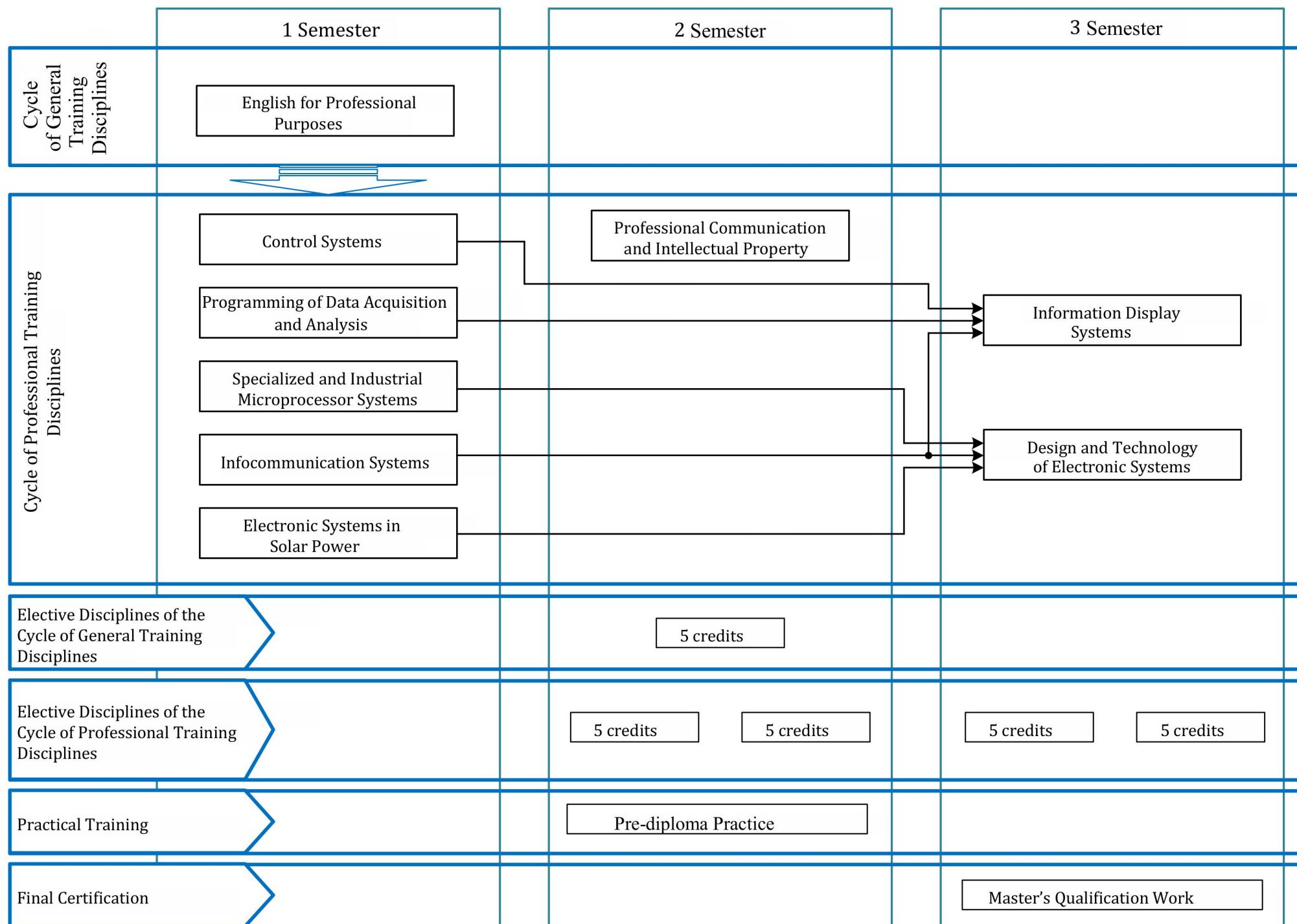
2. Перелік компонентів освітньої програми

Component Code	Educational Program Components	Number of Credits (ECTS)	Form of Final Control
CYCLE OF GENERAL TRAINING DISCIPLINES			
Compulsory Educational Disciplines			

OC 1	English for Professional Purposes	5	Differentiated credit
Total		5	
Elective Educational Disciplines			
EB 1	Elective Educational Disciplines (General Profile Catalog)	5	Differentiated credit
Total		5	
CYCLE OF PROFESSIONAL TRAINING DISCIPLINES			
Compulsory Educational Disciplines of the Specialty			
OC 2	Control Systems	5	Exam
OC 3	Programming of Data Acquisition and Analysis Systems	5	Differentiated credit
Total		10	
Compulsory Educational Disciplines of the Educational Program			
OC 4	Specialized and Industrial Microprocessor Systems	5	Differentiated credit
OC 5	Infocommunication Systems	5	Exam
OC 6	Electronic Systems in Solar Power Engineering	5	Differentiated credit
OC 7	Professional Communication and Intellectual Property	5	Differentiated credit
OC 8	Information Display Systems	5	Differentiated credit
OC 9	Design and Technology of Electronic Systems	5	Exam
Total		30	
Elective Educational Disciplines of the Educational Program			
EB 2	Elective Educational Disciplines of the Educational Program (Professional Profile Catalog)	20	Differentiated credit
Total		20	
CYCLE OF PRACTICAL TRAINING			

OK 10	Pre-diploma Practice	10	
Total		10	

CERTIFICATION			
OC 11	Master's Qualification Work	10	Defense
Total		10	
Total number of credits		90	



4. Forms of Certification of Higher Education Applicants of General

Forms of Certification of Higher Education Applicants	Certification is carried out in the form of a public defense of the qualification work.
Requirements for the Qualification Work (if applicable)	The qualification work must involve solving a complex problem in the field of electronics, which requires conducting research and/or implementing innovations. The qualification work must not contain academic plagiarism, fabrication, or falsification.
Requirements for the State Qualification Examination(s) (if applicable)	
Requirements for the Public Defense (Demonstration) (if applicable)	The qualification work must be made public before the defense on the official website of the higher education institution or its subdivision. The publication of qualification works containing information with restricted access is carried out in accordance with the requirements of the current legislation.

5. Procedures for Awarding Professional Qualifications

Awarding of professional qualifications is not provided.

6. Matrices of Correspondence

6.1 Matrix of Correspondence between Program Competences and Educational Program Components

Designations of Program Competences and Educational Components	OK 1	OC 2	OC 3	OC 4	OC 5	OC 6	OC 7	OC 8	OC 9	OC 10	OC 11
GC 1		+						+			
GC 2							+				+
GC 3	+										
GC 4							+			+	+
GC 5			+		+					+	
GC 6							+				+
GC 7	+									+	
GC 8							+		+	+	
PC 1		+		+		+				+	
PC 2						+	+				+
PC 3		+						+			+
PC 4			+		+						+
PC 5			+			+			+		
PC 6					+					+	
PC 7		+		+				+			+
PC 8		+							+		+
PC 9						+	+		+		+
PC 10					+	+					
PC 11			+	+							+
PC 12				+				+			+

Notes:

1. OC n – a certain compulsory component of the educational program according to Section 2.1;
2. GC n – a general competence according to Section 1.6 of the educational program profile;
3. PC n – a professional competence according to Section 1.6 of the educational program profile;
4. “+” – a mark indicating that a certain program competence is provided by the corresponding educational component of the current row.

6.2 Matrix of Ensuring Program Learning Outcomes by the Corresponding Educational Program Components

Designations of Program Learning Outcomes and Educational Components	OC 1	OC 2	OC 3	OC 4	OC 5	OC 6	OC 7	OC 8	OC 9	OC 10	OC 11
PL 1		+								+	+
PL 2			+	+	+					+	
PL 3	+						+		+	+	
PL 4						+		+	+		+
PL 5						+	+		+		+
PL 6	+					+				+	
PL 7	+		+		+					+	
PL 8		+		+				+	+		+
PL 9							+			+	
PL 10		+				+		+			+
PL 11			+				+		+		+
PL 12		+			+						
PL 13							+			+	+
PL 14					+	+		+			
PL 15				+				+			+
PL 16			+	+							+

Notes:

1. PLO n – a certain program learning outcome according to Section 1.7 of the educational program profile;
2. “+” – a mark indicating that a certain program learning outcome is ensured by the corresponding educational component of the current row..

Завідувач кафедри із спеціальної (фахової)
підготовки Електроніки і комп'ютерної
техніки

(підпис)

Анатолій ОПАНАСЮК

(підпис)

Керівник робочої проектної групи
(гарант освітньої програми)

(підпис)

Анатолій ОПАНАСЮК

ПОГОДЖЕНО:
Перший проректор

(підпис)

Інна ШКОЛЬНИК

Верифіковано в Особистому кабінеті Сумського державного університету