MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL TECHNICAL UNIVERSITY
"KHARKIV POLYTECHNIC INSTITUTE"

APPROVED BY
Rector of NTU "KhPI"
_____ Yevgen SOKOL
«04» 05 2024

EDUCATIONAL-PROFESSIONAL PROGRAM "ELECTRONICS"

The first (Bachelor) Level

by specialty: 171 Electronics

fields of knowledge: 17 Electronics, Automation and Electronic Communications

qualification: Bachelor of Electronics

APPROVED
BY THE ACADEMIC COUNCIL
OF NTU "KhPI"
Head of the academic council
_____ Leonid TOVAZHNYANSKYY
Protocol No. 4
26.04.2024

Kharkiv 2024

LETTER OF AGREEMENT

Educational and professional program "Electronics"

Higher education degree	First (bachelor) Level
Knowledge field	17 Electronics, automation and electronic communications
Specialty	171 Electronics
Qualification	Bachelor of Electronics

APPROVED
The EP workgroups
for the specialty "Electronics"
Guarantor of the educational program

_____ Viacheslav KULICHENKO
«13» 04 2024

RECOMMENDED
Methodical Council of NTU "KhPI"
Deputy Chairman of the methodical council

_____ Ruslan MYGUSHCHENKO
«17» 04 2024

AGREED
The head of department of
"Industrial and biomedical electronics"

_____ Sergiy KRYVOSHEIEV
«14» 04 2024

AGREED
Director of the Institute of Education and Science in Power Engineering, Electronics and Electromechanics

_____ Roman TOMASHEVSKYI
«16» 04 2024

AGREED
Student (member of EP workgroup)
E-622,

_____ Polina PROKOPENKO
«13» 04 2024

REVIEWERS:

Constructive comments and feedback on the draft of the educational program (EPP, ESP) were received from:

1. Volodymyr KARTASHOV, Doctor of Technical Sciences, Professor, Head of the Department of Media Engineering and Information Radio Electronic Systems.

2. Marina OVASAPOVA, Director of KB “Promavtomatika.”

3. Andrii KHOLOD, Chief Engineer of LLC “MYRENERGOCOM.”

PREFACE

Corresponds to the Standard of higher education of the first level of the branch of knowledge 17 “Electronics, automation and electronic communications”, specialty 171 “Electronics”, approved and put into effect by the order of the Ministry of Education and Science of Ukraine dated November 13, 2018, No. 1246

Design by EP workgroup 171 “Electronics” of the Institute of Education and Science in Power Engineering, Electronics and Electromechanics of the National Technical University “Kharkiv Polytechnic institute”.

Guarantor of the educational program:

KULICHENKO Viacheslav, candidate of technical sciences, associate professor of the department of industrial and biomedical electronics;

Members of EP workgroup:

1. BUTOVA Olga, candidate of technical sciences, associate professor of industrial and biomedical electronics;
2. KHOLOD Olha, candidate of technical sciences, associate professor of industrial and biomedical electronics;
3. PROKOPENKO Polina, student of group E-622b

1. Profile of the educational program by specialty 171 “Electronics”

1 - General Information	
Full name of higher educational institution and structural unit	National Technical University “Kharkiv Polytechnic Institute” Institute of Educational and Scientific of Power Engineering, Electronics and Electromechanics Department of Industrial and Biomedical Electronics
Higher education degree and name of the qualification in original language	Higher education degree – Bachelor Qualification – Bachelor of Electronics Diploma qualification – Bachelor of Electronics
The official name of the educational program	Educational-professional program of the first (Bachelor) level of “Electronics”
Type of diploma and scope of educational program	Bachelor diploma, unitary, based on High-school education: 240 ECTS credits – 3 years 10 months
Accreditation	Accreditation Commission. Ukraine: Series: НД No. 2192181 dated September 6, 2017 Validity: until July 1, 2024
Cycle / Degree	First (Bachelor) level of higher education NQM of Ukraine – 6 level, EQF– 6 level, FQ-EHEA – first cycle
Prerequisites	Availability High-school education
Language(s) of study	Ukrainian, English
Validity of educational program	According to the validity period of the certificate of accreditation. Reviewed annually
Internet address of the permanent placement of the educational program description	https://blogs.kpi.kharkov.ua/v2/quality/dokumenty/diyuchy-osvitni-programy/osvitnij-riven-bakalavr/osvitnij-riven-bakalavr-vstup-2024-2025-navchalnogo-roku/ https://web.kpi.kharkov.ua/pbme/osvitni-programy/
2 - Purpose of the educational program	
The combination of a high level of professional training in the specialty “Electronics” in the field of electronics and telecommunications with the formation of a scientific and technical worldview among specialists and the provision of a broad outlook in the social, humanitarian, fundamental (science) and professional fields. The achievement of this goal is based on the principles of continuity and individualization of training, the fundamentality and integrity of the provision of knowledge, practical orientation and awareness of the place of acquired competencies, the symbiosis of scientific and systematic approaches, etc.	

3 - Educational program characteristics	
Subject area (knowledge field, specialty, specialization (if any)**)**	Knowledge field: 17 "Electronics, automation and electronic communications" Specialty: 171 "Electronics" Object of study: devices and systems of electronics, analog and digital components, microprocessor and microcontroller devices, devices and systems of industrial and biomedical electronics, systems for collecting, processing, converting, transmitting information and integrating these systems for automating engineering solutions based on modern computer technology and software. Learning objectives: the acquisition of theoretical and practical knowledge and skills, skills and other competencies of successful professional activity: the use of technologies, materials and electronic equipment; modeling, design, construction, manufacturing, installation, operation and modernization of electronic equipment. Theoretical content of the subject area: fundamental physical processes and principles for constructing modern devices and systems of industrial and biomedical electronics, control and management systems, methods for modeling objects and processes, modern computer and information technologies, research methods and tools. Methods, techniques and technologies: methods for studying processes in devices and systems of electronics; methods of development, control, research of circuit solutions; methods and means of programming microcontroller systems; modern computer and information technologies in the design, construction of devices and electronics systems. Tools and equipment: power supply systems for electronic equipment, display and registration of information, electronic systems for various purposes, computer and microprocessor technology, software for analysis, calculation and modeling of processes, device design.
Orientation of the educational program	Educational-professional. It is focused on the formation of the widest possible scientific and technical worldview among specialists, is balanced in terms of the social, humanitarian, fundamental and professional components of training and contains a sufficient selective component of training in profiled blocks.
The main focus of the educational program and specialization	Special education in the field of electronics and telecommunications, in particular industrial and biomedical electronics, analog and digital electronics, microprocessor technology, electronic components and systems, systems of mathematical design, modeling and programming. Key words: analog and digital electronics; power electronics; electronics software; microcontroller devices.
Program Features	The educational and professional bachelor's program is designed for higher education applicants seeking to become specialists in the field of electronics and telecommunications engineering. The program is balanced in terms of the social and humanitarian, fundamental and professional components of training and contains sufficient selective components of training in specializations. This makes it possible to obtain basic knowledge of social and humanitarian, fundamental and natural science disciplines, disciplines of general professional training and special professional training in the field of industrial and biomedical electronics.

4 - Suitability of graduates for employment and further education	
Employment suitability	Employment at enterprises and companies of electronics and telecommunications, electric power industry, electrical and electromechanical industries, as well as branch scientific, design and design organizations and institutions. Professional opportunities of graduates (according to the Classification of Professions DK 003:2010). The main profession corresponds to codes from 2143 to 2144, 311 and 313 of the current editions of the State Classifier of Ukraine.
Further training	Opportunity to continue education at the next (Master's) level of higher education другий (second (master's) level of higher education, NQF – level 7, EQF – level 7, QF-EHEA – second cycle) according to the relevant educational-professional or educational-scientific programs. Opportunity for postgraduate education to obtain professional qualifications according to relevant professional standards.
5 - Teaching and Assessment	
Teaching and learning	Teaching is carried out in the form of: lectures, practical and laboratory classes, computer workshops; individual lessons Also provides for independent work with the possibility of consultation with the teacher on individual educational components, individual lessons, group project work, the performance of a bachelor's qualification work. The use of blended learning technologies: distance learning in the Microsoft 365 system, information and communication, student-centric, modular, research learning technologies, collaborative learning technologies, research-based learning, projective education.
Assessment	Current and final control of knowledge (surveys, control and individual tasks, testing, etc.), tests and exams (oral and written), defense of educational projects with a presentation, public defense of a qualifying work. Rating system of assessment in accordance with work programs / syllabus of educational disciplines, oral and written examinations, testing. The assessment system involves the use of the international ECTS system (with grades A, B, C, D, E, F), the national system (with grades “excellent”, “good”, “satisfactory” and “unsatisfactory”), as well as 100-point systems of universities with an established system of compliance.
6 - Program competencies	
Integral Competence	Ability to solve complex specialized problems and solve practical problems in professional activities in the field of electronics and telecommunications or in the learning process, which involves the application of theories and methods in electronics and telecommunications and is characterized by complexity and uncertainty of conditions.
General Competence (GC)	**GC 1.** Ability to apply knowledge in practical situations. **GC 2.** Knowledge and understanding of the subject area and understanding of professional activities. **GC 3.** Ability to communicate in the state language both orally and in writing. **GC 4.** Ability to communicate in a foreign language. **GC 5.** Skills in the use of information and communication technologies. **GC 6.** Ability to learn and acquire modern knowledge.

	GC 7. Ability to search, process and analyze information from various sources. **GC 8.** Interpersonal skills. **GC 9.** Ability to work in a team. **GC 10.** Skills for safe activities. **GC 11.** Ability to evaluate and ensure the quality of work performed. **GC 12.** Definiteness and perseverance in the tasks and responsibilities taken. **GC 13.** Ability to exercise one's rights and obligations as a member of society, to be aware of the values of a civil (free democratic) society and the need for its sustainable development, the rule of law, human and civil rights and freedoms in Ukraine. **GC 14.** Ability to preserve and increase the moral, cultural, scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technology, to use various types and forms motor activity for outdoor activities and healthy lifestyle
Special competences (SC) **(defined by the standard of higher education of the specialty)**	**SC 1.** Ability to use knowledge and understanding of scientific facts, concepts, theories, principles and methods for designing and using apparatus, devices and electronic systems. **SC 2.** Ability to perform analysis of the subject area and regulatory documentation, the necessary design and application of apparatus, devices and electronic systems. **SC 3.** Ability to integrate knowledge of the fundamental sections of physics and chemistry to understand the processes of solid-state, functional, energy and biomedical electronics, electrical engineering. **SC 4.** Ability to take into account social, environmental, moral, economic and commercial considerations that affect the efficiency and results of engineering activities in the field of electronics. **SC 5.** Ability to apply appropriate mathematical, scientific, and technical methods, modern information technologies, and computer software, along with skills in working with computer networks, databases, and Internet resources, to solve engineering problems in the field of electronics. **SC 6.** Ability to identify, classify, evaluate and describe processes in devices, devices and electronic systems using analytical methods, simulation tools, prototypes and experimental research results. **SC 7.** Ability to use creative and innovative potential in the synthesis of engineering solutions and in the development of designs for devices and electronics systems. **SC 8.** Ability to solve engineering problems in the field of electronics, taking into account all aspects of the development, design, production, operation and modernization of electronic apparatus, devices and systems. **SC 9.** Ability to determine and evaluate the characteristics and parameters of electronic materials, analog and digital devices for the design of microprocessor and electronic systems. **SC 10.** Ability to use in practice industry standards and quality standards for the functioning of electronic devices and systems. **SC 11.** Ability to monitor and diagnose the condition of equipment, apply modern electronic components and technical means, perform preventive maintenance, repair and maintenance of electronic devices

	and systems, mount, debug and repair analog, digital and optical modules, develop and produce printed circuit boards, develop software for microcontrollers.
Professional competence of specialization (determined by the institution of higher education) (defined by the standard of higher education specialty)	**SCS 1.** Ability to use professional knowledge and skills related to electrophysical processes in semiconductor devices of industrial and biomedical electronics in the construction of circuit solutions and their modeling, calculation of their parameters, static and dynamic characteristics in various operating modes, analysis of transient and stable operating modes. **SCS 2.** Ability to develop software for microcontroller control systems, receiving and processing information for industrial and biomedical electronics objects. **SCS 3.** Ability to develop design projects and simulate devices for industrial and biomedical electronics using automated design tools, CAD software packages.
7 - Program learning outcomes	
Results of studies (R) by specialty (defined by the standard of higher education specialty)	**R 1.** Describe the principle of operation using scientific concepts, theories and methods and verify the results in the design and application of devices, devices and electronic systems. **R 2.** Apply knowledge and understanding of differential and integral calculus, algebra, functional analysis of real and complex variables, vectors and matrices, vector calculus, differential equations in ordinary and partial derivatives, Fourier series, statistical analysis, information theory, numerical methods to solve theoretical and applied problems of electronics **R 3.** Find a solution to practical problems of electronics by applying the appropriate models and theories of electrodynamics, analytical mechanics, electromagnetism, statistical physics, solid state physics. **R 4.** Evaluate the characteristics and parameters of materials in electronic technology, understand the basics of solid-state electronics, electrical engineering, analog and digital electronics, converter and microprocessor technology. **R 5.** Use information and communication technologies, applied and specialized software products to solve the problems of designing and debugging electronic systems, demonstrate programming skills, analysis and display of measurement and control results. **R 6.** Apply experimental skills (knowledge of experimental methods and procedures for conducting experiments) to test hypotheses and study the phenomena of electronics, be able to use standard equipment, plan, draw diagrams; analyze, model and critically evaluate the results obtained. **R 7.** Analyze complex digital and analog information-measuring systems with an extended architecture of computer and telecommunication networks, taking into account the specification of the selected technical means and the corresponding technical documentation. **R 8.** Determine and identify mathematical models of technological objects when developing complex electronic systems in a computer environment and choosing the optimal solution. **R 9.** Design complex real-time systems and means of collecting and processing information, consistent with the specified information and software tools, by using software for embedded systems based on microcontrollers. **R 10.** Develop technical tools for building and diagnosing the

	technical condition of electronic devices and systems, organize and carry out scheduled and unscheduled repairs, adjustment and readjustment of electronic equipment in accordance with current production requirements **R 11.** To argue the regulatory framework for the implementation of electronic devices and systems; evaluate the benefits of engineering developments, their environmental friendliness and safety; to defend their worldview positions and beliefs in production or social activities. **R 12.** Use documentation related to professional activities, using modern technologies and office equipment; use English, including special terminology, to communicate with specialists, conduct literary searches and read texts on technical and professional topics. **R 13.** Be able to assimilate new knowledge, progressive technologies and innovations, find new non-standard solutions and ways to implement them; meet the requirements of flexibility in overcoming obstacles and achieving goals, rational use and regulation of time, discipline, responsibility for their decisions and activities. **R 14.** Comply with the norms of the modern Ukrainian business and professional language. **R 15.** Identify skills for independent and team work, leadership qualities, organize work in a limited time with an emphasis on professional integrity. **R 16.** Apply an understanding of the theory of stochastic processes, methods of statistical processing and data analysis in solving professional problems. **R 17.** Demonstrate the skills of conducting experimental research related to professional activities; improve measurement techniques; control the reliability of the results **R 18.** Apply methods of mathematical modeling and optimization of electronic systems in the development of automated and robotic production complexes.
Program results of studies with specialization (RS) (defined by the institution of higher education)	**RS 1** Be able to develop software modules for receiving, registering, processing, displaying and generating signals in accordance with specified algorithms for microcontroller systems and personal computers using modern software tools. **RS 2.** Be able to design and analyze devices for industrial and biomedical electronics, taking into account the specification of the selected technical means.
8 – Resource support of the program implementation	
Staffing	In accordance with the personnel requirements for ensuring the implementation of educational activities for the corresponding level of higher education, approved by the Decree of the Cabinet of Ministers of Ukraine dated December 30, 2015 No. 1187, “On the Approval of Licensing Conditions for the Educational Activities of Educational Institutions” (with amendments introduced by Resolution of the Cabinet of Ministers No. 365 dated 24.03.2021, Appendices 15-16). All scientific and pedagogical employers who provide an educational and professional program correspond to the profile and direction of the disciplines taught, have the necessary teaching experience and practical work experience. In the process of organizing the educational process, professionals with experience in research / managerial / innovative / creative work and work in their specialty are involved. 100% of teachers who provide educational activities in English have certificates in accordance with the Common European Guidelines for

	Language Education (at B2 level) or qualification documents related to the use of a foreign language.
Material and technical support	In accordance with the personnel requirements for ensuring the implementation of educational activities for the corresponding level of higher education, approved by the Decree of the Cabinet of Ministers of Ukraine dated December 30, 2015 No. 1187, "On the Approval of Licensing Conditions for the Educational Activities of Educational Institutions" (with amendments introduced by Resolution of the Cabinet of Ministers No. 365 dated 24.03.2021, Appendices 15-16). The use of equipment for conducting lectures in the format of presentations, network technologies, in particular, on the Microsoft 365 distance learning platform. Logistics support allows you to fully ensure the educational process throughout the entire cycle of training for the educational program. The condition of the premises is certified by sanitary and technical passports that meet existing regulations
Information and methodological support	In accordance with the personnel requirements for ensuring the implementation of educational activities for the corresponding level of higher education (Appendix 5 to the License Terms), approved by the Decree of the Cabinet of Ministers of Ukraine dated December 30, 2015 No. 1187, "On the Approval of Licensing Conditions for the Educational Activities of Educational Institutions" (with amendments introduced by Resolution of the Cabinet of Ministers No. 365 dated 24.03.2021, Appendices 15-16). Information support is provided by textbooks, teaching aids and electronic resources. Access to the NTU "KhPI" electronic repository (eNTUKhiPIIR) via the Internet (including via the university's Wi-Fi network). Methodological support is implemented by the obligatory support of educational activities with appropriate educational and methodological materials for each academic discipline of the curriculum.
9 - Academic mobility	
National Credit Mobility	On the basis of bilateral agreements between the National Technical University "Kharkiv Polytechnic Institute" and the leading technical universities of Ukraine. Double degree program DSG_2 between NTU "KhPI" and Magdeburg University. Otto-von-Guericke, including the EPP "Electronics". After graduation, graduates will receive two diplomas from NTU "KhPI" and Magdeburg University. Otto-von-Guericke.
International Credit Mobility	On the basis of bilateral agreements between the National Technical University "Kharkiv Polytechnic Institute" and educational institutions of higher education of foreign partner countries.
Training foreign applicants for higher education	According to the license of NTU "KhPI" foreigners and / or stateless persons can study for the educational program. Curricula for this contingent have expanded language training in the Ukrainian language. For the teaching of academic disciplines in foreign (English), separate groups are formed for foreign citizens, stateless persons who wish to obtain higher education for the funds of individuals or legal entities, or develop individual programs. At the same time, programs of higher education establishments provide the study of such persons of the state language as a separate discipline.

2. List of components of the educational-professional program

2.1. List of EP components

Code	Components of the educational program (disciplines, projects / work, practice, qualification work)	Credits ECTS	Final control form
1	**2**	**3**	**4**
OBLIGATORY EDUCATIONAL COMPONENTS			
General training			
GT 1	History and Culture of Ukraine	4	Exam
GT 2	English Language (for professional purposes)	3	Exam
GT 3	Ukrainian as a Foreign Language	12	Test (1-3, 7, 8) Exam (4)
GT 4	Philosophy	3	Exam
GT 5	Jurisprudence	3	Test
GT 6	History of Science and Technology	3	Test
GT 7	Ecology	3	Test
GT 8	Electrotechnical Materials	4	Test
GT 9	Higher Mathematics	19	Test (4) Exam (1–3)
GT 10	Physics	13	Exam (1–3)
GT 11	Physical Education	12	Test (1-6)
Professional training			
PT 1	Descriptive Geometry, Engineering and Computer Graphics	4	Exam
PT 2	Introduction to Specialty. Introductory Practice	3	Test
PT 3	Informatics	4	Exam
PT 4	Fundamentals of Programming and Information Technology	6	Exam
PT 5	Theory of Electrical Circuits	5	Exam
PT 6	Fundamentals of Electronic Device Design	5	Exam
PT 7	Analog Electronics	6	Exam
PT 8	Computational Mathematics	5	Exam
PT 9	Digital Electronics	6	Exam
PT 10	Sensors of Electric Quantities and Non-electrical Quantities	6	Exam
PT 11	Fundamentals of Occupational Safety and Health	3	Test
PT 12	Microprocessor Engineering	6	Exam
PT 13	Microcontrollers	6	Exam
PT 14	Enterprise Economics	3	Test
PT 15	Theory of Automatic Regulation	6	Exam
Total of Obligatory Components:		**153**	
PRACTICAL TRAINING			
PP 1	Industrial Practice	6	Test
PP 2	Pre-graduation Practice	6	Test
Total of Practical Training:		**12**	
ATTESTATION			
A	Attestation	6	Defense
Total of Attestation:		**6**	

OPTIONAL EDUCATIONAL COMPONENTS			
1	**2**	**3**	**4**
Profiled package of educational components 01 "Industrial electronics"			
OP 1.1	Solid-State Electronics	5	Exam
OP 1.2	Fundamentals of Electronic Equipment	5	Exam
OP 1.3	Computer Design of Electronic Devices	5	Exam
OP 1.4	Power Electronics	5	Exam
OP 1.5	Electromagnetic Technique	5	Exam
Profiled package of educational components 02 "Biomedical electronics"			
OP 2.1	Physical Basis of Electronic Equipment	5	Exam
OP 2.2	Anatomy and Biophysical Processes	5	Exam
OP 2.3	Electrotechnical Materials and Electronic Components in Medicine	5	Exam
OP 2.4	Functional Diagnostics	5	Exam
OP 2.5	Diagnostic Devices and Systems	5	Exam
Student-Selectable Educational Components of Professional Training according to the list			
OPT 1	Discipline 1	4	Test
OPT 2	Discipline 2	4	Test
OPT 3	Discipline 3	4	Test
OPT 4	Discipline 4	4	Test
OPT 5	Discipline 5	4	Test
OPT 6	Discipline 6	4	Test
OPT 7	Discipline 7	4	Test
OPT 8	Discipline 8	4	Test
Student-Selectable Educational Components of General Training from University Catalog			
OGT 1	Discipline 1	4	Test
OGT 2	Discipline 2	4	Test
OGT 3	Discipline 3	4	Test
Total of optional educational components:		**69**	
TOTAL VOLUME OF EDUCATIONAL PROGRAM		**240**	

2.2. List of Student-Selectable Educational Components of Professional Training

Code	Components of the educational program (disciplines, projects / work, practice, qualification work)	Credits ECTS	Final control form
OPTIONAL EDUCATIONAL COMPONENTS			
Student-Selectable Educational Components of Professional Training			
OPT 1	Transient Processes in Electrical Circuits	4	Test
OPT 2	Semiconductor Devices	4	Test
OPT 3	Biomedical Sensors	4	Test
OPT 4	Metrology and Data Processing	4	Test
OPT 5	Electrical Machines and Apparatus	4	Test
OPT 6	Basis of Software Development	4	Test
OPT 7	Computer Modeling of Electronic Devices	4	Test
OPT 8	Automatization Design of Electronic Devices and Systems	4	Test
OPT 9	Signal Converters and Interfaces	4	Test
OPT 10	Power Electronics. Inverters	4	Test
OPT 11	Sources of Power Supplies of Medical Equipment	4	Test
OPT 12	Data Acquisition and Signal Processing	4	Test
OPT 13	Power Semiconductor Devices	4	Test
OPT 14	Power Electronics. Power Supplies	4	Test
OPT 15	Fundamentals of Digital Signal Processing	4	Test
OPT 16	Physiotherapeutic Equipment	4	Test
OPT 17	Microcontroller Devices for Processing Medical Information	4	Test
OPT 18	Programming of Microcontroller Systems	4	Test
OPT 19	Control and Visualization Electronics	4	Test
OPT 20	Microcontroller Systems	4	Test
OPT 21	Telemedicine	4	Test
OPT 22	Smart Grid Technology in Electronics	4	Test
OPT 23	Fundamentals of Electronic Devices and Systems Design	4	Test
OPT 24	Grid-Connected Converters	4	Test

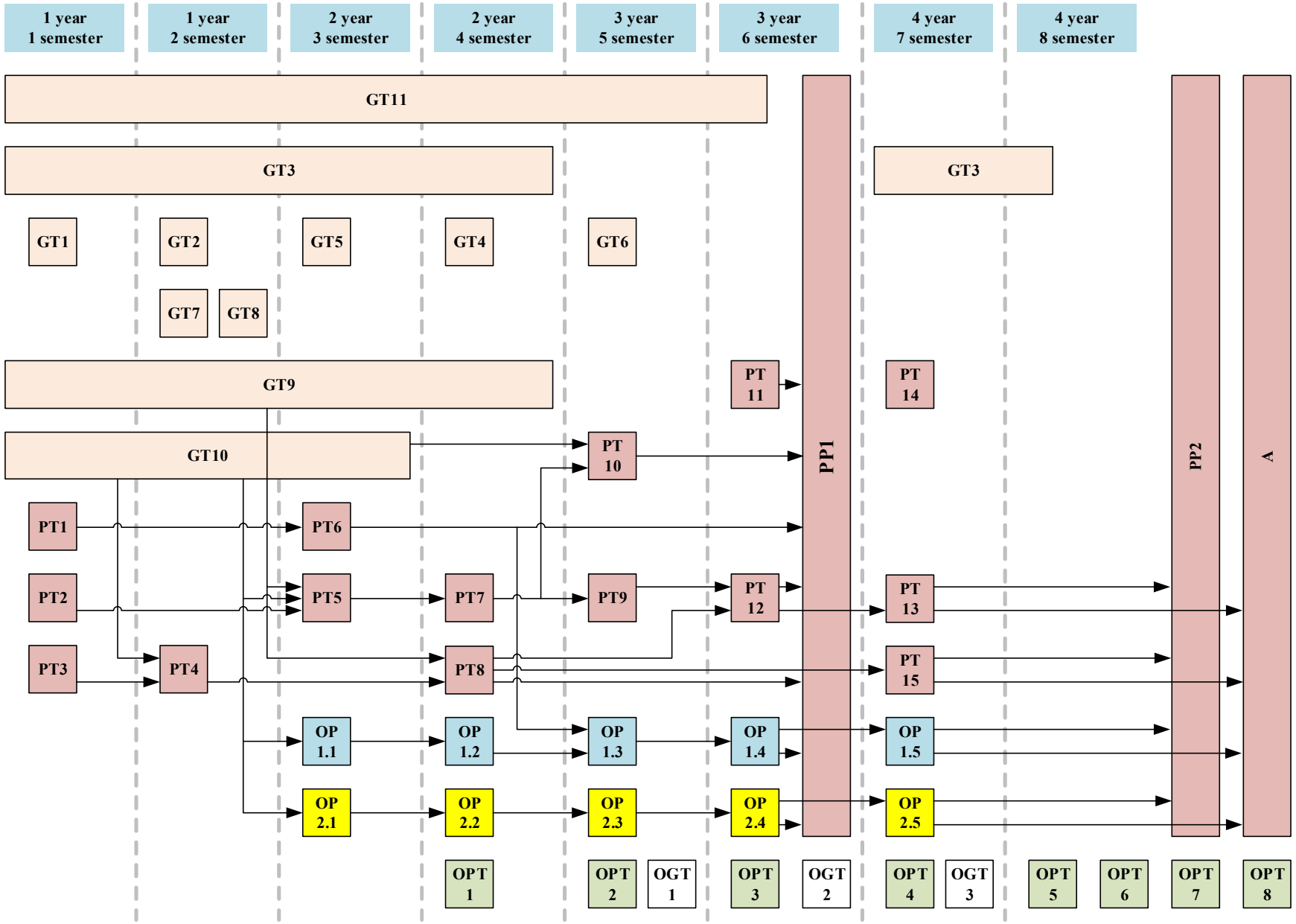
2.3. Distribution of the content of the educational program by groups of components and training cycles

№	Training cycle	Volume of study load of the applicant of higher education (ECTS credits /%)			
		Obligatory components of educational-professional program	Optional components of the educational-professional program	Practice and Attestation	Total for the entire period of study
1	General training	79 / 32,92	-		**79 / 32,92**
2	Professional training	74 / 30,83	-		**74 / 30,83**
3	Optional disciplines	-	69 / 28,75		**69 / 28,75**
4	Practical Training			12 / 5,00	**12 / 5,00**
5	Attestation			6 / 2,50	**6 / 2,50**
Total for the whole period of study		**153 / 63,75**	**69 / 28,75**	**18 / 7,5**	**240 / 100**

3. Form of attestation of applicants for higher education

Attestation of graduates of the educational program of the specialty 171 "**Electronics**" is carried out in the form of a defense of a qualifying bachelor's thesis and ends with the issuance of a standard document on awarding a bachelor's degree with the qualification: "**Bachelor in Electronics**". The qualification work is checked for academic plagiarism using software. Publication of qualification work in the depository of the university or its division. Public defense of the qualification work takes place at an open meeting of the examination committee.

4. Structural-logical diagram of EP



5. Matrix of correspondence of defined learning outcomes, competences, and educational components

A two-dimensional table is provided, containing the correspondence of competences (general and specific (professional)) and learning outcomes to educational components.

The column headers of the table list the general and specific (professional) competences, while the row headers list the learning outcomes. At the intersection, the list of educational components (EC) is indicated, indicating the correspondence of EC to a specific competence and learning outcome.

Matrix of compliance of program competencies with the components of the educational program

Results of training	Competencies													
	General competencies													
	GS1	GS2	GS3	GS4	GS5	GS6	GS7	GS8	GS9	GS10	GS11	GS12	GS13	GS14
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
R1	GT6 PP2	GT6 PP2 A	GT2 PP2 A				PT10 PP2					PP2 A		
R2	GT9 PT4 PT5 PT8 PT15				GT9 PT4 PT8 PT15									
R3	GT8 GT9 GT10 PT5													
R4	GT6 GT8 GT10 PT5 PT7 PT9	GT6 GT10 PT5 PT7 PT9												
R5		GT9 PT1 PT2 PT4 PT6 PT8 PT15 PP2 A		GT3 PT13	GT9 PT1 PT3 PT4 PT8 PT12 PT13 PT15 PP2 A					PP2	PT13 PP2 A	GT9 PP2 A		PT1
R6	GT8 GT10 PT5 PT7 PT9 PP1 PP2	GT10 PT5 PT7 PT9 PP1 PP2	PP2							GT8 PP1 PP2	PP1 PP2	PP2		
R7	PT7 PT9				PT12 PT13						PT13			
R8		GT9 PT5 PT6 PT8 PT15 PP1 PP2			GT9 PT1 PT8 PT12 PT13 PT15 PP2		PT6 PP2				PT13 PP1 PP2			

Results of training	Competencies													
	Professional competencies													
	SC1	SC2	SC3	SC4	SC5	SC6	SC7	SC8	SC9	SC10	SC11	SCC1	SCC2	SCC3
1	16	17	18	19	20	21	22	23	24	25	26	27	28	29
R1	GT6 PT10 PP2 A						PP2	PP2 A	PT10 PP2	PP2 A	PP2	PT10 PP2		
R2		PT8 PT15			PT4 PT8									
R3			GT8 GT10 PT10									PT10		
R4	GT6 PT5 PT10		GT8 GT10 PT7 PT10 PT11						GT8 PT9 PT10		GT8			
R5	PT2 PT12 PP2 A				PT4 PT8 PT12 PT13 PP2			PT1 PP2					PT4 PT12 PT13 PP2	PT6 PP2
R6			GT8 GT10 PT7 PT10 PT11			PT5 PT9 PP2			GT8 PT9 PT10 PP1 PP2		GT8 PP1 PP2	PT7 PT9 PT10 PP2		PP2
R7	PT12				PT12 PT13			PT7 PT9			PT12 PT13		PT12 PT13	
R8	PT5 PT12 PP2	PT8 PT15 PP2			PT8 PT12 PT13 PP2		PT6 PT8 PT15 PP2	PT1 PP2						PT6 PP2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
R9		PT9 PP2								PP2	PT13 PP2	PP2			PT12 PP2						PP2		PT9 PP2		PT12 PT13 PP2		PT12 PT13 PP2	
R10	PP1 PP2	PP1 PP2								PP1 PP2	PP1 PP2					PP2				PP2		PP2	PP1 PP2	PP1 PP2	PP1 PP2			
R11	GT6 GT7 PT14		GT5 A	PT13				GT5 GT11	GT11 PT11			GT5 PT14 A	GT5	GT6 GT7 GT11 PT11				GT7 PT14			PT14							
R12		PT2 PT4 PT6 PT7 PP1 A	GT1 GT2 GT5 A	GT3 PT13	PT4 PT13 A	GT4 PT6 PT10 PT12 PT13 PP1 A	GT1 PT6 PT10												PT4 PT12 PT13									
R13						GT4 PT3 PT6 PT10 PT12 PT13 PP1	PT6 PT10					GT5 GT9 PT14	GT4 GT5	GT4 GT6 GT7 GT11 PT11	GT6 PT2 PT10			GT7 PT14			PT3 PT6 PT14						
R14	PT2		GT1 GT2 GT5 A			A							GT1 GT5									A		A				
R15		PT2 PT4 PT9 PP1 PP2					GT1 PP2	GT2 GT3 GT5 GT11 PT2 PP1	GT11 PT3 PP1	PP1 PP2	PT14 PP1 PP2	GT5 PT14 PP2				PP2													
R16		PP2					PP2				PP2					PP2			PP2	PP2			PP2					
R17	GT8 GT10 PT7 PT9 PP1	GT10 PT7 PT9 PP1 A								GT8 PP1	PP1 A	A			PT10 A					PT9			GT8 PT9 PT10 PP1		GT8 PP1			
R18	PT2 PT15 PP2	PT2 PT15 PP2									PP2					PT15 PP2				PP2	PT15 PP2	PP2	PP2		PP2	PT15 PP2	PP2	
RS1	PP2																		PT4 PT12 PT13 PP2						PT12 PT13 PP2		PT4 PT12 PT13 PP2	
RS2	PT6 PT9 PT15 PP2						PT6 PP2								PP2	PT6 PT15 PP2					PT6 PT15 PP2				PP2	PT9 PT15 PP2		PT6 PP2

6. Discussion Results on the Educational Program

Stakeholder	Recommendation	Considered / Partially Considered / Not Considered	Note
Ovasapova M.S., Director, KB “Promavtomatika”	It is necessary to define the individual learning path in more detail, formed by elective educational components available each semester.	Partially Considered	Further review of course content is required, as well as their dependency on previously studied educational components.