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EDUCATIONAL PROGRAM

6B01503 Computer Physics

Code and classification of the field of education: 6B01 – Pedagogical sciences

Code and classification of training areas: 6B015 - Teacher training in science subjects

Group of educational programs: 03 – Physics teacher training

ISCE level: 6

NQF level: 6

IQF level: 6

Training period: 4 years

Total credits: 240



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Almaty, 2020

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List of abbreviations and symbols

ECTS	European Credit Transfer and Accumulation System
EP	Educational Program
RO	Registrar Office
SCES	State Compulsory Education Standard
GPA	Grade Point Average
ISCE	International Standard Classification of Education
NQF	National Qualifications Framework
IQF	Industry Qualifications Framework
EC	Educational competency
BC	Basic competency
PC	Professional competence
LO	Learning outcomes
JSC	Joint-Stock Company
PhD	Doctor of Philosophy
RC	Resistor (R), capacitor (C)
EMF	Electromotive force
RLC	Resistor (R), an inductor (L), and a capacitor (C)
ComSol	Multiphysics Simulation Software
TTL	Transistor–transistor Logic
CMOS	Complementary Metal-Oxide-Semiconductor
NAND	Not And
CMOS	Complementary Metal Oxide Semiconductor Structure
Verilog-HDL	Verilog Hardware Description Language
LHO	Limited Health Opportunities
Sw	Software
SDP5	Session Description Protocol
SQL	Structured Query Language
SHF	Super High Frequency
PHP	Hypertext Preprocessor
CISCO	Computer Information System Company
CPU	Central Processing Unit
ALU	Arithmetic Logic Unit
SIS	Student Independent Study
TSIS	Teacher supervised independent study
GED	General education disciplines
CC	Compulsory component
UC	University component
BD	Basic discipline
EC	Elective component
PD	Professional discipline

1. Description of the educational program

Educational program 6B01503 - Computer Physics is implemented in accordance with the requirements of state standards and regulatory documents in the field of higher education of the Republic of Kazakhstan.

During the formation of the educational program, the faculty and the department use scientifically based approaches to planning, methodological provision and training technologies. This contributes to the preservation of the continuity of state standards, model programs, work curricula and teaching materials. 15 The resulting academic integrity of regulatory and educational documents ensures the effective management of the mechanism for the implementation of educational programs.

Guided by the requirements of the model plan, the content of the catalog of elective courses and the academic calendar, students determine their individual path for each academic year. The logic of drawing up an individual plan determines the choice of elective courses, teachers, supervisor, topics of both course and graduation projects. Methodological assistance to students in the formation of an individual trajectory is provided by advisors. The trajectory of bachelor's studies is based on the vertical principle of continuity of academic courses; the curricula of educational trajectories are built taking into account the semester-based distribution; division into compulsory and elective components; general educational, basic, major academic courses.

The curriculum pays adequate attention and time to the professional component, natural sciences, and mathematics, as well as humanities and socio-economic disciplines.

In order to fully familiarize with the competencies obtained when choosing a particular educational program, advisers hold presentations, consultations and meetings with students in scientific and educational laboratories of the University. Responsibility for the work of the adviser service is borne by the head of the Registration Office and the heads of departments.

Working curriculum is one of the fundamental educational documents developed based on students' individual plans and regulates the order of development of the educational program. Based on the principles of continuity, continuation and adaptability, the working curriculum contains a list of academic courses, number of credits, duration of semesters, class types and control forms.

The study of any academic course, regardless of its academic status, is completed by passing an examination (course work (project)) and awarding credits; the minimum amount of credits for the entire period of study must be 240 ECTS credits.

1.1 Natural Sciences and Mathematics block

– to possess basic knowledge of fundamental mathematical, natural science and technical academic courses that contribute to the formation of a highly educated person with a broad outlook and level of thinking; to have the ability to define and understand the role of mathematics and physics in the world; to express well-founded mathematical judgments; to use mathematics and physics for needs appropriate to the creative, interested and thinking person; to understand the role of physical processes in the nature, technical capabilities and prospects for the use of physical technologies in various fields of human activity;

1.2 Humanitarian and socio-economic block

– To provide conditions for mastering literate and developed speech; native and foreign languages; knowledge in the field of communication technology, communication strategies, skills and techniques of constructive dialogue, communication in a multicultural, multi-ethnic and multi-religious society;

– To get an idea about ethical, spiritual and cultural values, as well as about the basic laws and forms of regulation of social behavior, sociological approaches to the individual; to learn the traditions and culture of the people of Kazakhstan; to know the trends in the development of society; be able to adequately navigate in various social situations, think creatively, be tolerant to the traditions and culture of other nations of the world; to have an active life position;

– To know economic basics; to become competent and have an understanding of economics.

1.3 Block of general professional and special academic courses

To be able to apply the knowledge of physics in the professional activities of a physics teacher in schools, secondary and special educational institutions taking into account information and communication technologies (ICT), to plan and organize the project activities of future physics teachers, to organize actual and virtual laboratory work; to understand the role and place of physics in solving problems of electronic engineering, telecommunications networks, computers and software, as well as using skills in these areas in the professional activities of a physics teacher; to use ICT, interactive 17 whiteboards and multimedia projectors for technical support of active types of education; to possess the skills of processing information of various kinds, including to receive, extract and systematize digital, textual, graphic and visual, hypermedia information and physical data bases; to use multimedia resources and media; own methods to search the information on the Internet and databases of physical data; to find, select and process data from digital and Internet sources; to be able to use models and perform object modeling, to master the methods to create multimedia presentations; to possess programming skills using modern tools, to develop algorithmic and operational thinking, logical, intellectual and creative abilities of students by means of information and communication technologies.

Professional sphere

The professional sphere of a bachelor in EP 6B01503 - Computer Physics is educational institutions (secondary schools, pedagogical colleges, institutes of advanced training and retraining of pedagogical personnel, education departments).

Objects of professional activity

The objects of professional activity of graduates are educational government-financed institutions, educational nongovernment-financed institutions, schools, lyceums, gymnasiums, colleges, vocational educational and training institutions; managerial organizations: government bodies, education departments.

Types of professional activity

The types of professional activities of graduates: socio-pedagogical, educational, research, organizational and methodological, cultural and educational, production and technological, organizational and managerial.

2. The purpose and objectives of the educational program

The aim of the educational program is to prepare in high demand, competitive and highly qualified teachers who are fluent in English, with all kinds of competencies necessary for the labor market in education, skilled in modern teaching methods, ICT technologies, and who are able to assess and analyze the current state of the industry.

Objectives of the EP:

1. Providing conditions for mastering a competent and developed speech, knowledge of native and foreign languages, knowledge in the field of communication technology, communication strategies, skills of constructive dialogue, communication in a multicultural, multi-ethnic and multi-denominational society.
2. Possession of basic knowledge in fundamental mathematical, natural science and technical disciplines that contribute to the formation of a highly educated person with wide outlook and thinking culture, have the ability to determine and understand the role of mathematics and physics in the world, express well-founded mathematical judgments, use mathematics and physics for the needs inherent in creative, interested and thinking citizen; understand the role of physical processes in nature and technology, technical capabilities and prospects for the use of information technology in various fields of human activity.

3. To know the basic laws and principles of physics, apply this knowledge in pedagogical activities, and possess the methods of education and teaching physics. Ability to apply information and communication technologies (ICT) in professional activities, possess network and multimedia technologies for planning and organizing project activities for future physics teachers, for organizing online forums and seminars, and a virtual learning environment; use ICTs, interactive whiteboards and multimedia projectors for technical support of active types of training; to have skills in processing information of various types, including: receiving, retrieving and systematizing digital, text, graphic and visual, hypermedia information and databases; apply multimedia resources and media; possess methods of searching for information on the Internet and databases: find, select and process data from digital and Internet sources; the ability to use models and perform modeling of physical objects and processes, to possess methods for creating multimedia presentations; possess programming skills using modern tools, the development of algorithmic and operational thinking, logical, intellectual and creative abilities of students by means of information and communication technologies. Have basic knowledge of electronic and telecommunication technologies.
4. Possession of a system of subject, psychological, pedagogical and methodological knowledge, skills and abilities to apply theoretical knowledge in professional activities, taking into account specific socio-pedagogical conditions, knowledge of the methods of organizing innovative activities in the teaching of physics, knowledge of the theory of pedagogical integration, pedagogical innovation, pedagogical technologies, the ability to integrate knowledge from various subject areas in solving pedagogical problems; knowledge of the methods of planning and conducting criteria-based assessment in physics lessons; Skills in planning educational activities within the framework of inclusive education; providing students with basic knowledge and skills to work with modern information and communication technologies for their effective use in the conditions of updated educational content, implementing trilingual education, which involves teaching not only three languages, but also organizing extracurricular activities of students in three languages (Kazakh, Russian and English), the ability to organize pedagogical cooperation (teacher-student, teacher-teacher, teacher-parent), including in the conditions of specialized training, consolidation of theoretical knowledge during training and pedagogical practices.
5. To be aware of ethical, spiritual and cultural values, of the basic laws and forms of regulation of social behavior, and of sociological approaches to the person, to know the traditions and culture of the peoples of Kazakhstan, to know the trends in the development of society, to be able to adequately navigate in various social situations, think creatively, be tolerant to traditions, the culture of other nations of the world, have an active attitude to life.
6. Possessing the basics of economic knowledge, in particular management in education, and be competent and have ideas in the field of economics.

3. Requirements for the assessment of educational program learning outcomes

The following examination forms are used as an assessment of learning outcomes: computer testing, written exam (answers on the sheets), oral exam, project (submitting a course project), practical (open questions on a computer, solving problems on a computer) comprehensive (test / written / oral + others). The following exams are recommended in accordance with table 1::

Table 1

№	Exams format	Recommended share, %
1	Computer testing	20%
2	Written exam	10%
3	Oral exam	5%
4	Project	30%
5	Practical	30%
6	Comprehensive	5%

In accordance with the provision of the grade-rating system for assessing student performance, control is performed during the ongoing monitoring of progress, interim and final certification.

Ongoing performance is monitored in all organizational study modes (types of academic studies): lecture, seminar, practical session, laboratory session, independent work, examination, consultation, educational and production practice. Types of current control: Operational and midterm.

Operational control of knowledge is carried out in order to objectively assess the quality of mastering the current program material under an academic course, the level of formation of general and professional competencies, as well as to stimulate students for learning activities, monitor the results of educational activities, prepare for midterm attestation. Forms of operational control include control work, testing, questioning, the preparation and defense of practical and laboratory project, the implementation of individual sections of the course project (course work), the performance of abstracts (reports), control over the implementation of extracurricular independent work, control over the implementation of written tasks, individual tasks; preparation of presentations, etc.

Midterm control is aimed at the comprehensive assessment of the level of mastering the program material according to the academic calendar of the University.

Current control forms, content and grades are determined by the teacher and specified in the academic course syllabus for the student.

Current control grade consists of grades from the current control of the curricular and extracurricular studies and grades from midterm control. Current control is rated on a 100% scale.

Verification of educational achievements is carried out by various types and forms of control.

Academic achievements of students for all types of control are evaluated according to a score-rating letter system to assess educational achievements of students.

According to the results of midterm attestation, the Registrar's office (RO) compiles an academic rating of students.

The order of the midterm control of students' achievement.

Midterm attestation of students at the University is carried out in accordance with the academic calendar, working curriculum and curriculum programs developed based on the State Compulsory Educational Standard and curriculum programs.

The period of midterm attestation of students is called the examination session. Midterm attestation of students is carried out in the form of exams, defense of coursework (projects) and reports on professional practice with the obligatory grading.

The form of the examination for each academic course is determined in the working program of the academic course and approved by the Scientific and Methodological Council of the University. According to the results of midterm attestation, the Registrar's office compiles an academic rating of students.

Based on examination results for the academic course, the final grade for the academic course is generated in percentage and is determined by the following formula:

$$G_{FINAL} \% = \frac{R_1 + R_2}{2} \times 0,6 + F \times 0,4,$$

Where: R_1 - first rating grade, percentage

R_2 - second rating grade, percentage

F - examination grade, percentage.

The final grade is percentage $G_{FINAL} \%$ is converted into the final grade G_{FINAL} in numerical and letter equivalents according to Table 1.

Table 1.

Letter Grade	Numerical grade	Percentage grade	Traditional grade
A	4,0	95-100	Excellent
A-	3,67	90-94	

B+	3,33	85-89	Good
B	3,0	80-84	Good
B-	2,67	75-79	
C+	2,33	70-74	
C	2,0	65-69	Satisfactory
C-	1,67	60-64	
D+	1,33	55-59	
D	1,0	50-54	
FX	0	25-49	Unsatisfactory with a retake
F	0	0-24	Unsatisfactory

A positive grade for the midterm attestation serves as the basis for offsetting credits in the prescribed amount for the relevant academic course and is recorded in the student's transcript.

If the student receives an "unsatisfactory F" grade for the final control (examination), the final grade for the academic course is not counted and its credits are not included.

In order to retake the examination from an "unsatisfactory F" grade to a positive one or increase the average grade (GPA), the student in the next academic period should re-attend all types of academic studies provided by the working curriculum for the academic course, and receive admission and pass the final control. In this case, the student should again go through the procedure of registration for the academic course.

The "FX" grade means that the student has the right to retake the academic course without retraining the theoretical course.

The "FX" grade is set for students who have less than 20% admission or who have received admission to the final control, but who have received an "unsatisfactory" grade.

In order to improve GPA, the student should choose the academic courses for re-study or retake the academic course on a fee basis. Retake of academic course in the same academic period is not allowed.

Students take exams in strict accordance with the approved working and individual curriculum, working curricula of academic courses. The student who disagrees with the result of the exam, must make an appeal no later than the next working day after the final control.

For the period of the examination session (midterm attestation), according to the order of the head of the higher education institution, an appeal commission is created from among the teachers whose qualifications correspond to the profile of the appealed academic courses.

The decision of the appeals commission shall be drawn up by the protocol whereby the examination sheet is compiled.

Based on the results of examination sessions (results of the winter, spring and summer sessions) of the academic period, the Registrar's office calculates a convertible score as a weighted average of the student's achievements.

Final certification ends with the defense of the graduation project.

4. Passport of the educational program

4.1 General Information

№	Field name	Note
1	Education area code and classification:	6B01 – Pedagogical sciences
2	Code and classification of training areas:	6B015 - Teacher training in science subjects
3	Group of educational programs:	03 – Physics teacher training
4	Name of the educational program	6B01503 Computer Physics
5	Brief description of the educational program	<p>The sphere of professional activity of graduates is the education and development of students in general educational organizations, educational institutions and centers; the field of science, organizations, institutions and enterprises related to research in the field of physics and technology, in particular radio-electronic and telecommunication technologies and computer modeling.</p> <p>The subject of the professional activity of graduates is: the educational process in the unity of its value-target guidelines, content, methods, forms and results; research, innovation, information and analytical activity in the field of physics, mathematics, pedagogy, psychology and teaching methods; the technological process of designing, implementing and maintaining software, mathematical and information support; software for computer visualization of tasks of science and technology, animation of natural processes, abstract concepts in scientific research and pedagogical activity; modern mathematical methods, methods of theoretical and experimental physics, mathematics for solving problems of science, education, technology, economics and management.</p> <p>The objects of professional activity of graduates are: state and non-state funded educational institutions, educational institutions, schools, lyceums, gymnasiums, colleges, technical and vocational education institutions; organizations of science: scientific, research centers in the field of physics, mathematics, pedagogy, psychology and teaching methods; management organizations: government bodies, education departments; organizations of various forms of ownership using the methods of physics and mathematics, radio-electronic and telecommunication techniques, and computer technologies in their work.</p>

6	The purpose of the EP	The aim of the educational program is to prepare in high demand, competitive and highly qualified teachers who are fluent in English, with all kinds of competencies necessary for the labor market in education, skilled in modern teaching methods, ICT technologies, and who are able to assess and analyze the current state of the industry
7	ISCE level	6
8	NFQ level	6
9	IQF level	6
10	<p>List of competencies of the educational program:</p> <p>CC1. To possess basic knowledge in the field of social, humanitarian, economic disciplines that contribute to the formation of a highly educated personality with a broad outlook and culture of thinking.</p> <p>CC2. To know the social and ethical values based on public opinion, traditions, customs, social norms and focus on them in their professional activities, know the basics of the legal system and legislation of Kazakhstan; comply with business ethics, possess ethical and legal standards of conduct.</p> <p>CC3. To be able to work in a team, correctly defend one's point of view, propose new solutions; be able to find compromises, relate your opinion with the opinion of the team; strive for professional and personal growth.</p> <p>CC4. To possess the basics of economic knowledge, have a scientific understanding of management in education, etc.; know and understand the goals and methods of state regulation of education, the role of the public sector in education.</p> <p>CC5. To be capable of professional written and oral communication in the Kazakh and Russian languages; know a foreign language at the level necessary to perform professional tasks.</p> <p>BC1. To be able to master the methods of solving problems in various branches of physics; to solve problems; build mathematical models of physical processes, perform discretization of differential equations of physics, plotting physical processes and visualizing the results obtained.</p> <p>BC2. To be capable of generalization, analysis, perception of information, setting a goal and choosing ways to achieve it; can formulate arguments and solve problems in the field of education and teaching physics; able to collect and interpret information for the formation of judgments, taking into account social, ethical and scientific- pedagogical considerations.</p> <p>BC3. To possess the methods of conducting and demonstrating a school experiment, to be able to substantiate the decisions made and implemented in the field of a physical experiment; be able to analyze and apply the results in practice.</p> <p>BC4. To be able to master the features and innovations in teaching physics and astronomy at school; apply this knowledge to explain the conditions for the occurrence of various phenomena in nature, the professional sphere and for making practical decisions in everyday life; show the formation of their own position in relation to information obtained from different sources.</p> <p>PC1. To be able to participate in the team of performers when performing laboratory, practical, lecture and other types of physics lessons at school; to be able to reflect, objectively assess their achievements; improve their physical qualities and mental abilities, competently use linguistic and cultural linguistic knowledge to solve communication problems in a multilingual and multicultural society of the Republic of Kazakhstan and in the international arena.</p> <p>PC2. Possess the ability to produce and evaluate experiment measuring the measurement results; conduct experimental studies of various phenomena, processes, properties of substances and determine the parameters of states.</p> <p>PC3. To be able to use the evaluation data of measurement results in the educational process</p>	

	<p>and in practice; analyze the measurement results, detect the relationship between the quantities, use the results and draw conclusions.</p> <p>PC4. To be able to use advanced technology in conducting classes in school physics and astronomy.</p>	
11	<p>Learning outcomes of the educational program:</p> <p>LO1. Be able to communicate in oral and written forms including in foreign language, formulate and prove justifiably personal point of view, worldview and citizen position in interpersonal interaction and intercultural medium.</p> <p>LO2. Demonstrate and apply basic mathematic, natural science, humanitarian, social economic and law knowledge in interdisciplinary context for solution of professional problems in field of physics.</p> <p>LO3. Demonstrate ability to self-organization, self- education and professional perfection, critical understanding of experience obtained.</p> <p>LO4. Use in professional activity various types of information-communication technologies: internet- resources, cloud and mobile services on search, storage, treatment, protection and distribution of information; use methods of analytical and numerical calculation of problems, computer methods of collection, storage and treatment of information.</p> <p>LO5. Demonstrate ability to gaining of new, widening and deepening of earlier obtained knowledge, abilities and competences in various fields of human activity including at the interface of various directions of activity and fields of science.</p> <p>LO6. Demonstrate skills of participation in creation of mathematical and physical models. Use methodologies of mathematical treatment of results of theoretical and experimental research.</p> <p>LO7. Carry out engineer calculations on typical methodologies and projecting certain physical problems in accordance with technical task.</p> <p>LO8. Be able to forecast, plan and control education- training process in conditions of renewed content of secondary education with account of physiological and functional peculiarities of processes of development, individual education needs of trainees and students.</p> <p>LO9. Be able to use in professional activity the basic knowledge of fundamental parts of mathematics, create mathematical models of typical professional problems and interpret results obtained with account of boundaries of models applicability.</p> <p>LO10. Be able to use basic theoretical knowledge of fundamental parts of general and theoretical physics, astronomy for solution of professional problems.</p> <p>LO11. Be able to project, organize and analyze pedagogical activity providing succession of information presentation and interdisciplinary relations of physics to other disciplines, use in their own work the progressive ideas of the past and the modern time, projecting and approve own innovations, analyze and evaluate results of implementations of innovations into education-training process, self-regulation and reflection, critical and creative thinking, consciousness, formulation and solution of pedagogical problems.</p> <p>LO12. Be able to organize and set up physical experiment (laboratory, demonstration, and computer) and be able to organize cognitive activity of students in process of physical experiment.</p> <p>LO13. Be able to organize and guide education- investigation activity of students, planning and organization theirs self-education, study self-consistently, realize own individual style of study, thinking and learning, develop needs and ability to self-education and self-development; critically analyze teachers experience, pedagogical literature and normative documentation.</p>	
12	Mode of study	Full-time
13	Medium of instruction	English
14	Credits	240 ECTS

15	Awarded academic degree	Bachelor of Education in the program of 6B01503 - «Computer Physics»
16	Developer (s) and the authors:	«International University of Information Technology» JSC, the department of « Radio engineering, electronics and telecommunications »: - Daineko Y.A., PhD, Assistant Professor. - Aitmagambetov A.Z., C.T.Sc , Professor. - Duzbayev N.T., PhD, Associate professor . - Kabatayeva R.S., PhD, Assistant Professor . - Shapiyeva A.Y., senior-lecturer, MSc . - Manatuly A., lecturer, MSc.

4.2 Correlation matrix of the learning outcomes of educational programs with evolving competencies

	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10	LO11	LO12	LO13
CC1	v												
CC2	v												
CC3			v										
CC4					v								
CC5	v												
BC1						v	v			v			
BC2		v		v	v								
BC3											v	v	
BC4								v	v				v
PC1								v			v		v
PC2										v		v	
PC3							v			v			
PC4				v							v		

4.3. Information about the disciplines

№	Name of the discipline	Brief description of the discipline (30-50 words)	Number of credits	Acquired competencies (codes)	Prerequisites	Post requisites
The cycle of general education disciplines Compulsory component						
1	Modern history of Kazakhstan	Studied the laws of the historical process, the place of man in the historical process	5	CC2	No	No
2	Philosophy	The principles of understanding philosophy as a methodology of human activity, readiness for self-knowledge, Amateur activity, development of cultural wealth as a factor of harmonization of personal and	5	CC1, CC2	No	No

		interpersonal relations are studied.				
3	Foreign language	The skills of written and oral communication in the language of international communication are taught.	10	CC3, CC4	No	Professionally-oriented foreign language
4	Kazakh (Russian) language	Skills of written and oral communication in the state language are imparted.	10	CC4	No	No
5	Information and communication technology (in English)	Ability to use modern information and communication technologies in substantive activities.	5	CC5	No	Introduction to the programming
6	Political science	Skills for identification of natural-scientific essences and the problems arising in the course of professional activity are imparted.	2	CC2	No	No
7	Sociology	Ability to systematize knowledge of the world and Kazakhstan legislation in the field of information security.	2	CC3	No	No
8	Psychology	The study of society, its development and patterns of social phenomena.	2	CC2	No	Educational Psychology
9	Culturology	Study of cultural heritage, interethnic relations, Knowledge of material, social and spiritual activities of people and spiritual values.	2	CC2	No	No
10	Physical Culture	The ability to understand the practical use of healthy lifestyles, including prevention.	8	CC1	No	No
Cycle of General Education Disciplines University component/Elective component						
1	Physics Teaching Methodology	Actual problems of the theory and methodology of teaching physics. The main objectives of learning physics. The relationship of teaching methods and methods of scientific knowledge. Classification of teaching physics. Methods of teaching physics with regard to teaching aids (demonstration, laboratory, problem solving). Forms of the organization of the educational process in physics.	5	BC1, BC2, BC3, BC4	Pedagogy	Innovative methods of physics teaching
Cycle of basic disciplines University component						
1	Mechanics	Physics and measurement. Vectors. One-dimensional and two-dimensional motion kinematics. Dynamics of a point particle and a rigid body. Newton's laws. Circular motion and other applications of Newton's laws. Work and energy. The laws of conservation. Linear momentum and collisions. Center of the mass. The motion	6	BC1, BC3	No	Molecular physics

		of a system of particles. Non-inertial reference frames. Rigid body mechanics. The moment of inertia and the application of the laws of the dynamics of a rigid body. Universal gravitation. Statics of liquids and gases. Hydrodynamics. Oscillations. Waves. Theory of relativity.				
2	Professionally-oriented foreign language	Includes a grammar course, vocabulary of professional nature and texts of professional orientation.	4	BC1, BC4	Foreign language	No
3	Mathematical Analysis - 1	Functions. The superposition of two functions. Inverse functions. Numeric sequences. The limit of the sequence. Cauchy criterion. The basic properties of converging sequences. Subsequences. Lemma Bolzano-Weierstrass. Limit function. Properties of the limit function. Infinitely small and infinitely large functions. Comparison of infinitely small quantities. Remarkable limitations. Continuous functions. Continuity of elementary functions. The basic properties of continuous functions. The first and second Weierstrass theorems. Bolzano-Cauchy theorem. The derivative of the function. The physical and geometric meaning of the derivative. Tangent line. Table of derivatives and differentiation rules. Differentiation of the composite function. Differentiation of the inverse function. Differential function. Theorems on differentiable functions (Rolle, Lagrange, Cauchy). Hospital rule. Derivatives and differentials of higher orders. Taylor Formula. Maclaurin's formula for some functions. Intervals of monotony. Extreme points. Concave and convex functions. Points of inflection Asymptotes. The general scheme of the analysis of the function and the construction of its schedule. Primitive. Indefinite integral and its properties. Table of main integrals. Integration by replacement. Integration in parts. Integration of rational	4	BC2	No	Mathematical analysis - 2

		functions. Integration of irrational and trigonometric functions.				
4	Mathematical Analysis - 2	<p>Definite integral. Newton-Leibniz formula. Basic properties. Theorems about the mean for a definite integral. Riemann integral. Definition Upper and lower Riemann sums and their properties. Necessary and sufficient conditions for the existence of the Riemann integral. The main properties of the Riemann integral. Class of Riemann integrable functions. Mean value theorems. The main theorem of calculus. Improper integrals of the first and second kind. Applications of a definite integral. Arc length, area in Cartesian and polar coordinates. Volume The solid body of the revolution. Surface area. Numerical integration. Rectangular approximation. Trapezoidal approximation. Simpson approximation. Infinite number series, basic concepts. Necessary condition for convergence. Harmonic series. Geometric series. A series with non-negative conditions. Convergence tests for series with non-negative conditions. Alternation series. Leibniz theorem. Absolute and conditional convergence. Sequences and series of functions. Point and uniform convergence. Major series. Weierstrass theorem. Power series. Abel's theorem. The main properties of power series. Power series of Taylor and Maclaurin. Applications of power series. Fourier series.</p>	4	BC2	Mathematical analysis - 1	Differential equations
5	Theory of probabilities	<p>Types of events, direct calculation of the probability of occurrence of events. Probability addition and multiplication theorems. More difficult tasks of adding and multiplying probabilities. The formula for total probability. Bayes formula. Independent trials and Bernoulli formula. Discrete random variable and its distribution function. Continuous random variable and its distribution function. Mathematical expectation and variance of a random variable.</p>	3	BC2	No	No

6	Introduction to programming	To study the methodological basis of program development and practical programming skills.	4	BC1, BC3	Information and communication technology (in English)	Basics of scientific computation
7	Molecular physics	Molecular kinetic theory. The internal energy of the system and the first law of thermodynamics. The equation of state of an ideal gas. Internal energy and heat capacity of an ideal gas. Adiabatic process. Polytropic processes. Maxwell distribution. Boltzmann distribution. Transfer phenomena. Real gases. Basics of thermodynamics. Thermal machines. Entropy. Crystalline state. Liquid state Phase equilibria and transformations.	6	BC1, BC3	Mechanics	Electricity and Magnetism
8	Electricity and Magnetism	Electric Fields. Properties of Electric Charges. Charging Objects by Induction. Coulomb's Law. The Electric Field. Electric Field Lines. Motion of Charged Particles in a Uniform Electric Field. Gauss's Law. Electric Flux. Gauss's Law. Distributions. Conductors in Electrostatic Equilibrium. Formal Derivation of Gauss's Law. Electric Potential. Potential Difference and Electric Potential. Potential Differences in a Uniform Electric Field. Electric Potential and Potential Energy Due to Point Charges. Obtaining the Value of the Electric Field from the Electric Potential. Electric Potential Due to a Charged Conductor. The Millikan Oil-Drop Experiment. Applications of Electrostatics. Capacitance and Dielectrics. Definition of Capacitance. Calculating Capacitance. Combinations of Capacitors. Energy Stored in a Charged Capacitor. Capacitors with Dielectrics. Electric Dipole in an Electric Field. Current and Resistance. Electric Current. Resistance. A Model for Electrical Conduction. Resistance and Temperature. Superconductors. Electrical Power. Direct Current Circuits. Electromotive Force. Resistors in Series and Parallel. Kirchhoff's Rules. RC Circuits. Magnetic Fields. Magnetic Field and Forces. Magnetic	6	BC1, BC3	Molecular physics	Optics

		Force Acting on a Current-Carrying Conductor. Sources of Magnetic Field. The Biot-Savart Law. Ampere's Law. The Magnetic Field of a Solenoid. Gauss's Law in Magnetism. The Magnetic Field of the Earth. Faraday's Law. Faraday's Law of Induction. Motional emf. Lenz's Law. Induced emf and Electric Fields. Maxwell's Equations. Inductance. Self-Inductance. Mutual Inductance. The RLC Circuit. Alternating Current Circuits. AC Sources. Resistors, Inductors and capacitors in an AC Circuit. Electromagnetic Waves. Maxwell's Equations and Hertz's Discoveries. Plane Electromagnetic Waves. Energy Carried by Electromagnetic Waves. Momentum and Radiation Pressure.				
9	Optics	The Nature of Light. Measurements of the Speed of Light. The Ray Approximation in Geometric Optics. Reflection. Refraction. Huygens's Principle. Dispersion and Prisms. Total Internal Reflection. Image Formation. Images Formed by Flat Mirrors. Images Formed by Spherical Mirrors. Images Formed by Refraction. Thin Lenses. Lens Aberrations. The Camera. The Eye. Interference of Light Waves. Conditions for Interference. Young's Double-Slit Experiment. Intensity Distribution of the Double-Slit Interference Pattern. Phasor Addition of Waves. Change of Phase Due to Reflection. Interference in Thin Films. The Michelson Interferometer. Diffraction Patterns and Polarization. Introduction to Diffraction Patterns. Diffraction Patterns from Narrow Slits. Resolution of Single-Slit and Circular Apertures. The Diffraction Grating. Diffraction of X-rays by Crystals. Polarization of Light Waves. Thermal radiation. Emissivity and absorptivity of the matter and their ratios. Blackbody radiation. Stefan-Boltzmann	6	BC1, BC3	Electricity and Magnetism	Atomic and Nuclear physics

		law. Derivation of the Planck Distribution Law. Wien's displacement law. The Rayleigh Jeans law.				
1 0	Differential equations	Introduction to differential equations. Classification of differential equations. Differential equation solution. Initial conditions. Guide fields. First order differential equations. Separable Equations. Homogeneous differential equation. Differential Equations Reducible to Homogeneous Form. First order linear equations. Bernoulli equation. Exact differential equations. Integrating factor. Singular solutions of a first order differential equation. Clairaut's equation. Lagrange's equation. Simulation using first-order differential equations. Higher order differential equations, general notation. Some types of second order differential equations, reducible to equations of the first order. Medium term. Homogeneous differential equations. Definitions and general properties. Linearly independent solutions. Vronsky. Structure of the overall solution. Homogeneous nth order linear equations with constant coefficients. Inhomogeneous second-order linear differential equations with constant coefficients. The properties of its solution. Inhomogeneous higher order linear differential equations. Systems of ordinary differential equations. Systems of linear differential equations with constant coefficients.	4	BC2	Mathematical analysis – 2	The theory of complex variable function
1 1	Atomic and Nuclear physics	Introduction to Quantum Physics. Blackbody Radiation and Planck's Hypothesis. The Photoelectric Effect. The Compton Effect. The Nature of Electromagnetic Waves. The Wave Properties of Particles. A New Model: The Quantum Particle. Atomic Physics. Atomic Spectra of Gases. Early Models of the Atom. Bohr's Model of the Hydrogen Atom. The Quantum Model of the Hydrogen Atom. The	6	BC1,BC3	Optics	Astrophysics

		Wave Functions for Hydrogen. Atomic Physics. Physical Interpretation of the Quantum Numbers. The Exclusion Principle and the Periodic Table. More on Atomic Spectra: Visible and X-Ray. Lasers. Molecules and Solids. Molecular Bonds. Energy States and Spectra of Molecules. Bonding in Solids. Free-Electron Theory of Metals. Band Theory of Solids. Electrical Conduction in Metals, Insulators, and Semiconductors. Superconductivity. Nuclear Structure. Some Properties of Nuclei. Nuclear Binding Energy. Nuclear Models. Radioactivity. The Decay Processes. Natural Radioactivity. Nuclear Reactions. Applications of Nuclear Physics. Interactions Involving Neutrons. Nuclear Fission. Nuclear Reactors. Nuclear Fusion. Radiation Damage. Radiation Detectors. Uses of Radiation. Particle Physics and Cosmology. The Fundamental Forces in Nature. Positrons and Other Antiparticles. Mesons and the Beginning of Particle Physics. Classification of Particles. Conservation Laws. Strange Particles and Strangeness. Finding Patterns in the Particles. Quarks. Multicolored Quarks. The Standard Model. The Cosmic Connection. Problems and Perspectives.				
1 2	Linear Algebra and Analytic Geometry	Matrices. Determinants. Non-degenerate matrices. Systems of linear equations. Vectors. The scalar product of vectors and its properties. Vector product of vectors and its properties. Mixed product of vectors. The coordinate system on the plane. Lines on the plane. Second-order lines on the plane. Equations of a surface and a line in space.	4	BC2	No	No
	Educational Internship	Educational practice for the purpose of familiarization with the educational process at school and the basics of teaching physics in school. Educational work with students	3	BC4, PC1	No	Pedagogical internship

		of the school and methods of conducting classes in physics				
Cycle of basic disciplines						
Elective disciplines						
1	Elective discipline - 1					
	Basic Circuit Theory	Calculations of electric circuits of direct and alternating current; determination of the types of resonances in electrical circuits. Acquaintance with physical processes in electric circuits of direct and alternating current; physical laws of electromagnetic induction; the main elements of electric circuits of direct and alternating current, linear and nonlinear electric circuits and their main elements; basic laws and methods for calculating electrical circuits; the phenomenon of resonance in electrical circuits.	4	BC4	Electricity and Magnetism	Fundamentals of Semiconductor Devices
	Oscillations and Waves	This course will provide the concepts and mathematical tools necessary to understand and explain a wide range of vibrations and waves. The course includes many topics from these phenomena, as well as related topics, including mechanical vibrations and waves, sound waves, electromagnetic waves, optics, and gravitational waves.	4	BC1, BC4	Electricity and Magnetism	Fundamentals of Semiconductor Devices
2						
	Basics of scientific computation	Ability to create conceptual models of various phenomena. Implementation of models using computer simulation. Factors assessing models: the ability to explain past observations, the ability to predict future observations.	4	BC3	Introduction to programming	Computer simulation in education
	Technology of criteria-based assessment	Formation and development of a student: knowledge of the current state of methods and means of diagnosing student achievements; skills in the practical application of modern means of assessing student learning outcomes; positive motivation and interest in mastering the basics of an objective assessment of students, the desire for creative activity.	4	BC3	Pedagogy	No
3	Elective discipline - 3 (Minor)					
	Educational Management	Methodological bases of management. Goals and objectives of managing organizations. Management functions. External and	4	BC4	Mediapedagogy	No

		internal environment of the organization. Theoretical foundations of management decisions. Fundamentals of the theory of management decisions. Management of risks. Strategic management. Management psychology. Features of management in the field of professional activity. Pedagogical management.				
	Health and safety	The knowledge and skills necessary for creating safe and harmless living conditions, designing new equipment and technological processes in accordance with modern requirements for the safety of their operation, forecasting and making competent decisions in emergency situations to protect the population and production personnel from the possible consequences of accidents, disasters, natural Disasters.	4	BC4	No	No
4	Elective discipline - 4 (Minor)					
	Mathematical simulation and numerical methods	The study of algorithms using numerical approximation for the problems of mathematical analysis. Calculation of values of functions, interpolation, extrapolation and regression, optimization, numerical calculation of integrals, solving differential equations. Studying the foundations of mathematical modeling such as dynamical systems, statistical models, differential equations, and game theory.	5	BC3, BC4	Methods of mathematical physics	No
	Basics of semiconductor devices	This course teaches the basics of semiconductors and semiconductor electronics, explains the principle of operation of transistors and semiconductor devices. The course also includes models of semiconductor devices and predicts how they can be used for electronic devices.	5	BC2, BC3	Electricity and magnetism	No
5	Elective discipline - 5					
	The theory of complex variable function	Complex numbers and actions on them. Algebraic form of a complex number. Trigonometric and exponential form of a complex number. Formula of Moivre. The functions of complex variable. Basic elementary functions of a complex variable. Inverse trigonometric functions. The relationship between exponential and trigonometric	4	BC4	Differential equations	Methods of mathematical physics

		<p>functions. Differentiation of functions of a complex variable. Cauchy-Riemann conditions. Harmonic functions. Integration of complex variable functions. The integral of the single-valued branch of multivalued functions. Branching points. Cauchy's integral formula. Rows in a complex area. Power series. Convergence. Rows of Taylor and Loran. Area of convergence. Zero functions. Isolated singular points. Pole functions. Residue. The calculation of the integral using the residue. Cauchy's theorem on residues. Annex to the computation of certain residues integrals. Jordan's lemma. The logarithmic residue. Repetition.</p>				
	Research methods in education	<p>A basic understanding of educational research and the scope of educational research; the process of conducting systematic scientific research (problem statement, literature review, sampling, data collection, data analysis and reporting) in the field of education; quantitative studies of design options and characteristics of each design alternative; concepts, methods and tools with which educational research is developed, conducted, interpreted and critically evaluated</p>	4	BC4	No	No
6	Elective discipline - 6					
	Basics of vector and tensor analysis	<p>Operator nabla, gradient, divergence, rotor. Consistent use of the operator nabla. Integration of vectors. Ostrogradsky-Gauss theorem, Green's theorem, Stokes theorem. Curvilinear coordinate systems, Cartesian, spherical, cylindrical coordinates. Differential operators of second order. Coagulation, the rule of the private.</p>	3	BC2, BC3	Mathematical analysis – 2	Theoretical mechanics
	Physiology of school student development	<p>The discipline covers: modern information about the anatomical and physiological characteristics of the body of children and adolescents, its relationships with the environment; knowledge of the</p>	3	BC4	No	No

		laws underlying the preservation and strengthening of the health of schoolchildren, maintaining their high performance in various types of educational activities; familiarization of students with problems arising at the border of pedagogical and physiological sciences; familiarization of students with basic hygiene standards and requirements for the organization of the educational process at school.				
7	Elective discipline - 7					
	Pedagogy	A critical aspect of teacher education is gaining pedagogical content knowledge of how to teach science for conceptual understanding. This research and development work centers on constructing a formative assessment resource to help expose pre-service teachers to a greater number of science topics within teaching episodes using various modes of instruction. The course includes four basic pedagogies: didactic direct, active direct, guided inquiry, and open inquiry. The intention is that students and teachers will be able to share and discuss particular responses to individual items, or else record their responses to collections of items and thereby create a profile of their teaching orientations.	4	BC4	No	Physics Teaching Methodology
	Basics of algorithms and data structures	This discipline teaches the analysis of the computational complexity of algorithms to design, implement and analyze basic data structures and graphs. Writing, evaluating and adapting standard basic sorting and search algorithms. Design and coding C programs	4	BC4	Information and communication technology (in English)	No
8	Elective discipline - 8					
	Educational psychology	Contains socio-political and psychological knowledge, reflecting the laws, mechanisms and facts necessary for the knowledge of the depth of objective and subjective processes of development of society and man. The interaction between scientific disciplines - sociology, cultural studies, political science, psychology, is	3	BC4	Psychology	No

		carried out on the basis of the principles of informational complementarity, integration and methodological integrity of research approaches.				
	Mediapedagogy	Formation of a general understanding of media pedagogy as a field of scientific and practical activity among students; mastering the methods of planning and implementation of media and pedagogical activities at different levels of the education system; mastering the skills of planning media and pedagogical activities for different levels of the education system; increasing the level of media and information literacy of students.	3	BC4	Pedagogy	Educational Management
9	Elective discipline - 9					
	Thermodynamics and statistical physics	The fundamental study of physical systems with a large number of degrees of freedom. Statistical thermodynamics describes the relationship between the macroscopic properties of materials in thermodynamic equilibrium and the microscopic properties and movements that occur inside a material. Microcanonical ensemble, canonical ensemble, large canonical ensemble.	4	BC3	Molecular physics	No
	Electronic methods in physics research	This course gives the student an understanding of the fundamental principles and practical capabilities of physical research methods, familiarity with their hardware and experimental conditions, the ability to interpret and correctly evaluate experimental data, including those published in the scientific literature. The student must also learn the optimal choice of methods for solving the tasks and make conclusions based on the analysis and comparison of the totality of the available data.	4	BC3	Atomic and Nuclear physics	No
10	Elective discipline - 10					
	Innovative methods of physics teaching	Information technology as a basis for innovation in education. Educational opportunities of innovative technologies. Means of multimedia in learning. Hypertext technologies. Basics of computer	4	BC4	Physics Teaching Methodology	No

		telecommunications. Distance learning. Questions of culture and morality in the modern educational environment.				
	Condensed state physics	Acquaintance with the basic methods of research and calculation of the physical characteristics of solids, the study of the physical properties of condensed matter at the atomic- molecular level. The formation of systematic knowledge among students in the following areas: methods for studying the atomic structure of a condensed state; types of bonds and defects of the crystal lattice; mechanical properties of solids; vibrations of atoms of the crystal lattice and thermal properties of crystals; thermal, electrical, optical and magnetic properties; superconductivity; properties of amorphous solids.	4	BC3	Quantum mechanics	No
1 1	Elective discipline - 11					
	Computer simulation in education	Numerical modeling of differential equations, stochastic modeling, Monte Carlo method, dynamic system modeling. Model visualization with ComSol. Solving mathematical models of physical systems with the help of ComSol.	5	BC3, BC4	Basics of scientific computation	No
	Technique of school experiment	High school physics experiments related to properties of matter; mixtures-solutions-acids and bases; liquids; pressure; heat and temperature; motion, force, work, power and energy; mechanical waves; mirrors, properties of images formed by spherical mirrors; lenses, properties of images formed by converging and diverging lenses; optical instruments; electrostatics; electric current; electrical appliances; simple electric circuits; magnetism; induced current; transformers	5	BC1, BC2, BC4	Electronic methods in physics research	No
1 2	Elective discipline - 12					
	Astrophysics	The study of the nature of astronomical objects, such as the sun, stars, galaxies, exoplanets, interstellar media, and relict radiation, using the laws of physics. By analyzing the electromagnetic spectrum of the radiation, the luminosity,	4	BC4	Atomic and nuclear physics	No

		density, temperature and chemical properties of these objects are studied.				
	Radio engineering	Transistor (BJT) switching circuits. Introduction to logic circuits. TTL and CMOS NAND gates. Parallel adders, subtractors and complementers. Multiplexers, code converters. Comparators with hysteresis. Multivibrator circuits using CMOS gates. Op-amps and 555 timers. Flip flops and counters. Introduction to hardware description language (verilog-HDL)		BC4	Basics of semiconductor devices	No
1 3	Elective discipline - 13					
	Multiple Integral Calculus	Double integral. Calculation of the double integral in Cartesian and polar coordinates. Triple integral. Calculation of the triple integral in Cartesian, spherical and cylindrical coordinates. Curvilinear integral of the first kind. Curvilinear integral of the second kind. Surface integral of the first kind. Surface integral of the second kind.	4	BC4	Mathematical analysis - 2	The theory of complex variable function
	Inclusive education	The philosophy, history and methodology of an inclusive approach. Documents governing the development of an inclusive process in higher professional education. Educational needs of students with disabilities and disabilities. Methods and forms of organization of the educational process at a university for students with disabilities. Development of adapted educational programs, curricula and educational paths for students with disabilities and disabilities. Psychological and pedagogical support of students with disabilities and disabilities at the university.	4	BC4	No	No
Cycle of Professional Disciplines University component						
1	Methods of mathematical physics	The equations of physics. Second order differential equations in partial derivatives. Classification, types, reduction to canonical form, finding common solutions. Fourier method. D'Alembert method. Wave equation, heat equation. Cauchy problem, initial and boundary conditions.	5	PC1, PC2	Theoretical mechanics	Thermodynamics and statistical physics

2	Theory of Electromagnetic Field	To present electrodynamics as a physical theory based on laws established by experience, further developed as a theoretical course in the form of field theory, its basic methods and provisions, to show that electrodynamics is the basis in theoretical and experimental physics and serves as an introduction to quantum theory of matter and radiation. The basic laws, methods and formalisms of modern classical field theory, apply and interpret them;	5	PC1, PC2	Electricity and magnetism	Theory of Electromagnetic Waves Transmission
3	Theoretical mechanics	The fundamental postulates of theoretical mechanics on space and time, which contain the clearest formulation of the basic physical assumptions of theoretical mechanics. The law of conservation of momentum, kinetic moment and energy and their connection with the properties of space-time and with the symmetry of the force fields. The role of covariant forms of the equations of motion. Lagrange, Hamilton, and Hamilton-Jacobi methods. Basic equations of motion of a rigid body.	3	PC1, PC2	Mechanics	Methods of mathematical physics
4	Pedagogical Internship	A passive practice, familiarization with the pedagogical process at school, attending classes in physics and all subjects of the assigned class. Active practice, conducting a lesson in physics and extracurricular educational activities with an assigned class.	8	PC1, PC2, PC3	Educational Internship	Pre-diploma Internship
5	Pre-diploma Internship	Preparation of the graduation project for the defense, the formulation of the project goal, the tasks set to achieve the goal. Performing basic calculations and obtaining results, the formulation of the conclusion and prospects of the project.	3	PC1-PC4	Pedagogical Internship	No
6	Quantum Mechanics	Introduction to the mathematics of quantum mechanics. Operators in quantum mechanics. Eigenfunctions and eigenvalues. Wave function. Schrödinger equation. One-dimensional harmonic oscillator. Potential well of infinite height. Potential well of finite height. Potential barrier and tunneling. The system of identical particles. The theory	6	PC1, PC2	Optics	Condensed state physics

		of the helium atom. Approximate methods of quantum mechanics.				
Cycle of Professional Disciplines						
Elective component						
1	Elective discipline - 14					
	Fundamentals of electronic engineering	We study the basics of electronic technology on the basis of lectures, laboratory and self-study. The problems of physical processes in semiconductor and optoelectronic devices are considered. Parameters, characteristics and schemes of electronic devices and chips used in radio engineering, and also subtleties of functional electronics are studied.	5	PC2, PC3	Basics of radio circuits and signals	Digital signal processing
	Python for data analysis	Be able to apply data structures, functions, modules, classes when programming in Python and R.	5	PC2, PC3	Algorithmitization and programming	Software Design and Architecture (SDP5)
2	Elective discipline - 15					
	Theory of Electrical Communication	The discipline provides for the study of: processes of formation, transformation, and transmission of signals through communication channels, mathematical models and probabilistic characteristics of random messages, signals and noise, spectral characteristics of signals, the foundations of the theory and modern methods of modulation and detection of signals, methods of noise-resistant message reception and noise-resistant coding, optimal signal reception, methods of channel separation. This makes it possible to analyze the processes in communication systems and solve problems to improve the efficiency of communication systems.	5	PC1, PC3	Theory of Electromagnetic Waves Transmission	No
	Database design. Introduction to SQL	Use modern database management systems to create databases. Design logical database schemes using relational, object-oriented, object-relational, key-value schemes for simple and complex systems.	5	PC2, PC3	Web-technologies	No
3	Elective discipline - 16					
	Theory of Electromagnetic Waves Transmission	Students learn the basics of the theory of electromagnetic processes occurring in different environments, in the transmission lines of electromagnetic energy and linear devices of microwave and optical range.	5	PC1, PC3	Theory of Electromagnetic Field	Theory of Electrical Communication

	Web-technologies	Be able to use the PHP programming language, master the basics of MySQL database and develop server client web applications.	5	PC2, PC3	Algorithization and programming	Database design. Introduction to SQL
4	Elective discipline - 17					
	Basics of radio circuits and signals	Study of methods and bases of construction of radio engineering circuits and devices, the description of signals and hindrances in radio engineering systems of information transmission, to learn physical essence of processes occurring in radio engineering circuits and devices of processing of reception and transmission of radio signals	5	PC2, PC3	Electricity and magnetism	Theory of Electromagnetic Waves Transmission
	Algorithization and programming	Know different types and types of algorithms. Apply the knowledge gained in the process of creating flowcharts of various algorithms.	5	PC1, PC3	Introduction to programming	Web-технологии
5	Elective discipline - 18					
	Robotics	Evolution of robots; elements of robotic systems; mathematics of manipulators; homogeneous transformations; endefector position orientation; kinematics; inverse kinematics; manipulator dynamics; robot control : linear control such as inverse dynamics control, impedance control force feedback and recent nonlinear control methods including sliding mode control.	5	PC1, PC2	Fundamentals of electronic engineering	No
	Computer networks (Cisco 1)	Principles of network technologies, access to local and remote network resources.	5	PC2, PC3	Python for data analysis	No
6	Elective discipline - 19 (Minor)					
	Digital signal processing	Theoretical and practical development of methods and means of digital signal processing, digital filtering, the use of modern software in signal processing.	5	PC2, PC3	Basics of radio circuits and signals	No
	Software design and architecture (SDP5)	Know basic computer components including CPU, ALU and control unit, memory, input-output and memory, and a wide range of memory technologies both internal and external. Analyzes and uses modern approaches and tools in front-end and back-end developments.	5	PC1, PC3	Algorithization and programming	No

4.4. List of modules and learning outcomes

Name of the educational program: 6B01503 - Computer Physics

Qualification: 6B015 - Teacher training in science subjects

Module Code / Module Name	Learning outcomes	Criteria for assessing learning outcomes	Module-forming disciplines Code / Name	Module Code / Module Name
GENERAL EDUCATION MODULES				
GEM1 – Humanitarian and socio-political module	5	LO1	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	Modern History of Kazakhstan
	5	LO1	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	Phyl3102 Philosophy
	2	LO1	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	Pol2106 Political science
	2	LO1	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	Psyh2108 Psychology

	2	LO1	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	Cult3109 Culturology
	8	LO1	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	FK1110 Physical culture
	5	LO6, LO7, LO10, LO2, LO4, LO5, LO11, LO12, LO8, LO9, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	MPF 3111 Physics teaching methodology
	2	LO3	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	Soci4107 Sociology
GEM2-Languages module	10	LO3, LO5	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	IYa1103 Foreign language
	10	LO5	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	KRYa1104 Kazakh (Russian) language

GEM3- Infocommunication Technologies	5	LO1	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	IKTA1105 Information and communication technology (in English)
BASIC MODULES				
BM1 -	6	LO6, LO7, LO10, LO11, LO12	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	Meh 1201 Mechanics
BM1- Languages module	4	LO6, LO7, LO8, LO9, LO10, LO11, LO12, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	POIY 2202 Professionally-oriented foreign language
	4	LO2, LO4, LO5	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	Math 1203 Mathematical Analysis - 1
	4	LO2, LO4, LO5	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	Math 1204 Mathematical Analysis - 2
	3	LO2, LO4, LO5	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	TV 1205 Theory of probabilities

	4	LO6, LO7, LO10, LO11, LO12	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	VP 2206 Introduction to programming
	6	LO6, LO7, LO10, LO11, LO12	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	MF 1207 Molecular physics
	6	LO6, LO7, LO10, LO11, LO12	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	ELM 2208 Electricity and Magnetism
	6	LO6, LO7, LO10, LO11, LO12	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	OP 2209 Optics
	4	LO2, LO4, LO5	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	DU 2210 Differential equations
	6	LO6, LO7, LO10, LO11, LO12	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	AYF 3211 Atomic and Nuclear physics

	4	LO2, LO4, LO5	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	LAAG 1212 Linear Algebra and Analytic Geometry
	3	LO8, LO9, LO11, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	UOP 2303 Educational Internship
Elective component (EC)	4	LO8, LO9, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	TEC 2213 Basic Circuit Theory
	4	LO6, LO7, LO8, LO9, LO10, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	KV 2214 Oscillations and Waves
	4	LO11, LO12	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	OM 2215 Basics of scientific computation
	4	LO11, LO12	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	TKO 2216 Technology of criteria-based assessment

	4	LO8, LO9, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	MP 4217 Educational management
	4	LO8, LO9, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	OBZ 2236 Health and safety
	5	LO8, LO9, LO11, LO12, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	MMChM 4219 Mathematical simulation and numerical methods
	5	LO2, LO4, LO5, LO11, LO12	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	OPPU 4220 Basics of semiconductor devices
	4	LO8, LO9, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	TFK 2221 Theory of complex variable function
	4	LO8, LO9, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	MIO 2222 Research methods in education

	3	LO2, LO4, LO5, LO11, LO12	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	OVT 2223 Basics of vector and tensor analysis
	3	LO8, LO9, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	FRS 2224 Physiology of school student development
	4	LO8, LO9, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	Pd 2225 Pedagogy
	4	LO8, LO9, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	OASD 2226 Basics of algorithms and data structure
	3	LO8, LO9, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	OPsy 3227 Educational psychology
	3	LO8, LO9, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	MP 3228 Mediapedagogy

	4	LO11, LO12	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	TSF 4229 Thermodynamics and statistical physics
	4	LO11, LO12	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	EMFI 4230 Electronic methods in physics research
	4	LO8, LO9, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	IMOF 4231 Innovative methods of physics teaching
	4	LO11, LO12	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	FKS 4232 Condensed state physics
	5	LO8, LO9, LO11, LO12, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	KM 4233 Computer simulation in education
	5	LO2, LO4, LO5, LO6, LO7, LO8, LO9, LO10, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	TSE 4234 Technique of school experiment

	4	LO8, LO9, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	APH 3237 Astrophysics
	4	LO8, LO9, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	RE 3238 Radio engineering
	4	LO8, LO9, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	Math 2239 Multiple Integral Calculus
	4	LO8, LO9, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	IO 2240 Inclusive education
PROFESSIONAL MODULES				
	5	LO8, LO10, LO1, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	MMF 3301 Methods of mathematical physics
		LO8, LO10, LO1, LO13	1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam	TEP 3302 Theory of Electromagnetic Field

		LO8, LO10, LO1, LO13	<ol style="list-style-type: none"> 1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam 	<p style="text-align: center;">TMH 2235 Theoretical mechanics</p>
		LO8, LO10, LO1, LO13	<ol style="list-style-type: none"> 1. Oral exam 2. Test 3. Midterm exam 4. Computational and graphic work 5. Exam 	<p style="text-align: center;">NRKM 3315 Quantum mechanics</p>

5. Curriculum of the educational program

№	Module code	Discipline code	Name of the discipline (ru)	Name of the discipline (kz)	Name of the discipline (eng)	Total credits	Semester	Type of assessment	Total number of academic hours	Number of classroom hours				Number of hours SIS		Prerequisites (Discipline code)
										In classroom	Including			Total hours SIS	Including TSIS	
											Lectures	labs	practicals			
1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1 GED		1 General Education Disciplines (GED) - 56 credits														
1.1 CC		1.1 Compulsory component - 51 credits														
GED 1		SIK 1101	Современная история Казахстана	Қазақстанның қазіргі тарихы	Modern History of Kazakhstan	5	1	State exam	150	45	15		30	90	15	-
GED 2		Phyl3102	Философия	Философия	Philosophy	5	2	written	150	45	15		30	90	15	-
GED 3		ҮҮа 1103	Иностранный язык	Шет тілі	Foreign language	10	1,2	complex	300	90			90	180	30	-
GED 4		К(Р) Үа 1104	Казахский (русский) язык	Қазақ (орыс) тілі	Kazakh (Russian) language	10	1,2	complex	300	90			90	180	30	-
GED 5		ІКТА1105	Информационно-коммуникационные технологии	Ақпараттық-коммуникациялық технологиялар (ағылшын тілінде)	Information and communication technology (in English)	5	1	complex	150	45	15	30		90	15	-
GED 6		Pol2106	Политология	Саясаттану	Political science	2	4	complex	60	30	15		15	20	10	-
GED 7		Soci4107	Социология	Әлеуметтану	Sociology	2	5	complex	60	30	15		15	20	10	-
GED 8		Psih2108	Психология	Психология	Psychology	2	3	complex	60	30	15		15	20	10	-

GED 9		Cult3109	Культурология	Мәдениеттану	Culturology	2	5	complex	60	30	15		15	20	10	-
GED 10		FK1110	Физическая культура	Дене шынықтыру	Physical Culture	8	1,2,3,4	credit	240	120			120	80	40	-
			Total:			51			1530	555	105	30	420	790	185	
1.2 University component (UC)																
GED 11		MPF 3111	Методика преподавания физики	Физиканы оқытудың әдістемесі	Physics teaching methodology	5	6	written	150	45	15	30		90	15	Pd 2225
			Total:			5			150	45	15	30	0	90	15	
2 BD		2 Basic disciplines (BD) - 112 credits														
2.1 UC		2.1 University component (UC) - 60 credits														
BD 1		Meh 1201	Механика	Механика	Mechanics	6	2	written	180	60	15	30	15	105	15	-
BD 2		POIY 2202	Профессионально-ориентированный иностранный язык	Кәсіби бағыттағы шет тілі	Professionally -oriented foreign language	4	4	complex	120	45			45	60	15	IYa 1103
BD 3		Math 1203	Математический анализ - 1	Математикалық талдау - 1	Mathematical Analysis - 1	4	1	written	120	45	15		30	60	15	-
BD 4		Math 1204	Математический анализ - 2	Математикалық талдау - 2	Mathematical Analysis - 2	4	2	written	120	45	15		30	60	15	Math 1203
BD 5		TV 1205	Теория вероятностей	Ықтималдықтар теориясы	Theory of probabilities	3	2	written	90	30	15		15	45	15	-
BD 6		VP 2206	Введение в программирование	Программалау негіздері	Introduction to programming	4	3	complex	120	45	15	30		60	15	IKTA 1105
BD 7		MF 1207	Молекулярная физика	Молекулалық физика	Molecular physics	6	3	written	180	60	15	30	15	105	15	Meh 1201
BD 8		ELM 2208	Электричество и магнетизм	Электр және магнетизм	Electricity and Magnetism	6	4	written	180	60	15	30	15	105	15	MF 1207
BD 9		OP 2209	Оптика	Оптика	Optics	6	5	written	180	60	15	30	15	105	15	ELM 2208
BD 10		DU 2210	Дифференциальные уравнения	Дифференциалды қ теңдеулер	Differential equations	4	3	written	120	45	15		30	60	15	Math 1204
BD 11		AYF 3211	Атомная и ядерная физика	Атомдық және ядролық физика	Atomic and Nuclear physics	6	6	written	180	60	15	30	15	105	15	OP 2209

BD 12		LAAG 1212	Линейная алгебра и аналитическая геометрия	Сызықтық алгебра және аналитикалық геометрия	Linear Algebra and Analytic Geometry	4	1	written	120	45	15		30	60	15	-
BD 13		UOP 2303	Учебно-ознакомительная педагогическая практика	Оқу-танымдық педагогикалық тәжірибе	Educational Internship	3	4	practice	90	30			30	45	15	-
			Total:			60			1800	630	165	180	285	975	195	
2.2 EC-BD		2.2 Elective component (EC)- 52 credits														
BD 14			Elective discipline- 1			4	5		120	45	15	30		60	15	
		TEC 2213	Теория электрических цепей	Электр тізбектер теориясы	Basic Circuit Theory			written								ELM 2208
		KV 2214	Колебания и волны	Тербелістер және толқындар	Oscillations and Waves			written								ELM 2208
BD 15			Elective discipline- 2			4	4		120	45	15	30		60	15	
		OM 2215	Основы научного моделирования	Ғылыми модельдеу негіздері	Basics of scientific computation		4	complex								VP 2206
		TKO 2216	Технологии критериального оценивания	Критериялық бағалау технологиялары	Technology of criteria-based assessment		4	written								Pd 2225
BD 16			Elective discipline- 3			4	8		120	45	15	30		60	15	
		MP 4217	Менеджмент в педагогике	Педагогикалық менеджмент	Educational management		8	written								MP 3228
		OBZ 2236	Основы безопасности жизнедеятельности	Тіршілік қауіпсіздігінің негіздері	Health and safety		8	written								-
BD 17			Elective discipline- 4			5	8		150	45	15	30		90	15	
		MMChM 4219	Математическое моделирование и численные методы	Математикалық модельдеу және сандық әдістер	Mathematical simulation and numerical methods		8	written								MMF 3301

		OPPU 4220	Основы полупроводниковых устройств	Жартылай өткізгіш құралдар негіздері	Basics of semiconductor devices		8	written								ELM 2208
BD 18			Elective discipline- 5			4	4		120	45	15		30	60	15	
		TFK 2221	Теория функции комплексного переменного	Комплекс айнымалы функция теориясы	Theory of complex variable function		4	written								DU 2210
		MIO 2222	Методы исследования в образовании	Білім берудегі зерттеу әдістері	Research methods in education		4	written								-
BD 19			Elective discipline- 6			3	3		90	30	15		15	45	15	
		OVT 2223	Основы векторного и тензорного анализа	Векторлық және тензорлық талдау негіздері	Basics of vector and tensor analysis		3	written								Math 1204
		FRS 2224	Физиология развития школьников	Оқушылар дамуының физиологиясы	Physiology of school student development		3	written								-
BD 20			Elective discipline- 7			4	3		120	45	15		30	60	15	
		Pd 2225	Педагогика	Педагогика	Pedagogy			written								-
		OASD 2226	Основы алгоритмов и структур данных	Алгоритмдер және деректер құрылымының негіздері	Basics of algorithms and data structure			complex								IKTA 1105
BD 21			Elective discipline- 8			3	4		90	30	15		15	45	15	
		OPsy 3227	Образовательная психология	Білім беру психологиясы	Educational psychology		4	Complex								Psih2 108
		MP 3228	Медиапедагогика	Медиапедагогика	Mediapedagogy		4	written								Pd 2225
BD 22			Elective discipline- 9			4	7		120	45	15		30	60	15	
		TSF 4229	Термодинамика и статистическая физика	Термодинамика және статистикалық физика	Thermodynamics and statistical physics		7	written								MF 1207
		EMFI 4230	Электронные методы в физических исследованиях	Физикалық зерттеулердегі	Electronic methods in		7	complex								AYF 3211

				электрондық әдістер	physics research												
BD 23			Elective discipline- 10			4	7		120	45	15		30	60	15		
		IMOF 4231	Инновационные методы обучения физике	Физика пәнін оқытуда инновациялық әдістер	Innovative methods of physics teaching		7	complex									MPF 3111
		FKS 4232	Физика конденсированного состояния	Конденсирленген күй физикасы	Condensed state physics		7	complex									NRK M 3315
BD 24			Elective discipline- 11			5	8		150	45	15	30		90	15		
		KM 4233	Компьютерное моделирование в образовании	Білімдегі компьютерлік модельдеу	Computer simulation in education		8	written									OM 2215
		TSE 4234	Техника школьного эксперимента	Мектеп экспериментінің техникасы	Technique of school experiment		8	written									EMFI 4230
BD 25			Elective discipline- 12			4	7		120	45	15		30	60	15		
		APH 3237	Астрофизика	Астрофизика	Astrophysics		7	written									AYF 3211
		RE 3238	Радиоэлектроника	Радиоэлектроника	Radio engineering		7	complex									OPPU 4220
BD 26			Elective discipline- 13			4	3		120	45	15		30	60	15		
		Math 2239	Теория кратных интегралов	Еселі интеграл теориясы	Multiple Integral Calculus		3	written									Math 1204
		Ю 2240	Инклюзивное образование	Инклюзивтік білім беру	Inclusive education		3	written									-
			Total:			52			1560	555	195	150	210	810	195		
3 PD		3. Professional disciplines (PD) - 60 credits															
3.1		3.1 University component (UC) - 30 credits															
PD 1		MMF 3301	Методы математической физики	Математикалық физиканың әдістері	Methods of mathematical physics	5	5	written	150	45	15		30	90	15		TMH 2235
PD 2		TEP 3302	Теория электромагнитного поля	Электрмагниттік өріс теориясы	Theory of Electromagnetic Field	5	5	written	150	45	15		30	90	15		ELM 2208

PD 3		TMH 2235	Теоретическая механика	Теориялық механика	Theoretical Mechanics	3	4	written	90	30	15		15	45	15	OVT 2223
PD 4		PP 3304	Педагогическая практика	Педагогикалық тәжірибе	Pedagogical Internship	4	6	Практика	120					90	30	UOP 2303
PD 5		PDP 4305	Преддипломная практика	Диплом алдындағы тәжірибе	Pre-diploma Internship	3	8	Практика	90					75	15	PP 4306
PD 6		PP 4306	Педагогическая практика	Педагогикалық тәжірибе	Pedagogical Internship	4	7	Практика	120					90	30	UOP 2303
PD 7		NRKM 3315	Квантовая механика	Кванттық механика	Quantum mechanics	6	6	written	180	60	30		30	105	15	OP 2209
			Total:			30			900	180	75		105	585	135	
3.2 EC-PD		3.2 Elective component (EC)- 30 credits														
PD 8			Elective discipline- 14			5	6		150	45	15	30		90	15	
		OT 3307	Основы электронной техники	Электрондық техника негіздері	Fundamentals of electronic engineering			written								ORZS V 3313
		PAD 3308	Python для анализа данных	Деректерді талдау үшін Python	Python for data analysis			complex								AP 3314
PD 9			Elective discipline- 15			5	7		150	45	15	30		90	15	
		TS 4309	Теория электрической связи	Электр байланысы теориясы	Theory of Electrical Communication			written								TPE M 3311
		PBD 4310	Проектирование баз данных. Введение в SQL	Деректер қорын жобалау. SQL-ге кіріспе	Database design. Introduction to SQL			complex								WT 3312
PD 10			Elective discipline- 16			5	6		150	45	15	30		90	15	
		ТРЕМ 3311	Теория передачи электромагнитных волн	Электрмагниттік толқындардың таратылу теориясы	Theory of Electromagnetic Waves Transmission			written								TEP 3302
		WT 3312	Web-технологии	Web-технологиялар	Web-technologies			complex								AP 3314
PD 11		ДВ 17	Elective discipline- 17			5	5		150	45	15	30		90	15	



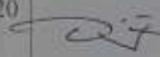
		ORZSV 3313	Основы радиотехнических цепей и сигналов	Радиотехникалық тізбектер мен сигналдардың негіздері	Basics of radio circuits and signals			written								ELM 2208
		AP 3314	Алгоритмизация и программирование	Алгоритмдеу және программалау	Algoritmizati on and programming			complex								VP 2206
PD 12		ДВ 18	Elective discipline- 18			5	7		150	45	15	30		90	15	
		RTT 4317	Робототехника	Робототехника	Robotics			written								OT 3307
		KS 4318	Компьютерные сети (Cisco 1)	Компьютерлік желілер (Cisco 1)	Computer Networks (Cisco 1)			complex								PAD 3308
PD 13			Elective discipline- 19 (Minor)			5	7		150	45	15	30		90	15	
		ZOS 4319	Цифровая обработка сигналов	Сигналдарды цифрлық өңдеу	Digital signal processing			written								ORZSV 3313
		AD 4320	Архитектура и дизайн ПО (SDP5)	Бағдарламалық жасақтама архитектурасы және дизайны (SDP5)	Software Design and Architecture (SDP5)			complex								AP 3314
			Total:			30			900	270	90	180	0	540	90	
			Amount of exams			60										
			Total of theoretical education						6840	2235	645	570	1020	3790	815	
			Sum of credits:			228										
5. Final examination																
		NZDP	Написание и защита дипломного проекта	Диссертацияны жазу және қорғау	Writing and defense of thesis	12	8		360					270	90	
			TOTAL			240			360					270	90	

6. Additional educational programs (Minor)

The name of the additional educational program (Minor) with an indication of the list of disciplines that form Minor	Total number of credits / Number of credits in the discipline	Semester of study	Documents on the results of the development of additional educational programs (Minor)
Physical processes in radio engineering and telecommunications	15		Transcript
- Electronic methods in physics research	5	5	
- Physical fundamentals of optoelectronics	5	6	
- Fundamentals of Quantum Physics	5	7	

7. An approval sheet with the developers

Code and classification of the field of education: 6B01 – Pedagogical sciences

№ n/n	Position, scientific or academic degree, name and surname of the developer of the educational program	Date	Signature	Note
1	Head. Department of «Radio engineering, electronics and telecommunications», Assistant Professor, PhD Daineko Yevgenia Alexandrovna	21.05.2020		
2	Professor of the «Radio engineering, electronics and telecommunications» Department, candidate of technical sciences, Aitmagambetov Altai Zufarovich	21.05.2020		
3	Associate professor of the «Computer Engineering and Information Security», Department, PhD Duzbayev Nurzhan Tokkuzhayevich	21.05.2020		
4	Assistant Professor of the «Radio engineering, electronics and telecommunications» Department, PhD Kabatayeva Raushan Sarsembekovna	21.05.2020	