MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF TAJIKISTAN
NATIONAL UNIVERSITY OF TAJIKISTAN

"Approved"
Rector of the National University of Tajikistan
_____ Khushvakhtzoda K.K.
"_____" _____ 2022

"Approved"
Minister of Education and Science
of the Republic of Tajikistan
_____ Saidzoda R.Kh.

"_____" _____ 2022

Educational Program
in the Field of Study (Specialty)

Group of Specialties: 3103
Specialty: 1-31 03 04 00 – Informatics
Major: Software Development / Programmer
Academic Degree: Bachelor
Duration of Study: 4 years

Dushanbe – 2022

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF TAJIKISTAN
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"**Deemed acceptable**"

At the meeting of the Council of Scientists of TNU

Decision No. 01 dated "31" September 2021 Chairman of the Council
_____prof. Khushvakhtzoda K.Kh.

"**Passed examination**"

Director of the Republican Educational and Methodological Center under the Ministry of Education and Science of the Republic of Tajikistan

_____ R. Mirzozoda

"_____" _____ 2022

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LIST OF ABBREVIATIONS

- MO and NRT – Ministry of Education and Science of the Republic of Tajikistan
- GSVPO RT – State standard of higher professional education in the Republic of Tajikistan
- UVPO – Institution of Higher Professional Education
- OP – Educational program
- TYPE – Standard curriculum
- RUP – Working Curriculum
- UMS – Educational and Methodological Council
- UPD – Curriculum of the discipline
- RPD – Work program of the discipline (syllabus)
- ED – Elective disciplines (optional)
- OD – Compulsory disciplines
- BD - Basic disciplines
- OD – General professional disciplines
- PD – Profile disciplines (special)
- PPS – Teaching staff
- R&D – Scientific research work
- SRS – Independent work of a student
- SRRP – Independent work under the guidance of a teacher
- TC – Current control
- IR – Final Control
- GPA **(Grade Point Average)** – Average general score
- TNU – National University of Tajikistan
- NTCPR – National Testing Center under the President of the Republic of Tajikistan

Table of contents

1. GENERAL PROVISIONS OF THE EDUCATIONAL PROGRAM

1.1. Information about the specialty

The name, code and group of specialty 1-31 03 04 00 – *Computer Science* correspond to the State Classification of Directions and Specialties of the Republic of Tajikistan, approved by the Decree of the Government of the Republic of Tajikistan No. 349 of June 30, 2007.

The bachelor's degree program in specialty 1-31 03 04 00 - *Computer Science* is accredited in accordance with certificate IA No. 0000914 dated July 17, 2019, issued by the State Service for Supervision in Education (currently - the Agency for Supervision in Education and Science under the President of the Republic of Tajikistan).

This educational program for the specialty 1-31 03 04 00 - *Computer Science* was revised in May 2021 and put into effect from the 2021-2022 academic year.

1.2. Graduate qualifications

After completing the educational program in specialty 1-31 03 04 00 – *Computer Science* in full-time education, the graduate is awarded:

- professional qualification – *Computer Science* ;
- Academic degree – Bachelor in Computer Science *(Programming)*

After completing the program in full-time or part-time form, the graduate is awarded the same qualification and degree.

1.3. General characteristics of graduate qualifications

A computer science specialist is preparing to work in:

- research institutions,
- computer information centers,
- centers and institutes of systems programming,
- government bodies,
- educational institutions (general education schools, institutions of secondary vocational, primary and higher vocational education),
- banking organizations,
- enterprises and objects of various forms of ownership.

The professional activity of a specialist in the field of information science is expressed in the creation of mathematical models of objects, systems, processes and technologies. These models are used for calculations, analysis, preparation of solutions, software development and the use of information technologies in all spheres of production: economic, socio-economic, managerial, in scientific and technical institutions, design and project centers, educational and health care institutions.

1.3.1. The objects of professional activity of bachelors are:

Mathematical models, methods and system software for analysis and decision-making in production, economic, socio-economic and management activities, as well as in research institutions, education, healthcare, banking and information spheres.

1.4. Graduation level requirements

A graduate who has completed a bachelor's degree program, in accordance with the types of professional activities that this educational program is aimed at, must meet the learning outcomes specified in Section 3 of this document.

1.5. Graduate's field of activity

A computer science specialist, having fundamental and specialized training, can perform the following types of professional activities:

- scientific research;
- planning and technological;
- organizational and managerial;
- systems programming;
- pedagogical;
- technological and communication;
- cultural and educational;
- scientific and methodological.

In addition, the graduate is able to perform:

- systems analysis of the planned object, the area under study and their interrelations;
- selection of initial data for planning;
- computer modeling of the planned object;
- development and consideration of options for solving the problem, analysis of these options, forecasting results and planning the implementation of the program;
- assessment of the reliability and quality of the facility’s functioning;
- calculation of economic efficiency;
- organizing quality control of incoming information;
- programming of banking information systems;
- programming of the educational process.

1.6. Opportunities for continuing education of graduates

Opportunities for continuing education of a graduate in the field of computer science: a person who has mastered the basic educational program of higher professional education in the specialty 31 03 04 00 - *Computer Science* , in accordance with the State Standard of Higher Professional Education of the Republic of Tajikistan, having a bachelor's degree, can continue education at the second level of higher professional education - in a master's degree program in the relevant direction and profile (specialty).

1.7. Opportunities for continuing education of graduates

A bachelor's degree is a specialist in computer science who has completed the educational program in the specialty 1-31 03 04 00 - *Computer Science* and is ready to continue his/her studies in a master's degree program.

In accordance with the State Standard of Higher Professional Education of the Republic of Tajikistan, persons with a bachelor's degree can continue their education at the second level of higher professional education - a master's degree in the relevant field and profile (specialty).

2. DOCUMENTS REGULATING THE CONTENT AND PROCESS OF IMPLEMENTING THE EDUCATIONAL PROGRAM IN THE SPECIALTY 1-31 03 04 00 "INFORMATICS"

2.1. The educational program is developed on the basis of the State Standard of Higher Professional Education of the Republic of Tajikistan and regulatory legal acts of the Republic of Tajikistan in the field of education. Further development of its applications must comply with the requirements of the following documents:

- Law of the Republic of Tajikistan "On Education" dated 22.07.2013, No. 1004 (as amended on 17.05.2018, No. 1527);
- Law of the Republic of Tajikistan “On Adult Education” dated 24.02.2017, No. 1394;
- Law of the Republic of Tajikistan “On Higher and Postgraduate Professional Education” dated 19.05.2009, No. 531;
- National Strategy for the Development of Education in the Republic of Tajikistan until 2030 dated September 29, 2020, No. 526;
- National concept of education in the Republic of Tajikistan, approved by the Decree of the Government of the Republic of Tajikistan dated 03.03.2006, No. 94;
- State standard of higher professional education of the Republic of Tajikistan dated 25.02.2017, No. 94;
- State classification of areas and specialties of the Republic of Tajikistan dated 30.06.2007, No. 349;
- Regulation on the credit system in institutions of higher professional education of the Republic of Tajikistan dated 30.12.2016, No. 19/24;
- Guidelines for the development and revision of educational programs of higher professional education in the Republic of Tajikistan;
- Strategic development plan of the Tajik National University for 2021–2025.

2.2. The requirements for the content and minimum mandatory volume of the educational program, the conditions for its implementation and the terms of mastering are determined by the State Standard of Higher Professional Education of the Republic of Tajikistan.

2.3. In the process of implementing the educational program in the specialty 1-31 03 04 00 "Computer Science", the following mandatory documents are used:

- curriculum for the specialty,
- work curriculum,
- internship programs,
- curricula of disciplines and syllabuses.

The minimum requirements for the content of the above documents are reflected in the State Standard of Higher Professional Education of the Republic of Tajikistan.

2.4. Brief annotations of compulsory and elective disciplines are an integral part of the educational program. They include: a brief description of the discipline, types of classes, language of

instruction, competencies that the student should develop while mastering the discipline, expected learning outcomes, a list of sections and topics of the discipline, educational, methodological and technical support, forms of current and final control. The minimum requirements for annotations of compulsory and elective disciplines are given in the appendix(es). The full content of the work programs of compulsory and elective disciplines is available in the electronic library of the Tajik National University (see https://tnu.tj).

2.5. The educational program must provide for mandatory study of the sections and modules specified in Section 3 of this document.

2.6. Sections and modules of the educational program include:

- compulsory subjects of the state and university components,
- elective courses,
- extracurricular activities,
- practices,
- final certification.

2.7. The list of sections, modules and disciplines of the state component of the educational program complies with the requirements of the document "Classification of academic disciplines by sections and modules".

3. MINIMUM MANDATORY CONTENT OF THE EDUCATIONAL PROGRAM IN SPECIALTY 1-31 03 04 00 "INFORMATICS"

1	**Name of the program**	1-31 03 04 00-informatics
2	**Academic degree**	Bachelor
3	**Type of study**	Daytime and distance learning
4	**Duration of study**	4 years
5	**Number of credits**	240 credits (60 credits per year)
6	**General week**	The purpose of this program is to develop professional competencies in students to work as a specialist in the field of computer science in research institutions, computer information centers, centers and institutes of system programming, government agencies, legal bodies, educational institutions, general education schools, secondary specialized, primary vocational and higher vocational educational institutions, banking institutions, with the possibility of continuing education in a master's degree program.
7	**BRIEF DESCRIPTION OF THE EDUCATIONAL PROGRAM**	**This educational program consists of the following sections and modules:** **Section 1. Basic disciplines (43 credits)** • Module of social and humanitarian disciplines – 22 credits • Language disciplines module – 15 credits • Module of natural economic disciplines – 6 credits **Section 2. Profile disciplines (113 credits)** • General professional disciplines module – 42 credits

		• Specialized disciplines module – 71 credits **Section 3. Elective courses (60 credits)** • Elective disciplines module of section 1 – 6 credits • Elective disciplines module of section 2 – 54 credits **Section 4. Practice (15 credits)** **Section 5. Final assessment (9 credits)** **Section 6. Electives (22 credits)**
8	**LEARNING OUTCOMES**	**After completing the educational program, the graduate:** 1. Possesses competencies in creating an educational and software environment and is able to successfully apply his developed projects in practice; 2. Can use new information equipment in management processes, programming, research activities and in the education system; 3. During the training process in general education institutions, secondary specialized, primary vocational and higher vocational educational institutions, he applies acquired knowledge of computer science and programming when teaching the subject "Computer Science", and is also able to develop computer programs; 4. Able to clearly and correctly express his thoughts orally and in writing, and also use at least one foreign language at the communication level in his work; 5. (number 5 missing in original) Has basic knowledge of research methodology and is able to apply this knowledge in research work; 6. Has interdisciplinary problem solving skills and is able to establish connections between different disciplines; 7. Able to assess own needs for continuous education and select appropriate methods for professional development.

Note: *Credits of elective classes (22 credits) are not included in the total volume of credits of the program and are not mandatory. The Tajik National University has the right to independently determine the list of elective classes and their volume in credits.*

9	**EVALUATION OF THE EDUCATIONAL PROGRAM**	**During the learning process, the results of mastering the educational program are assessed as follows:** 1. Drawing up calendar plans during educational and industrial practice; 2. "Entrance control" – students' readiness for the subject "Computer Science" at the beginning of the 1st year (tests, tasks, etc.);

		3. Planned and regular assessment of the level of knowledge, skills and abilities of future programmers in the subject "Computer Science", which students acquire while studying sections and modules; 4. Written assignments and presentations that provide an opportunity to assess students' progress in oral and written communication; 5. Research work, individual and group projects; 6. Homework, subject tests, assignments, exams, certification; 7. Comparative analysis of planned and achieved learning outcomes.		
10	**SPECIALITY**			
	CIPHER AND NAME OF SPECIALTY	1-31 03 04 00-informatics		
	SPECIALTY GROUP	Informatics		
	SPECIALTY AND PROFESSIONAL DEGREE AFTER GRADUATION	"Mathematician-programmer", goklavavriyat		
11	**SECTIONS AND MODULES**			
SECTION NAME		**BASIC DISCIPLINES**	**43**	**Credit**
PURPOSE OF THE SECTION		The purpose of this section is to provide basic knowledge and skills necessary for admission to the higher professional education system of the Republic of Tajikistan.		
SECTION BRIEF DESCRIPTION		**The basic disciplines section consists of the following modules:** • Social and humanitarian disciplines module – 22 credits • Language disciplines module – 15 credits • Module of natural economic disciplines – 6 credits		
MODULE NAME		**Module of social and humanitarian disciplines**	**22**	**credit**
PURPOSE OF THE SECTION		The purpose of the module is to study the fundamentals of social and humanitarian sciences, the fundamentals of history, culture and economy of the Republic of Tajikistan, as well as the formation of a cultural and communicative worldview.		
SECTION BRIEF DESCRIPTION		• Philosophy – 4 credits • Modern History of Tajikistan – 3 credits • Cultural and Religious Studies – 3 credits • Sociology – 3 credits • Political Science – 3 credits • Law in the specialty – 3 credits • Business Planning - 3 credits		

LEARNING OUTCOMES FOR THE MODULE	Student who has completed the module: • Knows the basics of history and culture, the role and place of Tajikistan in the history of mankind and the modern world; • Knows the basics of business planning, law and legislation of the Republic of Tajikistan; • Knows the basics of the humanities and social sciences, methods and approaches to philosophical analysis of issues, forms and methods of scientific teaching; • Can independently express his/her point of view, has logical thinking, is able to conduct official conversations, moral and ethical discussions, observes the principles of ethics and aesthetics; • Able to demonstrate knowledge of various forms of thinking and skills in applying them in various situations in accordance with pedagogical and political requirements; • Mastered theories, strategies and tools to empower students and develop their own creative potential; • Knows economic resources, economic systems and forms of ownership.		
MODULE NAME	**Language disciplines module**	**15**	**credit**
PURPOSE OF THE MODULE	The purpose of the module is to create a professional base of language and communication skills necessary for the work of a teacher.		
SECTION BRIEF DESCRIPTION	•Tajik language by specialty – 3 credits •Russian language by specialty – 6 credits • Foreign languages by specialty – 6 credits		
LEARNING OUTCOMES FOR THE MODULE	Student who has completed the module: • Able to correctly use Tajik, Russian and foreign languages in oral and written speech at the level of communication within the framework of his specialty; • Possesses knowledge and practical skills in searching for scientific information in a foreign language; • Has knowledge and skills in using terminology in a foreign language; • Possesses the skills to develop the content and structure of speech in accordance with the purpose, situation and participants in communication.		
LEARNING OUTCOMES FOR THE MODULE	**Module of natural economic disciplines**	**6**	**credit**
MODULE NAME	The purpose of the module is to provide a basis for the formation of competencies in the field of natural and exact sciences, contributing to the development of a creative and personally oriented approach.		

SECTION BRIEF DESCRIPTION	• Economic Geography of Tajikistan with Basics of Demography – 3 credits • Ecology – 3 credits		
LEARNING OUTCOMES FOR THE MODULE	Student who has completed the module: • Can analyze the geopolitical situation, knows the administrative-social and territorial division of the country; • Knows the peculiarities of Tajikistan's industry, the history of the country's industry and agriculture; • Understands the principles of sustainability and productivity of living nature and its changes under the influence of anthropogenic factors; • Possesses skills in systemic analysis of global environmental problems, environmental issues and rational use of natural resources based on knowledge of basic environmental laws.		
SECTION NAME	**SPECIALIZED DISCIPLINES**	**113**	**credit**
PURPOSE OF THE MODULE	The purpose of the section is to study programming languages, computer networks, mathematical and computer modeling		
SECTION BRIEF DESCRIPTION	**The section of specialized disciplines consists of the following modules:** • General professional disciplines module – 42 credits • Specialized disciplines module – 71 credits		
MODULE NAME	**General professional disciplines module**	42	credit
PURPOSE OF THE MODULE	The purpose of this module is to provide a knowledge base and skills in the field of programming, modeling, technologies and methods necessary for the activities of a programmer.		
SECTION BRIEF DESCRIPTION	• Mathematical Analysis – 12 credits • Algebra and Geometry – 6 credits • Differential Equations – 6 credits • Programming Languages – 12 credits • Databases and Expert Systems – 3 credits • • Optimization methods – 3 credits		
LEARNING OUTCOMES FOR THE MODULE	Student who has completed the module: • Can develop mathematical and computer models for given environmental objects; • Possesses basic skills of observation, description and analysis of activities; • Mastered the methodology of teaching computer science and is able to apply it at various levels of education; • Using computer programs, searches for optimal solutions to assigned tasks; • Has conceptual understanding and practical knowledge of algebra, mathematical analysis,		

	mathematical operations, discrete mathematics and differential equations, and demonstrates and applies them in practice; • Possesses professional skills in working with computer hardware and software; • Possesses research skills and methods, including research approaches and planning, ethical standards, writing and analytical skills, and communication and interaction abilities.		
MODULE NAME	**Module of specialized disciplines**	71	credit
PURPOSE OF THE MODULE	The purpose of the module is to provide the opportunity to obtain in-depth specialized knowledge and skills in the field of conceptual, mathematical and computer modeling at levels 2 and 3 of the general secondary education system.		
SECTION BRIEF DESCRIPTION	• Fundamentals of Computer Science and Theory of Algorithms – 12 credits • Computer Problem Solving Practice – 14 credits • Operations Research and Game Theory – 6 credits • Mathematical and computer modeling – 6 credits • Classical Mathematical and Computer Models. Modeling in CAD – 9 credits • Modeling Aquatic Ecosystems. Mathematical Modeling of Complex Systems – 12 credits • • Computer modeling of economic processes. Modeling of 3D objects – 12 credits		
LEARNING OUTCOMES FOR THE MODULE	Student who has completed the module: • Can study and investigate ecological systems; • Able to develop conceptual, mathematical and computational models for ecosystems; • Possesses skills in teaching subjects in programming, mathematical and computer modeling; • Can justify theories of modeling and programming, and describe experiments and hypotheses; • Knows the specifics of applying laws, patterns and solving specific mathematical problems and any logical problems using a computer.		
MODULE NAME	**ELECTIVE DISCIPLINES**	**60**	**credit**
PURPOSE OF THE MODULE	The purpose of this section is to provide students with additional basic knowledge in accordance with the purposes of the sections of basic and specialized disciplines **.**		
SECTION BRIEF DESCRIPTION	**The section of elective disciplines consists of the following modules:** • Elective disciplines module of section 1 – 6 credits • Elective disciplines module of section 2 – 54 credits		
MODULE NAME	**Module discipline by choice of section 1**	**6**	**credit**

PURPOSE OF THE MODULE	The purpose of the module is to create opportunities for obtaining additional knowledge in the basic disciplines of the state component		
LEARNING OUTCOMES FOR THE MODULE	**Student who has completed the module** : • Possesses in-depth knowledge gained through studying basic elective disciplines; • Can compare knowledge acquired through elective courses with the teaching of mathematics in general secondary education institutions.		
MODULE NAME	**Module discipline by choice of section 2**	**54**	**credit**
PURPOSE OF THE MODULE	The purpose of the module is to create opportunities for obtaining additional knowledge acquired during the study of specialized disciplines		
LEARNING OUTCOMES FOR THE MODULE	**Student who has completed the module:** • Possesses in-depth knowledge obtained through the study of specialized elective disciplines; • Can compare knowledge acquired through specialized elective courses with the teaching of mathematics in general secondary education institutions.		
SECTION NAME	**Practice**	**15**	**credit**
PURPOSE OF THE MODULE	The purpose of this section is to develop the ability to apply acquired theoretical knowledge in practice.		
LEARNING OUTCOMES FOR THE MODULE	• Educational and production practice - 6 credits • Pre-graduate practice - 9 credits		
THE RESULT OF THE EDUCATION OF THE MODULE	A student who has mastered the section: - can plan systematic education in accordance with the requirements of educational standards and educational programs; - can analyze and evaluate their own behavior as a computer scientist and programmer; - takes into account new and modern programming opportunities in work activities; - implements ways to automate information processing processes; - can analyze competencies and needs for self-improvement.		
NAZVANIE RAZDELA	**FINAL CERTIFICATION**	**9**	**credit**
PURPOSE OF THE MODULE	The purpose of this section is a deep and multifaceted test of theoretical knowledge and practical experience in the field of computer science, modeling, programming and mathematical disciplines, as well as an assessment of acquired general cultural and professional competencies.		
LEARNING OUTCOMES FOR THE MODULE	• Final qualifying work – 6 credits • State exam in specialized disciplines – 3 credits		
LEARNING OUTCOMES FOR THE MODULE	Student who has mastered the section: • Able to conduct research, referring to scientific and professional literature, analyze it, compare research results and methods;		

	• Applies research and information processing methods; • Can clearly, logically, correctly and briefly express his thoughts in writing on the problem under consideration and the results obtained; • Able to analyze and evaluate the results of his/her research based on previously completed work and provide comments and explanations on the results achieved, relying on initial theories and previous research; • Able to work with specialized (professional) literature; • Apply acquired knowledge in theoretical research and solving practical problems; • Knows the requirements for the design of scientific text and is able to work in accordance with them.
SECTION NAME	**OPTIONAL CLASSES**
PURPOSE OF THE MODULE	The purpose of this section is to develop students' knowledge about a healthy lifestyle and the ability to act independently in emergency situations.
LEARNING OUTCOMES FOR THE MODULE	• Physical Education – 6 credits • Military training - 16 credits
LEARNING OUTCOMES FOR THE MODULE	Student who has mastered the section: • Understands the social role of physical education in the development of personality and preparation for professional activity; • Understands issues of population protection and public order; • Prepared to defend the Motherland and civilians in emergency and military situations in accordance with various specialties.

4. PERIOD OF COMPLETION OF THE EDUCATIONAL PROGRAM

4.1. The period of mastering the educational program is 4 years of full-time study, which corresponds to 208 weeks, including:

- theoretical training, including students' research work, practical and laboratory classes – **123 weeks**;
- examination sessions – **21 weeks**;
- practice – **10 weeks** , including:
  • educational practice – **2 weeks** ;
  • industrial practice – **2 weeks** ;
  • pre-graduation practice – **6 weeks** ;
- final certification together with preparation and defense of the final qualifying work – **6 weeks**;
- holidays (including 8 weeks of post-graduate leave) – **48 weeks**.

4.2. The maximum volume of a student's academic workload (labor intensity) per week is **45 hours**, including all types of classroom and extracurricular (independent) studies.

4.3. The weekly classroom workload of a full-time student is **30–36 hours**. This volume does not include physical education classes and optional subjects.

4.4. In the case of correspondence courses, the student is provided with at least **144 hours** of classroom study with a teacher.

4.5. The school year holidays shall be at least **10 weeks long** , including winter holidays lasting at least **2 weeks** .

5. CONDITIONS FOR THE IMPLEMENTATION OF THE EDUCATIONAL PROGRAM

5.1. Provision and support for students

5.1.1. The University has a material and technical base that meets the requirements of current fire safety regulations and standards for conducting all types of training, practical and research work provided for in this document.

5.1.2. Each student has unlimited access to the library (including electronic) and the electronic information and educational environment during the period of study. The electronic library and the information and educational environment provide access from any point with an Internet connection. The electronic educational environment of the University includes: access to curricula, work programs of disciplines and practices, electronic resources of educational materials, electronic library systems specified in the curricula of disciplines; registration of the educational process, results of midterm assessment and mastering the program; conducting all forms of classes, as well as assessing the results of training using e-learning and distance learning technologies.

5.1.3. The University has **6 dormitories** for students and teachers. The dormitories are equipped with comfortable rooms, showers, toilets and kitchens on each floor. The dormitories also have canteens and fast food outlets. Residents are provided with the necessary furniture (bed, wardrobe, table and chair), as well as bedding. Work is regularly carried out in the dormitories to improve living conditions.

5.2. Control and final results of knowledge acquisition

5.2.1. A final grade is given for all disciplines and practical training provided by the educational program. The equivalent of the final grade corresponds to the following table:

Letter equivalent of the rating	**Letter equivalent of the rating**	**Letter equivalent of the rating**	**Letter equivalent of the rating**
A	4.0	$95 \le A \le 100$	Great
A -	3.67	$90 \le A- < 95$	
B +	3.33	$85 \le B+ < 90$	

IN	3.0	$80 \le B < 85$	Fine
IN -	2.67	$75 \le B- < 80$	
C +	2.33	$70 \le C+ < 75$	Satisfactorily
C	2.0	$65 \le C < 70$	
C-	1.67	$60 \le C- < 65$	
D+	1.33	$55 \le D+ < 60$	
D	1.0	$50 \le D < 55$	
Fx	0	$45 \le Fx < 50$	Unsatisfactory
F	0	$0 \le F < 45$	

5.2.2. The student's final grade for mastering the curriculum for each subject is calculated using the following formula.

$$\text{Итоговая отценка} = \left[\frac{P_1 + P_2}{2}\right] * 0.5 + Э * 0.5$$

P_1 –result of the intermediate credit 1
P_2 –result of the intermediate credit 2
E - examin

5.3. During the implementation of the educational program, the MTOK has the right to:

- to organize the educational process in the form of original theoretical courses and various group and individual classes, workshops and seminars in accordance with the educational programs implemented at the university itself, taking into account regional, national, ethnic, professional characteristics, as well as the research work of teachers, covering the content and content of the specialty;
- determine the depth of study of individual sections of subjects related to fundamental and specialized disciplines, in accordance with the cycle of professional training and taking into account the individual characteristics of students;
- determine the list of specialties in university areas, the list of specialized subjects, their volume, content and forms of control for their mastery, in addition to the provisions of this curriculum;
- implement the curriculum for specialty 1-31 03 04 00 – Computer Science in a shortened time frame for students with secondary vocational or higher education in the relevant areas.

The terms of shortened training are determined on the basis of the students' existing knowledge, skills, and abilities, previously acquired in other educational institutions. The minimum term of training may not be less than three years. Shortened training is also permitted for individuals whose education and abilities correspond to and are justified by the chosen specialty.

5.4. Personnel support for the educational process

The staffing of this educational program is provided by the departments:

- computer science;
- mathematical and computer modeling.

Also, to implement the section of fundamental disciplines and the module of general professional disciplines, the following departments are involved: algebra and number theory, mathematical

analysis, differential equations, philosophy, political science, history and law, Russian language, Tajik language, foreign languages, physical education, etc.

The qualifications of the management staff and research staff correspond to the description of qualifications specified in the “Job Guide for Employees of Institutions of Higher Professional Education”.

Full information about the teaching staff that implements the educational programs is available on the official website of TNU (https://tnu.tj).

5.5. Educational and methodological support of the educational process

The implementation of the program for training certified specialists must be supported by educational and methodological documents for all types of academic classes, students' access to library collections and information resources corresponding to the content of the academic disciplines of the program, the availability of textbooks, teaching aids and methodological recommendations for all disciplines and types of academic classes, including all types of laboratory and practical work within the framework of the academic disciplines of the specialty.

The availability of laboratories for performing laboratory and practical work is mandatory.

5.6. Material and technical support for the educational process

The university, implementing the program for training qualified specialists, has a material and technical base that meets sanitary and technical standards and requirements for conducting all types of laboratory, practical and research work of students, as provided for by the curriculum of the specialty.

5.7. Educational and methodological support for practice

The curriculum for preparation for professional activity provides for a practice section aimed at developing professional competencies. For this purpose, two types of practice are provided: educational and industrial. The number of allocated weeks and the terms of their implementation (semesters) are indicated in the corresponding table.

Practice	**Semester number**	**Quantity per week**
Training	4	2
Industrial	6	2
Before graduation	8	6

The reporting forms for each type of practice are determined by the Center for Practice and Development of Professional Competencies of TNU and specialized departments.

5.7.1. The educational practice is of an introductory nature and its purpose is to demonstrate to students the activities of general secondary education institutions, children's health institutions (summer camps) and the work of the employees of these institutions. This allows students to directly observe the process of organizing work, professional characteristics and other practical aspects.

5.7.2. Industrial practice is a complex process during which students perform activities defined by their specialty. The following aspects are defined in industrial practice:

- orientation in the professional environment;
- demonstration of the multifaceted professional skills of a future programmer in all areas of production activity.

Industrial practice takes place at state and private enterprises, such as banks, companies, tax committees and others. During the practice, the university assigns teachers of specialized departments for each enterprise (practice base). Teachers advise students on the course of industrial practice and on the preparation of necessary documents.

6. CONTENTS OF THE SET OF DOCUMENTS OF THE CURRICULUM FOR THE SPECIALTY 1-31 03 04 00 "INFORMATICS"

6.1. Curriculum for the specialty (UPS)

The curriculum is a part of the set of documents of the curriculum, including a list of disciplines, the volume of the time fund, the sequence of study and individual stages of preparation of disciplines, practices, optional classes, training modules and other types of educational activities. The curriculum for the specialties operating at TNU includes:

- name and code of the specialty, qualification, terms and forms of training;
- educational process calendar (weekly);
- total volume of temporary funds (in weeks);
- a plan of the educational process indicating the list of sections and required disciplines, the number of credits (classroom and extracurricular), semesters, practical training and state certification;
- list of optional subjects.

The curriculum for the specialty is developed by TNU in accordance with the regulatory and legal documents and requirements specified in paragraphs 2 and 4 of this document.

6.2. Working curriculum (WCS)

The RUP is developed taking into account the chosen specialty and the requirements of the structural divisions of TNU. It determines the structure of the course and the time fund required for its study, includes a list of disciplines and their volume in hours. The table of the educational process, the sequence of studying disciplines by courses and semesters, types of classes, forms of distance learning and types of final state certification are also recorded in the RUP. The RUP is prepared on the basis of a sample curriculum, agreed upon by the Academic Council of the faculty and approved by the Academic Department.

6.3. Programs by types of practice

Programs for types of practice (educational, industrial, pre-graduation) are developed on the basis of the State Standard of Higher Professional Education, taking into account the minimum requirements for the content and level of training of graduates in the specialty 1-31 03 04 00 -

"Informatics" for the formation of professional competencies and readiness for professional activity.

Programs include:

- basic principles of organizing practices;
- goals and objectives of practice;
- content, forms, places and timing of the practice;
- results of the formation of students' professional competencies after completing their internship;
- structure and content of practice;
- a list of mandatory assignments that students must complete;
- reporting documentation on the results of the internship;
- methods of student assessment;
- educational, methodological and informational support for practice.

Internship programs are developed by the specialized department with the involvement of the Internship Department and on the basis of the Internship Site, and are approved by the TNU Academic Department.

6.4. Curriculum of the discipline

The curriculum of a discipline is a part of the curriculum containing the goals and objectives of the course (discipline) with a description of the topics and additional information, on the basis of which the working program of the discipline (syllabus) is developed. The program includes a description of the discipline, a brief summary of the topics, teaching materials, assignments for independent work, test examples, knowledge assessment criteria and a list of literature. The program is developed by the specialized department, approved by the Scientific and Methodological Council of the faculty and agreed upon by the Scientific and Methodological Council of TNU.

6.5. Syllabuses / work program for a student

Syllabuses are a student's work program with a brief description of the course, learning objectives and results, assessment process and methods. It includes a description of the discipline being studied, goals and objectives, a list of topics and deadlines for their study, assignments for independent work, procedures for passing tests and assignments, laboratory work, consultations, a schedule of knowledge checks, requirements for the teacher, assessment criteria and a list of literature. The syllabus is developed by the teacher, reviewed by the department, approved by the Scientific and Methodological Council of the faculty and approved by the Academic Department.

6.6. Brief description of the curricula of compulsory and optional disciplines

A brief description is an integral part of the curriculum (appendix), including information about the discipline and its content. The document must contain:

- name of the discipline;
- brief description of the discipline;
- types of activities;
- language of instruction;
- expected learning outcomes;
- list of parts of the discipline;

- teaching aids used;
- forms of current and final control.

A brief description of the curricula for the specialty 1-31 03 04 00 “Computer Science” is developed by the Faculty of Mechanics and Mathematics with the involvement of specialized and general departments and is not approved separately from the curriculum.

7. STATE CERTIFICATION OF A GRADUATE IN A SPECIALTY

7.1. Basic concepts of graduate certification

Certification of a graduate in the specialty "Computer Science - Programmer" includes the defense of a final thesis and passing a state exam in specialized disciplines. Certification is carried out to determine the level of theoretical and practical training of a future programmer, necessary for performing professional tasks and continuing education in a master's degree program (clause 1.6 of this document).

The state exam in specialized disciplines is part of the certification and must correspond to the content of the mastered curriculum.

7.1.1. Final qualifying work

The final qualifying work is submitted in the form of a computer printout or manuscript. The requirements for the volume, content and structure of the work are established by the university based on the "Regulations on final qualifying works" approved by the Ministry of Education and Science of the Republic of Tajikistan. No less than four weeks are allocated for the preparation of the work.

7.1.2. State examination in specialized disciplines

The procedure and program of the state examination in the specialty 1-31 03 04 00 - "Computer Science" is determined by the university on the basis of methodological recommendations and sample programs ("Regulations on the certification of graduates") approved by the Ministry of Education and Science of the Republic of Tatarstan.

7.2. State sample document on higher education (diploma)

7.2.1. A graduate who has completed the higher professional education program is issued a state diploma of higher education with a bachelor's degree in the specialty 1-31 03 04 00 - "Computer Science".

7.2.2. Structure of the Diploma Supplement

The appendix to the state diploma shall indicate: academic degree, specialty, list of disciplines and results of completed credits by semester; average grade (GPA) based on the results of semesters and the results of coursework, practical training, state certification and defense of the final thesis; learning outcomes; diploma number and series.

8. INTERNAL SYSTEM OF QUALITY ASSURANCE OF THE CURRICULUM

8.1. Basic concepts of quality assurance

Education quality is a comprehensive description of educational activities and student preparation that reflects the degree of compliance with the state education standard, the requirements of stakeholders, and the level of achievement of the planned goals and results of educational programs.

Quality assurance is the process of creating conditions and allocating necessary resources to ensure that the curriculum content, learning opportunities and facilities provided by the programme meet the required level of quality.

The internal quality assurance system at a university is a set of organizational structures, internal documentation, indicators, processes and resources aimed at continuously improving the quality of educational programs and forming a sustainable quality culture.

8.2. Principles of Quality Assurance

The principles of quality assurance in TNU include:

- TNU bears primary responsibility for the quality of education and its guarantees;
- quality assurance meets the requirements of different higher education systems, the university and students;
- the requirements of students, society and other stakeholders are taken into account;
- the curricula are regularly reviewed and updated by the relevant university structures;
- periodic self-assessment of the results of students' training in academic programs is carried out;
- surveys of students, graduates and employers are conducted regularly;
- external experts are involved to analyze the quality of programs;
- The results of the program quality assessment are available to the public.

8.3. Internal quality assurance standards

The internal quality assurance system is developed on the basis of the “Standards and Guidelines for Quality Assurance in Higher Education in the European Higher Education Area (ESG)” and includes:

- internal quality assurance policy;
- updating and improving curricula;
- quality-oriented student education;
- standards for student admission, monitoring of attendance and academic performance, recognition and certification;
- standards for fair and transparent processes for hiring, professional development and termination of employees;
- standards of resources for learning (adequate funding, high-quality and accessible teaching materials, student support);
- information management standards (collection, analysis and use of information for effective management of programs and other areas of activity);

- standards of information openness to the public (information must be transparent, accurate, objective, relevant and accessible);
- regular monitoring and periodic evaluation of programs;
- ensuring continuous external quality control.

9. RULES FOR ADMISSION TO THE CURRICULUM

9.1. Both citizens of the Republic of Tajikistan and foreign citizens may apply for individual places in the specialty 1-31 03 04 00 – "Informatics" at the Tajik National University. The number of places for admission to the 1st year in this specialty is determined by the Agency for Control in the Sphere of Education and Science of the Republic of Tajikistan in accordance with the appendix to the license for the right to educational activities.

9.2. Admission to the 1st year is carried out based on the results of entrance examinations through the National Testing Center under the President of the Republic of Tatarstan (NTC). In this case, persons with complete secondary education are accepted. Continuation of education to the 2nd year is possible for persons with secondary vocational or higher education based on entrance examinations (interview) at TNU.

9.3. Admission to the daytime department is limited to those under 35 years of age, while admission to the correspondence department is open without age restrictions.

9.4. You can find the admission plan and the list of documents on the official websites of the Scientific and Technical Center and TNU: https://ntc.tj and https://tnu.tj .

10. CHANGE MANAGEMENT

In the event of changes or revision of curricula, the relevant department is obliged to provide the necessary information for consideration by the Academic Council.

Overview of the curriculum for compulsory subjects
1. SECTION OF BASIC DISCIPLINES
1.1. SOCIAL AND HUMANITARIAN MODULE

1.1.1. Philosophy

Parameter	Content
Brief description of the discipline	Philosophy is a social science whose subject is the knowledge of the truth of being, and whose object is everything that exists: nature, society, man and his cognitive abilities.
Types of classes	Lectures, seminars, independent work of students under the guidance of a teacher
Language of instruction	Tajik, Russian

Competencies developed in a student while mastering the discipline	- Ability to search, critically analyze and process information, systematically use knowledge in solving assigned tasks; - Ability to understand the cultural diversity of society on a socio-historical, ethical and philosophical basis.
Learning outcomes achieved in the study of the discipline	**Know:** - the need to study philosophy, the main concepts and tasks of philosophy, historical stages of development of science, the difference between philosophy and other social sciences, the connection of philosophy with social and humanitarian, natural science and technical disciplines; - civilizations and globalization of cultural values, the revival of ethical and educational traditions; - the history of the formation of the Tajik nation; - the role of philosophical knowledge in society, the value of philosophical ideas in the context of technogenic and information society; - basic scientific methods and philosophical methodologies for conducting one's own research work. **Be able to:** - correctly analyze philosophical ideas; - understand and interpret philosophical concepts and categories; - distinguish the views of representatives of philosophical schools on issues of ontology and epistemology; - take into account the features of philosophical concepts depending on the stages of development of philosophy; - apply philosophical methods to solve current life issues; - give definitions to key philosophical concepts; - understand modern current problems and ways to solve them. **Master:** - analytical thinking skills; - theoretical and practical research skills; - skills of cooperation with colleagues.
Contents of sections/topics of the discipline	- History of Philosophy - Ontology - Gnoseology - Philosophy of Development - Social Philosophy - Philosophical Anthropology - Philosophy of Science
Educational and technical means	Personal computer, projector, electronic board
Forms of current control	Test assignments, individual interviews
Final assessment form	Exam (test, computer)

1.1.2. Political Science

Parameter	**Content**
Subject: Modern History of Tajikistan	**Brief description of the discipline :** Modern history of Tajikistan is a social science that studies the main stages of events of past years, economic, social, political and cultural life during the period of independence of Tajikistan to the present day. The goal is to provide students with knowledge about the events of modern Tajik statehood. **Types of classes :** lectures, seminars, independent work under the guidance of a teacher **Language of instruction :** Tajik, Russian **Student competence:** analysis of historical events, understanding of political, economic and cultural dynamics,

	working with sources **Learning outcome:** to know key events, to understand the relationship between various spheres of state life, to be able to analyze and conduct research work **Chapter titles:** stages of independence, political system, economy and social life, culture and traditions **Educational and technical means :** projector, interactive whiteboard, computers, teaching materials **Type of current control:** tests, assignments, seminar discussions **Form of assessment of the final result of mastering the subject :** exam (test, written)
Type of activity	Lectures, seminars, independent work of the student under the guidance of the teacher
Language studies	Tajik, Russian
Competencies developed in a student while mastering a subject	The ability to search, critically analyze and process information, systematically use it to solve assigned tasks;
Learning outcomes obtained when studying the subject A student who has mastered this subject should:	Learning outcomes obtained from studying the subject: A student who has mastered this subject should: **Know:** • the need to study the modern history of Tajikistan, the basic concepts, tasks of history, historical stages of the country's development, the relationship with social, humanitarian, natural science and technical disciplines, the formation of ideas about the statehood of modern Tajikistan; • the role of historical knowledge in society, understanding the historical development of the Tajik people, the main historical documents of the country's development; • basic scientific methods and methodologies of history for research. **Be able to:** • to form a correct understanding of the historical development of modern Tajikistan; • understand and explain historical concepts and categories; • distinguish between historical approaches depending on the stages of historical development; • understand current contemporary issues and ways to solve them. **Master:** • analysis skills; • theoretical and practical research skills; • skills of cooperation with classmates.
List of sections/subject topics:	• Society of Tajikistan in the process of modern history • Formation of science, education and culture in the course of modern history of Tajikistan • Formation of social, economic, legal and political spheres in the process of modern history of Tajikistan
Educational and technical means of the discipline	textbooks, multimedia presentations, projector, computer, electronic board

Forms of current control	test assignments, individual interviews, practical assignments.
Form of assessment of the final result of studying the subject	exam (test, computer)

1.1.3. Law by specialty

Brief description of the subject	Jurisprudence is a scientific discipline that is the basis for studying other legal disciplines. This course studies the basic and general concepts of the origin, essence, forms, types and functions of the state and law, issues related to the system of normative regulation, legal relations, their implementation, application and interpretation of law, the consequences of improper execution of law, laws and legal order, the national legal system and legal families of the civilized world, the essence and functions of the rule of law, the social state, the formation of civil society, the fate of the state and law.
Type of activity	lectures, practical (problem solving), independent work of the student under the guidance of the teacher
Language studies	Tajik
Competencies that a student must develop in the process of mastering this subject	• The ability to search, critically analyze and process information, systematically use these skills in solving assigned tasks; • Understanding the legal, social and historical-cultural aspects of society; • Ability to apply basic legal principles and norms in the analysis and practical application of law.
The learning outcomes that a student should achieve when studying a subject	**Know:** • Basic concepts and objectives of law, structure and functions of the state and law; • The procedure for the formation of the regulatory framework, legal relations and their application; • Principles and methods of legal regulation, national legal system and international legal families; • The role of law in society, the tasks of the rule of law and civil society. **Be able to:** • Apply legal norms to specific life and professional situations; • Analyze and distinguish between various legal concepts; • Interpret legal documents and legislation; • Solve legal problems using scientific and methodological approaches. **Acquire skills:** • Analytical skills; • Research skills; • Ability to work in a team and collaborate with colleagues.

List of sections and topics of the subject	• concept of law; • legal norms; • sources of law; • creation of law; • legal system and legislative system; • legal technique; • legal regulation; • legal relations; • implementation of rights; • interpretation of law; • the effect of law and violation of law; • legal liability.
Educational and technical means of providing the subject	projector, computer, electronic board
Current control type	Midterm exam (P-1, P-2)
Form of assessment of the final learning outcome in the subject	Exam (test - computer, oral)

1.1.4. Economic Theory

Brief description of the subject	Economic theory is a social science that studies the rational use of limited economic resources in the context of unlimited human needs.
Type of activity	Lectures, seminars, independent work of the student under the guidance of the teacher.
Language studies	Russian, Tajik
Competencies that a student must develop in the process of mastering this subject	The perception and understanding of economic processes are based on the emergence of economic phenomena; the level of perception, the degree of coverage and development of these phenomena directly depend on the level and stage of development of social production. It is the stages of economic development, the "cores" and factors that determine the level of perception and understanding of economic events and processes. • Study of economic processes based on the methodology of economic theory; • Analysis of facts and figures, as well as determination of the prospects for the activities of economic entities. Economic life is considered as a set of countless and disparate economic phenomena and processes regulated by laws and regularities that are not subject to external order. Therefore, means or levers are needed by which the activity of spending and using resources (disorderly) will be taken into account, regulated and directed towards achieving a certain goal.

The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **Know:** • goals and essence of macroeconomics; • macroeconomic indicators and the system of national accounts; • economic development and the need for financing; • indicators of balance and imbalance of the macroeconomy; • state monetary and credit system; • financial system and state budget; • sources of income of the population, standard of living and poverty; • important issues of the global economy; • currency system and exchange rate. **Be able to:** • explain the goals of the national economy; • present methods of calculating macroeconomic indicators and the national accounting system; • show the sources and forms of economic development; • explain inflation, money depreciation and the credit crisis; • analyze the banking system and the amount of money required for circulation; • explain the budget deficit, the tax system and the fiscal policy of the state; • determine the indicators of the standard of living and social policy of the state; • explain global markets, international economic integration and labor migration; • explain the patterns of the emergence of money and currency relations. **Acquire skills:** • analysis; • theoretical and practical research; • cooperation with colleagues.
List of sections and topics of the subject	• Macroeconomic theory. Objectives and instruments of macroeconomic policy • Theory of consumption, savings and investment • Theory of macroeconomic equilibrium • Economic growth is the result of the national economy's activity • Cyclical development of the economy • Causes, consequences and forms of economic crises • Theory of employment and unemployment • Monetary system • Inflation and measures to combat it • Modern credit and banking system • Financial system and financial policy of society • Fiscal policy of the state, taxes and tax system • Population income • Social policy of the state and its main directions • Theoretical issues of world economy • International financial and monetary system
Educational and technical means of	projector, computer, electronic board

providing the subject	
Current control type	Midterm exam (P-1, P-2)
Form of assessment of the final learning outcome in the subject	Exam (test - computer, oral)

1.2. MODULE OF LANGUAGE DISCIPLINES

1.2.1. Tajik language for specialty

Brief description of the subject	**Tajik language for specialty** – The program is developed on the basis of the "Curriculum for the Tajik language (for students of non-specialized faculties of higher professional educational institutions)" of the Ministry of Education and Science of the Republic of Tajikistan in 2016 for non-philological faculties. The goal of the Tajik language study program is to increase and improve the level of written and oral literacy of students, develop public speaking skills, expand vocabulary and terminology in the specialty through vocabulary work, mastering office work and other skills.
Type of activity	Lectures, seminars (practical), independent work of the student under the guidance of the teacher.
Language studies	Tajik
Competencies that a student must develop in the process of mastering this subject	• Compliance with the norms of the Tajik literary language. • Compliance with the spelling of the Tajik literary language in written speech. • Development of oral speech based on compliance with pronunciation norms. • Memorizing difficult to understand words and special terms.
The learning outcomes that a student should achieve when studying a subject	Improving language proficiency. Studying the norms of the Tajik literary language. Ways to develop written and oral speech. Forming and improving vocabulary. Correct use of writing norms in official documents. Memorizing difficult-to-understand words, phrases and figurative expressions from the works of Tajik writers.
List of sections and topics of the subject	The most important sections of linguistics: • Phonetics • Lexicology (dictionary) • Morphology and syntax • Phraseology • Graphic signs • Stylistics
Educational and technical means of providing the subject	projector, computer, electronic board
Current control type	Completing exercises, analyzing texts and specialized vocabulary, preparing official documents; survey using questionnaires (cards); individual interview (upon admission to the KMRO); test assignments (during the rating).

Form of assessment of the final learning outcome in the subject	Exam (test - computer, oral)

1.2.2. Russian language by specialty

Brief description of the subject	Russian language by specialty - The program is developed on the basis of the "Curriculum for the Russian language (for students of non-philological specialties of higher professional education institutions)" of the Ministry of Education and Science of the Republic of Tajikistan 2016 for non-philological faculties. The Russian language is considered the language of interethnic communication. It has a beneficial effect on enriching our national language. Literary and social thinkers - classical Russian poets - wrote about the richness and expressiveness of the Russian language in their works. The Russian language in the specialty is used to improve the students' speech culture, their awareness, language competence and communication skills in this language. In the specialty, the Russian language is used to improve oral and written speech, master professional texts, analyze and explain their content.
Type of activity	Lectures, seminars (practical), independent work of the student under the guidance of the teacher.
Language studies	Russian
Competencies that a student must develop in the process of mastering this subject	• **Possession of** skills in analyzing information obtained during the learning process, improvement of knowledge and skills in the specialty, as well as their practical application to solve assigned tasks. • **Ability to** correctly construct sentences using professional vocabulary and expressions.
The learning outcomes that a student should achieve when studying a subject	A student who has completed this course should know: • The importance of studying the Russian language, basic rules of grammar and spelling; • Correct pronunciation of sounds in syllables and words, correct use of words in cases, declension of nouns, adjectives, pronouns, numerals and verb forms; • Types of expressions, rules for constructing phrases and sentences in Russian; • Rules for the correct use of punctuation marks. The student should be able to: • Use professional words and expressions in the chosen specialty when preparing abstracts, reports, term papers; • Conduct a conversation on various topics using fiction and professional literature; • Apply acquired knowledge and skills in your research activities. The student must master: • Analytical and critical thinking skills; • Conducting scientific research work; • Ability to communicate and collaborate with colleagues and others.

List of sections and topics of the subject	• Basic information about the language; • The main sections of the Russian language course (phonetics, vocabulary, lexicology, phraseology, the concept of grammar: morphology, syntax, stylistics, spelling).
Educational and technical means of providing the subject	projector, computer, electronic board
Current control type	Completing exercises, analyzing texts and specialized vocabulary, preparing official documents; survey using questionnaires (cards); individual interview (upon admission to the KMRO); test assignments (during the rating).
Form of assessment of the final learning outcome in the subject	Exam (test - computer, oral)

1.2.3. Foreign language (English) by specialty

Brief description of the subject	English as a foreign language is one of the Western languages of the Germanic group, which is currently used in Great Britain, Ireland, North America, Australia, New Zealand, Canada, as well as in a number of countries in Asia and Africa; more than 500 million people on our planet currently speak this language. The main goal of studying English as a foreign language is the practical use of the language in order to master it as a means of communication and acquire the necessary skills for successful language learning.
Type of activity	Lectures, seminars (practical), independent work of the student under the guidance of the teacher.
Language studies	English
Competencies that a student must develop in the process of mastering this subject	mastering the methods of pronouncing sounds, intonation, stress and the main features of full pronunciation characteristic of professional vocabulary; mastering the main grammatical topics, correctly translating sentences, understanding the content of the text, answering questions, enriching the professional vocabulary and briefly summarizing the content of the professional text.
The learning outcomes that a student should achieve when studying a subject	A student who has completed this course should: **Know:** • the purpose of learning English, the role of English in the development of the energy sector, the growing importance of English in the life of modern Tajik society; the culture and historical traditions of the countries of the studied language, communication norms, speech etiquette, and dialogue skills. **Be able to:** **a) Understanding (** comprehension **):** understand the content of exercises compiled on the basis of the studied lexical and grammatical material. **b) Oral speech:**

	• retell the content of a read or listened to text, audio and video material, completed exercises based on the studied vocabulary; • conduct a conversation on the topic studied; • read and retell individual and home texts; • briefly discuss current life issues; • provide definitions of key professional terms. **c) Reading:** master the skills of working with text (conjugation, logical structuring and proving one's position), develop the skills of preliminary reading, familiarization and study of educational materials. **d) Written speech:** be able to convey the content of a read or listened to text in writing. **Master:** • discussion skills; • analysis skills; • review skills; • communication skills.
List of sections and topics of the subject	• Phonetics • Lexicology • Morphology • Syntax • Phraseology • Style of management
Educational and technical means of providing the subject	projector, computer, electronic board
Current control type	Completing exercises, analyzing texts and specialized vocabulary, preparing official documents; survey using questionnaires (cards); individual interview (upon admission to the KMRO); test assignments (during the rating).
Form of assessment of the final learning outcome in the subject	Exam (test - computer, oral)

1.3. MODULE OF NATURAL ECONOMIC SCIENCES

1.3.1. Economic Geography of Tajikistan with Basics of Demography

Brief description of the subject	Economic Geography of Tajikistan with Basics of Demography is a subject that studies all the changes that occur in the economy and social sphere of the country during the transition to market relations. This course provides students with knowledge about the patterns of development and distribution of the country's productive forces (population, industry, agriculture, transport, construction and trade, demographic situation, external relations, etc.).
Type of activity	lectures, practical classes in the classroom, solving assignments, preparing reports, completing independent work, discussions, business games, testing and similar forms.
Language studies	Tajik, Russian

Competencies that a student must develop in the process of mastering this subject	• master the content of the basic concepts of economic-geographical and social geography of Tajikistan; • know the basics of economic zoning, levels, principles and basic standards; • fully understand the essence of the location of production based on the availability of raw materials, energy, fuel and industries requiring raw materials, labor and energy; • to master the methods of developing resources and natural conditions, effective ways of using them, protecting nature and the environment; • have sufficient information about the development of priority industries.
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **Know:** • the need to study the economic and geographical geography of Tajikistan with the basics of demography, the main concepts, objectives of the subject, the historical stages of its development, the difference between economic and geographical geography with the basics of demography from other social sciences, as well as its connection with the social and humanitarian, natural and mathematical and technical sciences; • history of development and tasks of economic and geographical geography of Tajikistan with the basics of demography; • determine the role of geographical knowledge in society, study the main scientific methods and approaches. **Be able to:** • predict demographic processes; • understand and explain geographic and demographic concepts and categories; • provide definitions of key geographic and demographic concepts; • participate in classes and practical exercises, observing the established rules of the university; • explain the content of basic geographical concepts; • without knowledge of the manifestations of economic and geographical features of Tajikistan and the world, continuing to study economic specialties and complexes is impossible; • use methods for the development of natural resources, their effective use and protection of nature and the environment; • explain the variety of placement factors. **Master:** • analysis skills; • theoretical and practical research skills; • skills of collaboration with colleagues.
List of sections and topics of the subject	• history of development and tasks of economic and geographical geography of Tajikistan with the basics of demography; • nature as an important factor in the territorial organization of the economy; • territorial organization of the economy and production complexes; • population as an important factor in the location of production;

	• The Republic of Tajikistan on the political map of the world; • natural conditions and natural resources of the Republic of Tajikistan; • Geography of the world population; • geography of natural resources of the world; • international tourist geography; • geography of world economic sectors.
Educational and technical means of providing the subject	projector, computer, electronic board
Current control type	Completing exercises, analyzing texts and specialized vocabulary, preparing official documents; survey using questionnaires (cards); individual interview (upon admission to the KMRO); test assignments (during the rating).
Form of assessment of the final learning outcome in the subject	Exam (test - computer, oral)

1.3.2. Ecology

Brief description of the subject	Ecology is a science that studies the relationships between living and nonliving organisms in nature. The environment creates all the conditions necessary for life, without which man could not and cannot exist. In the course of its historical development, man has destroyed thousands of species of animals and plants to meet his needs, threatening not only the environment, but also food sources, building materials and nutritional resources for the animal world. The main reason for this behavior is that many individuals, nations and some social groups are either unaware of the consequences of the ecological crisis, or the ecological culture of these groups is insufficiently developed. The purpose of studying the discipline "Ecology" is to train competent specialists with both theoretical and practical knowledge.
Type of activity	Lectures, practical classes, independent work of the student under the guidance of the teacher
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	• Analysis and practical solution of environmental problems with the aim of reducing anthropogenic impact during production activities and implementation of economic projects of the country from an environmental point of view; • Rational use of natural resources (including water, soil and plants) and their protection; • • Ensuring the correct operation of gas and dust collection systems, wastewater treatment and processing of industrial and household waste as secondary raw materials.

The learning outcomes that a student should achieve when studying a subject	A student who has mastered this discipline should: **Know:** • the need to study ecology, basic concepts, tasks of ecology, historical stages of the development of science, the difference between ecology and other technical and biological sciences, the relationship between ecology and economic and natural-mathematical sciences, environmental laws and the circulation of substances in nature; • the current and future state of the natural environment, forecast of anthropogenic impact on the environment and rational use of surface and underground resources; • the role of environmental knowledge for specialists in various areas of the economy (industry, energy, transport, etc.); • basic scientific methods of ecology for developing plans and projects for the country's economy from an environmental point of view, and conducting scientific research activities. **Be able to:** • formulate correct conclusions when analyzing the physical and chemical characteristics of the environment and anthropogenic impact on the atmosphere, water and land; • apply and comply with legal frameworks, the Red Book, concepts and environmental standards for various production areas; • understand current modern problems and ways to solve them; • to develop the environmental culture of the population, improve the environment and promote sustainable development; • conduct environmental monitoring in various ecosystems and provide the results of the analysis to the public; • identify various methods of waste treatment and use for environmental protection; • to solve global, regional and local environmental problems of Tajikistan and protected areas. **Master:** • analytical skills; • theoretical and experimental research skills; • ability to collaborate with colleagues.
List of sections and topics of the subject	• environmental protection • science ecology • social ecology • economic ecology • urban ecology • industrial and agricultural ecology • transport ecology • energy ecology

Educational and technical means of providing the subject	projector, computer, electronic board
Current control type	Test assignments, individual interview
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

SECTION OF SPECIAL DISCIPLINES
2.1. MODULE OF GENERAL PROFESSIONAL DISCIPLINES
2.1.1. Mathematical analysis

Brief description of the subject	**Mathematical analysis** is one of the main branches of mathematics, closely related to the emergence and development of its other sections. It is in this course that students become familiar with general scientific methods, such as analysis, induction, deduction and conclusions, and acquire the ability to use them to solve various problems. The purpose of studying the discipline is to provide students with deep theoretical knowledge and practical skills in the field of mathematical analysis, which are necessary for understanding and mastering specialized disciplines. For this reason, the course introduces students not only to theoretical concepts, but also to their practical application in solving problems.
Type of activity	Lectures, laboratory, practical (problem solving), independent work of the student under the guidance of the teacher
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	The student must: • have a high sense of responsibility, attend classes on time and have study materials with you; • pay special attention to self-study, self-education, self-management and self-assessment, constantly implement and apply them in practice; • consolidate your knowledge together with your classmates and take an active part in each other's scientific development; • be able to analyze and reason about processes in the field of computer science using the basic laws of mathematical analysis; • be able to analyze and process computer science problems using formulas and laws of mathematical analysis; • develop technical thinking and, depending on the area of activity, generate new ideas.
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this discipline should: **Know:** • concepts of mathematical analysis; • methods of calculating concepts of mathematical analysis;

	• development of logical thinking and mathematical reasoning; • application of concepts in solving practical problems of mathematical analysis; • digital methods for solving mathematical problems using a computer; • special sections of mathematical analysis necessary for studying specialized disciplines. **Be able to:** • use the concepts of mathematical analysis when solving and discussing problems of professional activity; • develop a correct understanding of the concepts of mathematical analysis and their basic properties; • understand and explain the concepts of mathematical analysis in the context of professional activities; • apply in practice theorems and basic formulas of mathematical analysis to solve problems that arise in professional activities; • explain and quantify concepts of mathematical analysis; • understand current technical problems and ways to solve them. **Master the skills:** • solutions to examples and problems of mathematical analysis; • analysis and logical understanding of the concepts of mathematical analysis; • getting out of difficult situations using mathematical analysis algorithms; • conducting theoretical and practical research.
List of sections and topics of the subject	• real numbers and sequences; • the concept of a function, the limiting value of a function and its continuity; • Fundamentals of differential calculus; • antiderivative function and indefinite integral; • integration of rational and irrational expressions, integration of trigonometric expressions; • definite integral and its application; • improper integrals; • functions of several variables; • basic concepts and continuity of functions of several variables; • partial and total derivatives of a function of several variables; • partial derivatives of functions of several variables and their differentials; • derivative of an implicit function; • derivative of a complex function, derivative of growth; • extrema of a function of several variables; • numerical and functional sequences; • numerical and functional series.
Educational and technical means of	Teaching aids, personal computer, projector, electronic board

providing the subject	
Current control type	Laboratory assignments, individual interviews, problem solving, monitoring of independent work
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

2.1.2. Algebra and Geometry

Brief description of the subject	**Algebra and Geometry** - introduces students to analytical methods for studying the properties of geometric objects, as well as some basic concepts of algebra and number theory. Algebra and Geometry are directly related to the discipline **"Mathematical Analysis"** and serve as the foundation for studying such courses as **Differential Equations, Computational Mathematics, Optimization Methods** .
Type of activity	Lectures, laboratory, practical (problem solving), independent work of the student under the guidance of the teacher
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	The student must: • have a high sense of responsibility, attend classes on time and have educational materials with you; • pay special attention to self-study, self-education, self-management and self-assessment, constantly carry them out and apply them in practice; • strengthen your knowledge together with your fellow students and take an active part in their scientific development; • be able to analyze and reason about processes in the field of computer science using basic mathematical laws; • be able to analyze and process computer science problems using formulas and mathematical patterns; • develop technical thinking and, depending on the area of activity, generate new ideas.
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **Know:** • concepts of geometry, algebra and number theory; • methods for calculating geometric and algebraic concepts; • development of logical thinking and mathematical reasoning; • application of concepts in solving practical problems in geometry and algebra; • digital methods for solving geometric and algebraic problems using a computer; • special sections of geometry and algebra necessary for studying specialized disciplines.

	Be able to: • use geometric and algebraic concepts when solving and discussing problems of professional activity; • develop a correct understanding of the concepts of algebra and geometry and their basic properties; • understand and explain the concepts of the subject in the context of professional activity; • apply in practice theorems and basic formulas to solve problems that arise in professional activities; • explain and quantify the concepts of the subject; • understand current technical problems and ways to solve them. **Master the skills:** • solutions to examples and problems in algebra and geometry; • analysis and logical understanding of the concepts of the subject; • getting out of difficult situations using mathematical algorithms; • conducting theoretical and practical research.
List of sections and topics of the subject	• Cartesian coordinate system on a line, plane and in space; • other coordinate systems; • the simplest problems of analytical geometry; • vectors and operations with them; • projection of a vector onto a direction; • linear dependence of vectors; • basis on the plane and in space; • scalar and vector product of two vectors; • mixed product of three vectors; • coordinates of space and plane; • the distance between two points in space and on a plane; • equation of a line and a plane; • matrices and linear operations with them; • determinant of a square matrix and its properties; • systems of linear algebraic equations, homogeneous and non-homogeneous; • second order curves and their equations; • algebraic surfaces and their equations; • number theory and problems related to it; • Basic concepts of number theory.
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, electronic board
Current control type	Laboratory assignments, individual interviews, problem solving, monitoring of independent work
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

2.1.3. Differential equations

Brief description of the subject	**Differential equations** are one of the main subjects of the curriculum of this specialty. Differential equations are widely used in variational calculus, optimal control, geometry, topology, mathematical physics and other fields. **The purpose of studying the subject** is to develop deep knowledge of the fundamentals of the theory of ordinary differential equations and to develop skills in applying this knowledge to research and solve specific problems encountered in various fields of natural sciences.
Type of activity	Lectures, laboratory, practical (problem solving), independent work of the student under the guidance of the teacher
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	• the student must have a high level of responsibility, attend classes on time and have educational materials with him; • pay special attention to self-study, self-education, self-management and self-assessment, constantly carry them out and apply them in practice; • strengthen your knowledge together with your classmates, without showing indifference to their academic progress; • is able to analyze and reflect on processes in the field of computer science, using the basic laws of differential equations; • able to analyze and process computer science problems using formulas and laws of differential equations; • The student's scientific and practical thinking develops, new ideas are formed depending on the direction of his activity.
The learning outcomes that a student should achieve when studying a subject	**A student who has mastered this subject should:** **Know:** • concepts of differential equations and mathematical physics; • methods of differential equations and mathematical physics; • development of logical thinking and mathematical reasoning; • application of concepts in solving practical problems in differential equations and mathematical physics; • numerical methods for solving mathematical problems using a computer; • special sections of differential equations and mathematical physics necessary for studying professional disciplines. **Be able to:** • apply the concepts of differential equations and mathematical physics in solving and analyzing practical problems of professional activity; • to correctly form an opinion about the concepts of differential equations and their basic properties; • understand and explain the concepts of differential equations (in the context of professional activities); • to practically apply theorems and basic formulas of differential equations to solve problems that arise in professional activities;

	• explain and evaluate the concepts of differential equations quantitatively; • understand current technical problems and ways to solve them. **Skill development:** • solving problems in differential equations and mathematical physics; • analysis and logical thinking on topics of differential equations and mathematical physics; • ability to find solutions to problems using algorithms of differential equations and mathematical physics; • carrying out theoretical and practical research.
List of sections and topics of the subject	**Differential equations** • Introduction to the discipline; • Basic concepts of differential equations; • Homogeneous linear differential equation; • Differential equations of the first and second order; • Homogeneous and inhomogeneous differential equations of higher order; • System of differential equations. **Differential equations of mathematical physics** • Basic concepts of partial differential equations; • Hyperbolic models and their solutions; • Parabolic models and their solutions; • Elliptic models and their solutions.
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, electronic board
Current control type	Laboratory assignments, individual interviews, problem solving, monitoring of independent work
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

2.1.4.Programming languages

Brief description of the subject	**Objectives and goals of the course "Programming Languages"** **Description:** Programming languages are one of the key areas of training future specialists in the field of computer science. Without knowledge of programming languages, it is impossible to become a full-fledged specialist in this field.

	Course objective: To teach future specialists the basics of algorithmization and program development in modern high-level programming languages. **Course objectives:** • To prepare students to create information models using modern programming languages; • To introduce programming technologies and object-oriented programming as a tool for solving practical problems; • To develop analytical and technological thinking, as well as the worldview of students; • To improve the programming culture and skills of independent design of software solutions; • To provide the opportunity for practical application of modern programming languages in educational, research and professional activities. **Learning outcome:** The student acquires deep knowledge of modern programming languages and is able to apply them in practical and research tasks.
Type of activity	Lectures, laboratory, practical (problem solving), independent work of the student under the guidance of the teacher
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	• skills in developing, inputting, debugging, searching, and maintaining various programs using programming languages and solving assigned tasks; • skills in using algorithms, flowcharts, and different programming languages; • for specialists in this field — skills in programming tasks related to informatics in various languages.
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **Know:** • the need to study the subject "Programming Languages", basic concepts, objectives of the subject, historical stages of the emergence and formation of languages, the connection of the subject with social and humanitarian, natural and mathematical and technical sciences, to have an idea of issues of the information society; • forms of presentation of algorithms; • elements of programming languages; • structures of programming languages; • programming environments; • components, methods and features of programming languages; • coding of information and forms of algorithms. **Be able to:** • correctly formulate and present problems in programming languages; • build algorithms for solving problems; • write programs based on developed algorithms;

	• enter programs into the computer, analyze and configure them; • receive the results of the program's work and check their correctness; • use different components to solve different problems; • prepare drafts of various programs; • apply the developed programs. **Skills acquired:** • skills in constructing and using algorithms; • skills in developing, testing and executing programs; • analytical skills; • theoretical and practical research skills; • skills of interaction and cooperation with colleagues.
List of sections and topics of the subject	Here is a translation of your list into Russian: • Introduction to the subject and basic concepts • Alphabet of programming language • The structure of a program in a programming language • Structures of programming languages • Complex structures of programming language • Strings and String Types • Subroutines and their development • Files and programming with them • Modern programming environments • Standard components of the programming language environment • Additional components of the programming language environment • Dialogue components of the programming language environment • Graphical and additional capabilities of the programming language environment
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, electronic board
Current control type	Course projects (2 projects), midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

2.1.5. Database in expert systems

Brief description of the subject	The main objective of the course "Databases and Diagnostic Systems" is to provide a conceptual understanding of the construction of databases, database management systems (DBMS), mathematical

	models describing databases, principles of database design, ensuring database security, as well as analysis of the application of technologies in the implementation of DBMS. This course teaches students professional knowledge of DBMS, DBMS objects and methods of their construction, the structure of data sources, data models and their security.
Type of activity	Lectures, laboratory, practical (problem solving), independent work of the student under the guidance of the teacher
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	• the ability to create, enter, search, analyze and process various information from data sources on a computer, use a DBMS when solving assigned tasks; • ability to work with various DBMS to build databases; • for specialists in this field - programming skills in SQL language and in the Oracle environment.
The learning outcomes that a student should achieve when studying a subject	**A student who has mastered this subject should:** **Know:** • the need to study this subject, basic concepts, objectives of the subject, historical stages of the emergence and formation of DBMS, the connection of the subject with technical sciences; • various information systems and the structure of their data; • DBMS software and its importance; • DBMS objects and their functions; • types of data models: hierarchical, network, relational; • methods of installing and configuring Sql Server DBMS; • Sql Server components and their functions; • Configuring the Database Engine server. **Be able to:** • install and configure Sql Server 2012 DBMS or its other versions; • use Sql Server components; • configure the Database Engine server; • work with the Management Studio program; • work with system data sources and their functions; • create various database objects in SQL Server; • use SQL and T-SQL language operators; • link tables, databases and integrate databases with other applications. **Acquire skills:** • analytical skills; • theoretical and experimental research skills; • ability to collaborate with colleagues.
List of sections and topics of the subject	• basic concepts, objectives of the subject, historical stages of the emergence and formation of DBMS, the connection of the subject with other sciences;

	• various information systems and the structure of their data; • DBMS software and its importance; • DBMS objects and their functions; • types of data models: hierarchical, network, relational; • Sql Server DBMS and its components; • Sql Server component functions; • Database Engine server; • Management Studio program; • system data sources and their functions; • creating various database objects in SQL Server; • use of SQL and T-SQL language operators; • • linking tables, databases and integrating the database with other applications.
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, electronic board
Current control type	midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

2.1.6. Optimization method

Brief description of the subject	**Optimization methods** – are taught to teach students the properties of extreme processes and systems that are used in science, technology, economics and social activities. A computer science specialist should be able to build optimization models and master the methods for solving them.
Type of activity	Lectures, laboratory, practical (problem solving), independent work of the student under the guidance of the teacher
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	• The student must be highly responsible, attend classes on time and have study materials with him; • Pay special attention to the processes of self-study, self-education, self-management and self-assessment, constantly carry them out and apply them in practice; • To consolidate your knowledge together with your classmates, without showing indifference to the joint educational process; • Be able to analyze and reason about processes in the field of computer science, using the basic laws of optimization methods; • Able to analyze and process computer science problems using formulas and laws of optimization methods; • The student's scientific and practical thinking develops, and depending on the direction of activity, a new vision is formed.
The learning outcomes that a student should	A student who has mastered this subject should:

achieve when studying a subject	**Know:** • basic concepts of the discipline "Optimization Methods"; • basic methods of the discipline "Optimization Methods"; • development of logical thinking and mathematical reasoning; • application of concepts in solving practical problems of optimization methods; • numerical methods for solving mathematical problems using optimization methods; • special sections of optimization methods necessary for studying professional disciplines. **Be able to:** • use the concepts of optimization methods when solving and analyzing problems of professional activity; • correctly understand the basic properties of optimization methods; • understand and explain the concepts of optimization methods in the context of professional activities; • apply in practice theorems and formulas of optimization methods to solve problems in the professional sphere; • explain and quantify the concepts of optimization methods; • understand current technical problems and ways to solve them. **Acquire skills:** • solutions to examples and problems using optimization methods; • analysis and reasoning on the concepts of optimization methods; • getting out of difficult situations using algorithms and models of optimization methods; • conducting theoretical and practical research.
List of sections and topics of the subject	• Introduction, purpose and main objectives of the discipline "Optimization Methods"; • Optimization methods in finite-dimensional spaces; • Mathematical programming and its components, linear programming; • Optimization methods in functional spaces; • Optimality principle, discrete Bellman equation; • Dynamic programming methods, variational calculations; • Moses method; • Changing pipe methods; • • Krotov's method.
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, electronic board
Current control type	midterm exams (P-1, P-2).
Form of assessment of the final learning	Exam (test - computer)

outcome in the subject	

2. SEPARATE PART OF SPECIAL DISCIPLINES
2.2. MODULE OF SPECIAL DISCIPLINES
Specialty 1-31 03 04 00 – Computer Science

2.2.1. Fundamentals of computer science and theory of algorithms

Brief description of the subject	**Fundamentals of computer science and the theory of algorithms.** This is a technical science that studies the methods and means of data processing using electronic computers, as well as information processes in technical systems, nature and society. **The purpose of studying the discipline "Fundamentals of computer science and the theory of algorithms"** is to teach future specialists the use of technical and software tools, methods of presenting and transmitting information, including the use of office software to solve professional problems, as well as mastering the methods of constructing algorithms and the basics of programming languages.
Type of activity	Lectures, laboratory, practical (problem solving), independent work of the student under the guidance of the teacher
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	• Skills of entering, searching, storing, analyzing and processing information on a computer and their use in solving assigned tasks; • Skills in working with programs, networks and various computer devices; • For specialists in this field - programming skills in various languages.
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **Know:** • the need to study the subject "Information Technology", basic concepts, objectives of the subject, historical stages of the emergence and development of computers, the connection of the subject with social and humanitarian, natural and mathematical and technical sciences, ideas about the problems of the information society; • computer technical support; • computer software; • basics of 2-3 programming languages; • information coding and forms of presentation of algorithms. **Be able to:** • correctly format and present solutions to programming problems; • build algorithms for solving problems; • write programs based on the created algorithms;

	• enter the program into the computer, analyze and configure it; • receive the results of the program's work and check their correctness; • use office applications (word processors and spreadsheets); • prepare visual presentations (slides) for speeches; • work with graphic and antivirus programs. **Master:** • analytical skills; • theoretical and practical research skills; • ability to collaborate with colleagues.
List of sections and topics of the subject	• Introduction to the subject and basic concepts • Computer hardware • Computer software • Operating systems (Windows OS) • Microsoft Word text editor • Microsoft Excel Spreadsheets • Using visual presentations (slides) for presentations • Database management systems (MS Access, MS SQL) • Graphic programs with functional coloring • Development of algorithms and application of computing systems • Programming languages (environments) • Antivirus programs • Internet services
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, electronic board
Current control type	midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

2.2.2. Practical work on solving problems on a computer

Brief description of the subject	The practice of solving problems on a computer is one of the key areas of training future specialists in the field of computer science. Without knowledge of programming, it is impossible to become a full-fledged specialist in this field. The purpose of studying this course is to familiarize future specialists with the basics of algorithmization and program development in modern high-level programming languages. This, in turn, helps the student master the skills of designing information models using modern programming languages, programming technologies and an object-oriented approach as a means of solving practical problems.

	The course promotes the development of logical thinking and technological outlook of students, and enhances the culture of programming. The training introduces students to the inherent capabilities of modern programming languages, providing unique skills for their practical application and research activities.
Type of activity	Practical classes and independent work of the student under the guidance of the teacher (course projects).
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	• Skills in developing, entering, correcting, searching and storing various programs using programming languages and solving assigned tasks; • Skills in using algorithms, flowcharts and various programming languages; • For specialists in this field, programming skills for computer science-related tasks in various programming languages.
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **Know:** • the need to study the subject "Programming", basic concepts, objectives of the discipline, historical stages of the emergence and formation of programming languages, the connection of the subject with social and humanitarian, natural and mathematical and technical sciences, as well as ideas about the problems of the information society; • forms of presentation of algorithms; • elements of programming languages; • structures of programming languages; • programming language environment; • composition, methods and features of programming languages; • coding of information and forms of algorithms. **Be able to:** • correctly formulate solutions to programming problems; • create algorithms for solving problems; • write programs based on developed algorithms; • enter the program into the computer, analyze and configure it; • receive program results and analyze their correctness; • use different components to solve different problems; • prepare drafts of various programs; • use the developed programs. **Master:** • skills in creating and using algorithms; • skills in developing, testing and executing programs; • analysis skills; • theoretical and practical research skills; • skills of collaboration with colleagues.

List of sections and topics of the subject	• Introduction to the subject and basic concepts • Alphabet of programming language • Program structure in programming languages • Structures of programming languages • Complex programming structures • Strings and String Types • Subroutines and their development • Files and programming with them • Modern programming environments • Standard components of programming environments • Additional components of programming environments • Dialog components of programming environments • Graphical and additional capabilities of programming environments
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, electronic board
Current control type	Course projects (2 projects), midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

2.2.3. Operations Research and Game Theory

Brief description of the subject	Operations research and game theory are designed to introduce students to the fundamentals of decision making and to explore models of operations in various real-life settings.
Type of activity	Lectures, practical classes, independent work of students under the guidance of a teacher (calculation and graphic work)
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	• the student must have a high sense of responsibility, attend classes on time and have educational materials with him; • pay special attention to the processes of self-study, self-education, self-management and self-assessment, constantly carry them out and apply them in practice; • strengthen your knowledge together with your classmates and do not show indifference to equal development in learning; • is able to analyze and reason about processes in the field of computer science, using the basic laws of operations research and game theory; • able to analyze and process computer science problems using formulas and patterns of operations research and game theory; • The student's scientific and practical thinking develops, and depending on the direction of activity, new views are formed.
The learning outcomes that a student should	**A student who has mastered this subject should:** **Know:**

achieve when studying a subject	• basic concepts of the discipline "operations research and game theory"; • basic methods of the discipline "operations research and game theory"; • development of logical thinking and mathematical reasoning; • application of concepts in solving practical problems of operations research and game theory; • numerical methods for solving mathematical problems using operations research and game theory; • special sections of operations research and game theory necessary for studying specialized disciplines. **Be able to:** • apply concepts of operations research and game theory to solving and examining life and professional problems; • to form a correct understanding of the concepts of operations research and game theory and their basic properties; • understand and explain the concepts of operations research and game theory (depending on professional activity); • to practically apply the basic theorems and formulas of operations research and game theory to solve problems arising in the professional sphere; • be able to explain and quantify the concepts of operations research and game theory; • to understand the current technical problems of our time and ways to solve them. **Acquire skills:** • solutions to problems and examples in operations research and game theory; • analysis and understanding of the concepts of operations research and game theory; • ability to overcome challenges using algorithms and models of operations research and game theory; • conducting theoretical and practical research.
List of sections and topics of the subject	• introduction, purpose and main objectives of the discipline “operations research and game theory”; • the role of studying operations research and game theory in life; • linear models of operations research and game theory; • linear programming, model building; • transport model and its research; • resource management model, basic integer programming models; • game models, matrix games; • stochastic models; • simulation (modeling) models; • decision-making process, its elements and conditions.
Educational and technical means of	Teaching aids, personal computer, projector, electronic board

providing the subject	
Current control type	midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

2.2.4. Mathematical and computer modeling

Brief description of the subject	The purpose of this discipline is to ensure deep and conscious acquisition by doctoral students of knowledge about the process of transformation, transfer and use of mathematical modeling in solving the assigned tasks. During the study of the discipline, doctoral students should understand the importance of mathematical modeling in accordance with modern scientific ideas about the world, be able to describe the role of mathematical modeling and modern object-oriented languages in the development of a new society, and also develop their skills and abilities in using a computer in the educational process for future professional activities.
Type of activity	Lectures, laboratory classes, independent work of students under the guidance of a teacher, practical independent work of students.
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	**ideological** , associated with the formation of a systemic and informational understanding of the world, the unity of the community of management processes in living nature, society and technology; • **technological** , associated with the formation of computer knowledge and information culture; • **algorithmic** , associated with the development of thinking about algorithms, methods of their expression and implementation.
The learning outcomes that a student should achieve when studying a subject	**A student who has mastered this subject should:** **Know:** • development of skills for rational and effective use of a computer in the daily activities of doctoral students; • preparing doctoral students for a full and active life in the information society and, on this basis, improving their information culture; • explaining the essence of information processes in the scientific worldview of doctoral students and revealing the role of information technologies in modern society; • widespread use of new information and communication technologies in the educational process; • ensuring sustainable development of technology and computer technologies in all spheres of life. **Be able to:** • know the safety rules when working with a computer;

	• know the names and functional purposes of the main parts of the computer; • have a reasonable understanding of computer software; • be able to work correctly with a keyboard and mouse; • use the "system menu", program directories, etc. **Master:** • understand the essence of the concept of an algorithm, know its basic properties and be able to demonstrate them using specific examples; • understand the possibility of automating human activity using algorithms; • know the basic structures of algorithms and use them when creating algorithms; • apply the algorithm's command system to solve a specific problem; • be able to write an algorithm for solving a specific problem in any programming language.
List of sections and topics of the subject	• revival of mathematical modeling in the study of nature and society **;** • awareness of the general scientific essence of mathematical modeling as a method of scientific knowledge **.**
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, electronic board
Current control type	midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

2.2.5. Classical mathematical and computer models. Modeling in SCM

Brief description of the subject	The purpose of this course is to ensure comprehensive, solid and conscious acquisition by doctoral students of knowledge about the process of transformation, transfer and use of mathematical modeling in solving assigned problems. During the course of studying the discipline, doctoral students should understand the importance of mathematical modeling in accordance with modern scientific ideas about the world, be able to describe the role of mathematical modeling and modern object-oriented languages in the development of a new society, and also improve their skills and abilities in using a computer in the educational process for their future professional activities.
Type of activity	Lectures, laboratory classes, independent work of students under the guidance of a teacher, practical independent work of students.
Language studies	Tajik, Russian

Competencies that a student must develop in the process of mastering this subject	**ideological** - associated with the formation of a systemic and informational understanding of the world, the unity and community of management processes in wildlife, society and technology; • **technological** - associated with the formation of computer knowledge and information culture; • **algorithmic** - associated with the development of thinking about algorithms, methods of their expression and implementation.
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **To know:** • development of skills for skillful and effective use of a computer in the daily activities of doctoral students; • preparation of doctoral students for a full and active life in the information society and, on this basis, improvement of their information culture; • disclosure of the essence of information processes in the scientific worldview of doctoral students and understanding of the role of information technologies in the new society; • widespread use of new information and communication technologies in the educational process; • ensuring a solid mastery of computer equipment and technologies in all spheres of life. **Be able to:** ✓ know the safety rules when working with a computer; ✓ know the names and functional responsibilities of the main parts of the computer; ✓ have sufficient knowledge of computer software; ✓ work correctly with the keyboard and mouse; ✓ be able to use the "system menu", "program directories" and other means. **To master:** ✓ to understand the essence of the concept of "algorithm", to know its basic properties and to be able to demonstrate them using specific examples; ✓ to understand the possibilities of automating human activity using an algorithm; ✓ to know the basic structures of algorithms and to be able to use them when compiling algorithms; ✓ to be able to apply the algorithm command system to solve a specific problem; ✓ to be able to write an algorithm for solving a specific problem in one of the programming languages.
List of sections and topics of the subject	• the use of mathematical modeling in the study of nature and society; • understanding the general scientific essence of mathematical modeling as a method of scientific knowledge.
Educational and technical means of	Teaching aids, personal computer, projector, interactive whiteboard.

providing the subject	
Current control type	midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

2.2.6. Modeling of aquatic ecosystems. Mathematical modeling of complex systems

Brief description of the subject	The next stage of life and activity of people in the 21st century and in subsequent periods is the information society. In this society, the key role is played by the ability to effectively use various types of electronic equipment and the global Internet, especially computers and the latest mobile electronic devices. The implementation of the achievements of informatics and the introduction of information and communication technologies in all spheres of modern life are gradually bringing this stage closer. In this regard, the study of the disciplines of informatics and information and communication technologies, especially mathematical and computer modeling of various processes occurring in nature, society and technology, which constitute the essence of their research topics, is the most important factor in the formation of knowledge, skills and professional competence of future specialists in the field of informatics.
Type of activity	Lectures, laboratory classes, independent work of students under the guidance of a teacher, practical independent work of students.
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	**the first aspect** consists of studying the information system of the representation of the world and the general information patterns of the structure and functioning of self-governing systems, such as biological, social and technical systems. The peculiarity of these systems is manifested in their ability to perform targeted actions, and their behavior is regulated by the organs of perception, transformation and implementation of information; – **the second aspect** is devoted to the study of methods and technical means of searching, collecting, storing, transforming, transmitting and using information using a computer and modern technological means. This aspect is primarily associated with the application of educational material in life and preparing students for practical activities.
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **To know:** – the content, essence, features and objectives of the special course "Computer modeling of aquatic ecosystems"; – understanding the concept of information and knowledge of the methods of its measurement; – the concepts of a model, simulation, mathematical modeling, computer modeling; – theoretical and practical foundations of computer modeling; – the place of the discipline "computer modeling" in the system of computer sciences; – the essence of

	information processes, the structure and functions of information systems, the principle of feedback, the commonality of information principles for the construction and functioning of aquatic systems. **To be able to:** - have the ability to independently master new research methods, develop scientific and practical professional activity; - be able to apply the acquired knowledge and skills in practice; - be able to analyze and use various sources to understand scientific phenomena; - be able to independently prepare assignments related to scientific problems; - be able to apply the basic units of information measurement; - be able to apply forms of computer representation of quantities; - be able to transmit, record and process information about nature, society and technology; - have an idea of information systems, the commonality of information principles of construction and functioning of their control parts, regardless of their nature; - have an idea of the principles of operation of closed and open type control systems, as well as their feedback. **To master:** - modeling as a method of scientific research; - basic principles of formation and methods of construction of computer models; - technological sequence of computer problem solving: problem setting, model construction, development and implementation of an algorithm, analysis of intermediate and final results; - be able to create models of water body ecosystems and study them on a computer.
List of sections and topics of the subject	Water bodies as ecological systems – Conceptual modeling of fish populations in aquatic ecosystems – Mathematical modeling of fish populations in aquatic ecosystems – Software packages and computer experiments
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, interactive whiteboard.
Current control type	midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

2.2.7. Computer modeling of economic processes. Modeling of 3D objects

Brief description of the subject	The formation of a new attitude towards understanding the goals of studying the discipline "mathematical modeling" is primarily associated with general educational tasks and the potential of students in solving the problems of teaching, education and development of their thinking. In this regard, the program of this course should cover three areas of development of doctoral students' thinking: • **ideological** , associated with the formation of a systemic and informational understanding of the world, the unity and community of

	management processes in wildlife, society and technology; • **technological** , associated with the formation of computer knowledge and information culture; • **algorithmic** , associated with the development of thinking about algorithms, methods of their expression and implementation.
Type of activity	Lectures, laboratory classes, independent work of students under the guidance of a teacher, practical independent work of students.
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	• Developing skills in the skillful and effective use of a computer in the daily activities of doctoral students. • Preparing doctoral students for a full and active life in the information society and, on this basis, improving their information culture. • Explanation of the essence of information processes in the scientific worldview of doctoral students and disclosure of the role of information technologies in modern society. •Wide use of new information and communication technologies in the educational process. • Ensuring a solid understanding of computer technology and equipment in all areas of life.
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **Know:** 1. Understand the essence of the concept of “algorithm”, know its basic properties and be able to demonstrate them using specific examples. 2. Understand the possibilities of automating human activities using algorithms. 3. Know the basic structures of algorithms and be able to use them when creating algorithms. 4. Be able to apply the algorithm's command system to solve a specific problem. 5. Be able to write an algorithm for solving a specific problem in any programming language. **Be able to:** 1. Know the safety rules when working with a computer. 2. Know the names and functional responsibilities of the main parts of a computer. 3. Have sufficient knowledge of computer software. 4. Be able to work correctly with a keyboard and mouse. 5. Be able to use the “system menu”, “program directories” and other tools. **Master:** 1. Using different programs to save data. 2. Analysis skills. 3. Skills in theoretical and experimental research. **4.** Collaboration skills with colleagues.

List of sections and topics of the subject	The purpose of this course is to ensure comprehensive, solid and conscious acquisition by doctoral students of knowledge about the process of transformation, transfer and use of mathematical modeling in solving assigned problems. During the course of studying the discipline, doctoral students should understand the importance of mathematical modeling in accordance with modern scientific ideas about the world, be able to describe the role of mathematical modeling and modern object-oriented languages in the development of modern society, and also improve their skills and abilities in using a computer in the educational process for their future professional activities.
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, interactive whiteboard.
Current control type	midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

Brief description of the curriculum for the elective subject
3. SECTION
3.1. MODULE 3.1. SECTION 1

3.1.1. Logic

Brief description of the subject	The main educational goal of the discipline "Logic" in institutions of higher professional education is the formation and development of theoretical and abstract knowledge, as well as logical thinking of students. This requires an increase in the level of abstract thinking of students and contributes to their professional training. The discipline covers the study of logical forms, concepts, judgments, inferences, hypotheses, theories, proofs, laws of formal logic and propositional logic. At the same time, logic defines methodological tools, including rules for defining concepts, classification, proof, argumentation, criticism and questions and answers, and provides the necessary knowledge about them. The goal of studying logic is ultimately to apply it in professional activities, as well as to acquire practical skills in applying the rules and laws of logic. After mastering the course, students should be able to use the means of logical analysis of texts, proof, argumentation, classification, analysis of judgments and conclusions, questions and answers, and, in particular, formulate their thoughts in a logically sound manner. Learning and teaching the discipline "Logic" requires a serious attitude.
Type of activity	Lectures, laboratory classes, independent work of students under the guidance of a teacher, practical independent work of students.
Language studies	Tajik, Russian
Competencies that a student must develop in the	The student must:

process of mastering this subject	• with a high sense of responsibility, attend classes on time and have educational materials with you; • pay special attention to the processes of self-study, self-education, self-management and self-assessment, constantly carry them out and apply them in practice; • strengthen your knowledge together with your classmates and do not show indifference to joint scientific learning; • When studying the discipline, attach importance to the interrelationship and sequence of the content of the topics. If students study the discipline "Logic" systematically and regularly, its mastery will not be difficult for them.
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **Know:** 1. The discipline "Logic" and the topic of its study; 2. The connection of logic with other sciences; 3. Development of logical thinking and mathematical reasoning; 4. Application of concepts in solving practical logical problems; 5. The importance of studying the discipline "Logic"; 6. Formal and dialectical logic; 7. Special sections of logic. **Be able to:** 1. Apply the principles of formal logic methodology; 2. Use concepts to solve practical logical problems; 3. Understand and explain logical concepts (depending on professional activity); 4. In practice, apply theorems and basic formulas of logic to solve problems that arise in the professional sphere; 5. Explain and evaluate logical concepts quantitatively; 6. Understand current technical problems of our time and ways to solve them. **Master the skills:** 1. Solving logical problems and examples; 2. Analysis and reflection on logical concepts; 3. Ability to find a way out of difficult situations using algorithms of discrete mathematics and mathematical logic; **4.** Conducting theoretical and practical research.
List of sections and topics of the subject	• The discipline “Logic” and the topic of its study. • The connection of logic with other sciences. • Development of logical thinking and mathematical reasoning. • The importance of studying the discipline “Logic”. • Formal and dialectical logic. • Logical teachings of thinkers of the Persian and Tajik traditions (Abu Nasr al-Farabi. Logical treatises). • Concept as a form of thinking.

	• Laws of traditional logic and propositional logic, the law of contradiction. • Deductive reasoning, forms of deductive reasoning. • Inductive inference, features of inductive inference. • Application of concepts in solving practical logical problems.
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, interactive whiteboard.
Current control type	midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

3.1.2. Civil defense

Brief description of the subject	**Civil defense** is a science that introduces students to the regulatory and legal documents of the Republic of Tajikistan on emergency situations and civil defense, the basics of organizing measures to protect the population from emergency situations of natural and man-made nature, emergency situations of natural and man-made nature that may occur on the territory of the Republic of Tajikistan, natural disasters and the protection of the population from them (earthquakes, floods, landslides, avalanches and mudflows), general information about highly toxic substances and their use at industrial facilities, as well as new threats associated with terrorist activities.
Type of activity	Lectures, laboratory classes, independent work of students under the guidance of a teacher, practical independent work of students.
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	• Organization and management of forces and means for the prevention and elimination of emergency situations. • The role and tasks of civil defense in modern times. • Civil defense management and administration.
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **Know:** 1. Regulatory and legal documents of the Republic of Tajikistan on emergency situations and civil defense; 2. Fundamentals of organizing measures to protect the population from natural and man-made emergencies; 3. Their responsibilities in case of emergency; 4. Organization of readiness, training of the population and registration of civil defense forces that are not part of armed formations in emergency situations;

	5. Emergencies of natural and man-made nature that may arise on the territory of the Republic of Tajikistan. **Be able to:** 1. Conduct basic measures to strengthen industrial facilities during wartime; 2. Know about the main means of civil defense; 3. Protect the population from natural disasters (earthquakes, floods, landslides, avalanches and mudflows); 4. Manage and manage civil defense; 5. Use highly toxic substances in industrial facilities and take into account new threats associated with terrorist activities. **Master the skills:** 1. Analytical skills; 2. Skills in theoretical and experimental research; **3.** Collaboration skills with colleagues.
List of sections and topics of the subject	• Introduction to the discipline and basic concepts. • Regulatory documents of the Republic of Tajikistan on emergency situations and civil defense. • Fundamentals of organizing measures to protect the population from natural and man-made emergencies. • Responsibilities in the event of an emergency. • Organization of readiness, training of the population and registration of civil defense forces that are not part of armed formations in emergency situations. • Emergencies of natural and man-made nature that may arise on the territory of the Republic of Tajikistan. • Basic measures to strengthen industrial facilities during wartime. • Civil defense services: general information about modern means of destruction. • Protection of the population from natural disasters (earthquakes, floods, landslides, avalanches and mudflows). • Civil defense management and administration. • Use of highly toxic substances in industrial facilities and new threats associated with terrorist activities.
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, interactive whiteboard.
Current control type	midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

3.1.3. The concept of modern natural science

Brief description of the subject	The purpose of the subject "Concept of Modern Natural Science" is to introduce the basic principles and current state of development of natural sciences, which contributes to the formation of ideas about the world, man's place in it and understanding the problems of social development.
Type of activity	Lectures, laboratory classes, independent work of students under the guidance of a teacher, practical independent work of students.
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	• Understanding the laws of nature and the manifestations of these laws in various processes; • Understanding the scientific picture of the world and, on its basis, acquiring skills in the scientific interpretation of phenomena and events in the surrounding world.
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **Know:** • historical stages of development of natural sciences; • the concept and role of science in society; • the main content of scientific theories and basic concepts; • scientific picture of the world; • achievements and results of modern science. **Be able to:** • distinguish between scientific and non-scientific knowledge, based on the scientific picture of the world; • apply the acquired knowledge in practice; • understand the characteristics of certain scientific knowledge and its impact on the development of society; • participate in discussions of natural science issues; • search, collect, systematize and use information on natural sciences; • use the methodology of studying natural sciences. **Acquire skills:** • analytical thinking; • theoretical and experimental research; • cooperation with colleagues.
List of sections and topics of the subject	Scientific, natural-scientific and humanitarian culture; scientific methods; history of natural science; main stages of development of natural sciences; corpuscular and continuous concepts of describing nature; order and disorder in nature; chaos; micro-, macro- and megaworld; space; time; Big Bang, scattered cosmic radiation, cosmic models; formation of the Solar System; formation of the Sun and stars; galaxies, classification of galaxies; energy sources of stars; formation of supermassive objects, black holes; conservation laws; mutual influences; short-range action, long-range action; states; principles of superposition, uncertainty, completeness, laws of dynamics and statistics in nature; law of conservation of energy in macroscopic

	processes; principle of entropy increase; chemical processes, reactivity of substances; hypotheses about the origin of the Earth and the Moon, internal structure and history of the formation of the Earth's geology; diversity of planets, their physical nature and internal structure; modern concepts of the formation of geospheric shells; lithosphere as the basis of abiotic life; ecological functions of the lithosphere: reserve, thermodynamics, geophysical and geochemical functions; geographic crust of the Earth; features of the biological level of organization of matter; principles of evolution, emergence and formation of living systems; diversity of living organisms as the basis for orderliness and stability of the biosphere; genetics and evolution; man: physiology, health, emotions, creativity, ability to work; bioethics, man, biosphere and cosmic cycles: noosphere, cyclicality of time, orderliness in living and inanimate nature; principle of universal evolutionism; path to a single civilization.
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, interactive whiteboard.
Current control type	midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

3.2. Elective discipline modules, section 2
3.2.1. Elective discipline modules of the general education cycle
3.2.1.1. Probability theory and mathematical statistics

Brief description of the subject	**Probability theory and mathematical statistics** is one of the main subjects of the curriculum of higher professional education, developed on the basis of the state standard for training highly qualified specialists in the field of computer science and information and communication technologies. The purpose of this course is to present the fundamentals of probability theory and mathematical statistics, as well as to develop skills in solving a wide range of practical problems related to various types of random phenomena. The subject of probability theory is the mathematical analysis of random phenomena, the identification of quantitative measures of the probability of complex events for the problems under consideration. Mathematical statistics aims to draw conclusions about the patterns characteristic of a mass phenomenon based on quantitatively not too large observations.
Type of activity	Lectures, laboratory classes, independent work of students under the guidance of a teacher, practical independent work of students.
Language studies	Tajik, Russian

Competencies that a student must develop in the process of mastering this subject	The student must: • have a high sense of responsibility, attend classes on time and have study materials with you; • pay special attention to the processes of self-study, self-education, self-management and self-assessment, constantly carry them out and apply them in practice; • consolidate your knowledge together with your classmates and do not show indifference to mutual development in educational activities; • be able to analyze and reason about processes in the field of computer science using the basic laws of differential equations and mathematical physics; • be able to solve computer science problems using formulas and laws of differential equations and mathematical physics; • develop scientific and practical thinking, forming new ideas depending on the direction of their activities.
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **Know:** • basic concepts, objectives of the subject, historical stages of its development, connections with natural science and technical disciplines, as well as develop their understanding of various types of calculations; • the role of probability theory and mathematical statistics in the field of electronic computers, science, technology, etc.; • features of event grouping; • ways of applying subject methods to solve emerging problems. **Be able to:** • analyze events and classify them into groups; • use methods, formulas and patterns of the subject to solve emerging problems; • identify processes related to probability theory and mathematical statistics; • apply in practice theorems, hypotheses and basic formulas of probability theory and mathematical statistics to solve professionally oriented problems. **Acquire skills:** • analysis of events and tasks; • theoretical, practical and experimental mathematical research; • programming problems related to probability theory and mathematical statistics.
List of sections and topics of the subject	• Introduction, goals and main objectives of the subject "Probability Theory and Mathematical Statistics". • Probability and its properties.

	• Independent testing schemes, binomial and hypergeometric distributions. • Random variables and their distribution laws, multidimensional random variables. • Mathematical expectation and its properties. • Dispersion and its properties. • Characteristic functions and their properties. • The law of large numbers and its strengthened versions. • Random processes and their classification. • Basic concepts of sampling method and problems of mathematical statistics. • Empirical distribution function and its numerical characteristics. • Confidence intervals. • Testing statistical hypotheses and general formulation of problems. • Errors of the first and second type. • Testing hypotheses about the distribution law. • Regression analysis and least squares method. • Correlation and stochastic relationships. • Evaluation of the correlation coefficient, correlation relationships.
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, interactive whiteboard.
Current control type	midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

3.2.1.2. Numerical methods

Brief description of the subject	Error theory. Solution of systems of linear equations. Exact methods: integration method. Solution of nonlinear equations. Concept of Newton's method — solution of systems of nonlinear equations. Method of best approximation. Discrete version of the least squares method. Certain system of linear equations. Concept of determination of parameters of functional dependence.
Type of activity	Lectures, laboratory classes, independent work of students under the guidance of a teacher, practical independent work of students.
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	The student must: • have a high sense of responsibility, attend classes on time and have study materials with you; • pay special attention to the processes of self-study, self-education, self-management and self-assessment, constantly carry them out and apply them in practice;

	• consolidate your knowledge together with your classmates and actively participate in the joint development of educational activities; • be able to analyze and reason about processes in the field of computer science using the basic laws of mathematical analysis; • be able to solve computer science problems using formulas and patterns of mathematical analysis; • develop technical thinking, forming new ideas depending on the direction of their professional activity.
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **Know:** • Numerical interpolation. • Algebraic interpolation polynomials: Lagrange and Newton forms. • Inverse interpolation. • Chebyshev polynomials. • Numerical differentiation. • General case of calculating derivatives of arbitrary order. **Be able to:** • Use the incorrigible form of the numerical differentiation formula. • Perform numerical integration. • Apply quadrature formulas for rectangles: Newton-Cotes formula. • Method of undetermined coefficients. • Trapezoid formulas, Simpson. • Gauss quadrature formulas. • Numerical methods for solving differential equations. **Acquire skills:** • Numerical solution of the Cauchy problem for simple differential equations. • Runge-Kutta method. • Multi-step methods. • Numerical unification of partial differential equations: initial and boundary conditions.
List of sections and topics of the subject	• Error theory. • Solution of systems of linear equations. • Exact methods: integration method. • Solution of nonlinear equations. •The concept of Newton's method is the solution of systems of nonlinear equations. • Best approximation method. • Discrete version of the least squares method. • A certain system of linear equations.

	• The concept of determining the parameters of functional dependence. • Numerical interpolation. •Algebraic interpolation polynomials: Lagrange and Newton forms. • Inverse interpolation. • Chebyshev polynomials. • Numerical differentiation. • General case of calculating derivatives of arbitrary order. • Incorrigible form of the formula for numerical differentiation. • Numerical integration.
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, interactive whiteboard.
Current control type	midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

3.2.1.3. Discrete Mathematics and Mathematical Logic

Brief description of the subject	**Discrete mathematics and mathematical logic** are currently used in various fields of science and technology, especially in cybernetics, electronic computers, linguistics, jurisprudence, etc. The main objective of the course in discrete mathematics and mathematical logic is for the student to develop logical and algorithmic thinking skills, master methods of research and solving problems presented in mathematical form, and become familiar with numerical methods and their application using computers.
Type of activity	Lectures, laboratory classes, independent work of students under the guidance of a teacher, practical independent work of students.
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	The student must: • have a high sense of responsibility, attend classes on time and have study materials with you; • pay special attention to the processes of self-study, self-education, self-management and self-assessment, constantly carry them out and apply them in practice; • consolidate your knowledge together with your classmates and actively participate in the joint development of educational activities; • be able to analyze and reason about processes in the field of computer science using the basic laws of discrete mathematics and mathematical logic; • be able to solve computer science problems using formulas and patterns of discrete mathematics and mathematical logic; • develop technical thinking, forming new ideas depending on the direction of their professional activity.

The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **Know:** • concepts of discrete mathematics and mathematical logic; • methods of discrete mathematics and mathematical logic; • development of logical thinking and mathematical reasoning; • application of concepts in solving practical problems of discrete mathematics and mathematical logic; • numerical methods for solving mathematical problems using computers; • special sections of discrete mathematics and mathematical logic necessary for studying specialized disciplines. **Be able to:** • use the concepts of discrete mathematics and mathematical logic when solving and analyzing problems of professional activity; • to reason correctly about the concepts of discrete mathematics and mathematical logic and their basic properties; • understand and explain the concepts of discrete mathematics and mathematical logic as applied to professional activities; • apply in practice theorems and basic formulas of discrete mathematics and mathematical logic to solve professionally oriented problems; • quantify and interpret concepts of discrete mathematics and mathematical logic; • understand the current technical problems of our time and ways to solve them. **Acquire skills:** • solutions to problems and examples in discrete mathematics and mathematical logic; • analysis and logical thinking based on the concepts of discrete mathematics and mathematical logic; • getting out of difficult situations using algorithms of discrete mathematics and mathematical logic; • conducting theoretical and practical research.
List of sections and topics of the subject	• Nodes and graphs; • Boolean functions; • Normal forms; • Computable functions; • Turing machine and operations with it; • Recursive functions.
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, interactive whiteboard.
Current control type	midterm exams (P-1, P-2).

Form of assessment of the final learning outcome in the subject	Exam (test - computer)

3.2.1.4. Physics

Brief description of the subject	**Physics** introduces students to various processes in the surrounding world and allows them to apply the laws of physics in practice in various fields of science, technology and national economic management.
Type of activity	Lectures, laboratory classes, independent work of students under the guidance of a teacher, practical independent work of students.
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	The student must: • have a high sense of responsibility, attend classes on time and have study materials with you; • pay special attention to the processes of self-study, self-education, self-management and self-assessment, constantly carry them out and apply them in practice; • consolidate your knowledge together with your classmates and actively participate in the joint development of educational activities; • be able to analyze and reason about natural processes using the laws of physics; • be able to analyze and process events in the surrounding nature using formulas and laws of physics; • develop scientific and practical thinking, forming new ideas depending on the direction of their professional activity.
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **Know:** • basic concepts of physics; • basic methods of physics; • development of natural scientific thinking and physical reasoning; • application of physical formulas in solving practical problems; • principles and laws operating in the micro-world ; • principles and laws operating in the macro-world . **Be able to:** • use the concepts and formulas of physics when solving and analyzing problems of professional activity; • to reason correctly about various phenomena of the surrounding world and their basic properties; • understand and explain physical concepts as they apply to professional activities;

	• apply in practice the principles and basic formulas of physics to solve professionally oriented problems; • to quantitatively evaluate and interpret phenomena in the surrounding world; • understand the current physical problems of our time and ways to solve them. **Acquire skills:** • solutions to problems and examples in physics; • analysis and logical thinking on natural phenomena; • getting out of difficult situations using physical algorithms; • conducting theoretical and practical research.
List of sections and topics of the subject	• Introduction, goals and main objectives of the physics course; • Kinematics; • Dynamics of movement; • Dynamics of rotational motion; • Law of universal gravitation; • Elements of the theory of relativity; • Fundamentals of molecular physics and thermodynamics; • Fundamentals of electrodynamics; • Optics; • Physics of elementary particles.
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, interactive whiteboard.
Current control type	Midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

3.2.2. Module discipline for choosing a specialized direction

3.2.2.1. Computer graphics

Brief description of the subject	• Obtaining raster images using a scanner and digital cameras. • Image processing and transformation: scaling, changing color depth and graphic file format. • Drawings and diagrams using vector graphics and computer-aided design (CAD) systems. • Printing images.
Type of activity	Lectures, laboratory classes, independent work of students under the guidance of a teacher, practical independent work of students.
Language studies	Tajik, Russian
Competencies that a student must develop in the process of	• **Graphic editor (GE)** is the main tool for processing graphic information. • Basic concepts and tasks of a graphic editor. • Raster (dot) and vector graphic editors.

mastering this subject	• Graphic editor window.
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **Know:** • Technologies for creating, entering, editing and formatting graphic documents. • Obtaining raster images using a scanner and digital cameras. • Image processing and transformation: scaling, changing color depth and graphic file format. **Be able to:** • Obtain raster images using a scanner and digital cameras. • Process and transform images: scaling, changing color depth and graphic file format. • Create drawings and diagrams using vector graphics and computer-aided design (CAD) systems. • Print images. **Acquire skills:** • Mastering technologies for creating, entering, editing and formatting graphic documents. • Receiving and processing raster images using a scanner and digital cameras. • Image conversion: scaling, changing color depth and file format. • Creation of drawings and diagrams using vector graphics and CAD. • Printing images.
List of sections and topics of the subject	• **Graphic editor (GE)** is the main tool for processing graphic information. • Basic concepts and tasks of a graphic editor. • Raster (dot) and vector graphic editors. • Graphic editor window. • Technologies for creating, entering, editing and formatting graphic documents. • Obtaining raster images using a scanner and digital cameras. • Image processing and transformation: scaling, changing color depth and graphic file format. • Creation of drawings and diagrams using vector graphics and computer-aided design (CAD) systems. • Printing images.
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, interactive whiteboard.
Current control type	Midterm exams (P-1, P-2).

Form of assessment of the final learning outcome in the subject	Exam (test - computer)

3.2.2.2. Laboratory by specialization

Brief description of the subject	**The aim of the course** is to provide deep theoretical knowledge, develop practical skills and apply acquired knowledge in life, while the course pursues the following objectives: • development of the skill of skillful and effective use of a computer in students' activities aimed at modeling water bodies; • preparing students for a full and active life in the information society and improving their information culture; • explaining the essence of information processes in the scientific worldview of students and revealing the role of information and communication technologies and modeling in modern society; • widespread use of modern information and communication technologies in the process of studying mathematical and computer modeling of water body ecosystems; • ensuring comprehensive and sustainable computer technology and applications in all areas of life.
Type of activity	Laboratory work, practical work, independent work, solving practical problems, creating programs using programming languages.
Language studies	Tajik, Russian
Competencies that a student must develop in the process of mastering this subject	• Scientific and educational task • The task of forming and expanding the worldview • Methodological task • Educational task • Practical task
The learning outcomes that a student should achieve when studying a subject	A student who has mastered this subject should: **Know:** • content, essence, features and objectives of the course "Computer modeling of water body ecosystems"; • the concept of information and methods of its measurement; • concepts: model, simulation, mathematical modeling, computer modeling; • theoretical and practical foundations of computer modeling; • the place of computer modeling in the system of informatics sciences; • the essence of information processes, the structure and functions of information systems, feedback, general principles of information and operational systems of water bodies. **Be able to:**

	• independently master new research methods and develop professional and practical skills; • apply acquired knowledge and skills in practice; • analyze and use various sources to understand scientific phenomena; • independently prepare assignments on scientific issues; • apply basic units of measurement of information; • use forms of computer representation of quantities; • transmit, record and process information about nature, society and technology; • have an understanding of information systems, general principles of construction and management of their parts, regardless of their nature; • have an understanding of the operating principles of closed and open control systems and their feedback. **Acquire skills:** • the formation of a worldview associated with a systemic and informational view of the world, the unity of control processes in living nature, society and technology; • technological skills related to the development of computer knowledge and information culture; • algorithmic thinking, development of skills for expressing and executing algorithms; • research skills, development of creative and analytical abilities.
List of sections and topics of the subject	**WATER BODIES AS ECOLOGICAL SYSTEMS** • Features of aquatic ecosystems: ocean, sea, lake, river, reservoir, pond, pool. • Trout is a special object of fish farming in artificial reservoirs of Tajikistan and the world. • Methods of modeling aquatic ecosystems. • Models of the trophic state of aquatic ecosystems. • Models of population dynamics in aquatic ecosystems.
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, interactive whiteboard.
Current control type	Midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

3.2.2.3. Mathematical modeling of biological systems, ecosystems of reserves and reservoirs

Brief description of the subject	**Mathematical modeling of biological systems, ecosystems of reserves and reservoirs** is the next stage of human life and activity in the 21st century and subsequent periods – the information society. In

	this society, the key role is played by the ability to effectively use various types of electronic equipment and the global Internet, especially the computer and modern mobile electronic devices. The introduction of the achievements of computer science and the use of information and communication technologies in all areas of modern times is gradually bringing this stage closer. Therefore, the study of computer science and information and communication technologies, especially mathematical and computer modeling of various processes in nature, society and technology, which form the essence of research topics, is the most important factor in the formation of knowledge, skills and professional competence of future specialists in the field of computer science.
Type of activity	lectures, practical classes, laboratory work, independent work of students under the guidance of a teacher.
Language studies	Tajik, Russian.
Competencies that a student must develop in the process of mastering this subject	**The first aspect** is the study of the information system of the world representation and general information patterns of the structure and functioning of self-governing systems, such as biological, social and technical systems. The peculiarity of these systems is manifested in the ability to perform targeted actions, and their behavior is controlled by means of elements of reception, transformation and application of information. **The second aspect** is the study of methods and technical means of obtaining, collecting, storing, transforming, transmitting and using information using computers and modern technological means. This aspect is primarily associated with the application of educational material in life and preparing students for practical activities.
The learning outcomes that a student should achieve when studying a subject	**A student who has completed this course should:** **Know:** • formation of an understanding of design as a method of scientific research; • understanding of the basic principles of modeling and methods of organizing computer models; • obtaining information about the technological sequence of solving problems using a computer: setting the problem, creating a model, processing and executing the algorithm, analyzing intermediate and final results. **Be able to:** • have an understanding of the essence of modeling and design methods; • create educational and scientific models and conduct their research on a computer. **Master:** • production and distribution of mathematical modeling; • mastering modern object-oriented programming languages;

	• generation of new computer reports using databases.
List of sections and topics of the subject	• Algorithm. Properties of the algorithm • Model and simulation • Classification of models • Basic models of the economic system • CES production model • Capital model taking into account the production of the CES model • CES production-based labor force model • CP production model • Capital model taking into account the production of the CP model • Labor force model taking into account the production of the CP model • Cobb-Douglas production model • Capital model taking into account the production of the Cobb-Douglas model
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, interactive whiteboard.
Current control type	Midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

3.2.2.4. Programming mobile systems

Brief description of the subject	**Mobile systems programming** is a technical discipline that studies the methods and tools for developing mobile applications and analyzing them. The purpose of teaching this course to students is to provide them with knowledge of the key aspects of mobile applications, the ability to ensure their security and analyze them. This is especially important since most information is located on networks, and security issues must be taken into account when receiving and transmitting it.
Type of activity	lectures, practical classes, laboratory work, independent work of students under the guidance of a teacher.
Language studies	Tajik, Russian.
Competencies that a student must develop in the process of mastering this subject	• skills in entering, searching, storing, analyzing and processing information on mobile phones and the ability to use them to solve assigned tasks; • skills in using mobile protocols, ensuring their security and conducting analysis; • for specialists in this field – skills in programming network protocols in various languages.
The learning outcomes that a student should achieve when studying a subject	**Skills:** • the ability to enter, search, store, analyze and process information on mobile phones and use it to solve assigned tasks; • ability to work with mobile protocols and ensure their security, as well as conduct their analysis;

	• For specialists in this field – skills in programming network protocols in various languages. **A student who has completed this course should:** **Know:** • basic concepts, objectives, stages of historical formation and the relationship of this discipline with natural, mathematical, technical and specialized sciences; • basic data exchange protocols in local and global networks; • TCP/IP transport protocols; • methods of protecting network protocols; • network protocol security analysis. **Be able to:** • work with major Internet protocols; • analyze network protocols; • analyze the security of network protocols; • ensure the security of network protocols. **Purchase:** • analysis skills; • theoretical and experimental research skills; • skills of collaboration with colleagues.
List of sections and topics of the subject	**Concepts and basic definitions:** • standards and network protocols; • models and seven-layer protocols; • physical layer protocols; • data link layer protocols; • network layer protocols; • transport layer protocols; • network security; • methods and means of information security; • encryption and algorithms; • electronic digital signature; • protection of communications; • application layer protocols; • network protocol analysis.
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, interactive whiteboard.
Current control type	Midterm exams (P-1, P-2).

Form of assessment of the final learning outcome in the subject	Exam (test - computer)

3.2.2.5. Web programming

Brief description of the subject	In modern times, the development of information technology and the Internet has played a significant role in the daily life of society. The use of various sites for the purpose of exchanging information, advertising company products, providing various services, creating online stores, teleconferences and other tasks has become one of the important everyday problems. During their studies, students actively use Internet sites and, one way or another, show interest in creating such resources. Therefore, learning web development and programming languages is of great importance for them. Hyper Text Markup Language (HTML) is one of the popular languages for creating documents in the Web environment. In addition, web programming includes various tools and technologies that students are introduced to in this course. This course is designed to prepare specialists in the field of Web programming. Along with providing knowledge and skills in accordance with the curriculum and state standards, it also lays the foundation for a stable database, expands the student's worldview and provides Internet users with the necessary information.
Type of activity	lectures, practical classes, laboratory work, independent work of students under the guidance of a teacher.
Language studies	Tajik, Russian.
Competencies that a student must develop in the process of mastering this subject	• Skill in searching, storing, analyzing, developing and processing websites, as well as their use in solving assigned tasks; • Skill in using programs, networks and various web programming technologies; •For specialists in this field – web programming skills in various languages.
The learning outcomes that a student should achieve when studying a subject	A student who has completed this course should: **Know** • the need to study web programming, basic concepts, tasks, stages of the historical formation of the discipline, connections with other sciences; • Hypertext Markup Language HTML, its structure and basic commands; • commands for inserting images, tables, audio and video into the site; • forms and controls; • CSS Basics; • Basics of the JavaScript programming language; • JavaScript programming language structures; • Basics of the PHP programming language; • Basics of modern web programming technologies.

	Be able to • create websites using HTML markup language; • insert images, tables, audio and video into the site; • create forms and controls; • basic work with CSS; • basic work with JavaScript; • use JavaScript language structures; • basic work with PHP; • apply the basics of modern web programming technologies. **Acquire skills** • analytical skills; • theoretical and practical research skills; • skills of collaboration with colleagues.
List of sections and topics of the subject	• basic concepts, objectives, stages of the historical emergence and formation of the discipline; • hypertext markup language HTML, its structure and basic commands; • commands for inserting images, tables, audio and video into the site; • forms and controls; • CSS basics; • basics of the JavaScript programming language; • structures of the JavaScript programming language; • basics of the PHP programming language; • basics of modern web programming technologies; • creation of websites using the hypertext markup language HTML; • inserting images, tables, audio and video into the site; • creation of forms and controls; • basic work with CSS; • basic work with the JavaScript programming language; • use of JavaScript programming language structures; • basic work with the PHP programming language; • basic work with modern web programming technologies.
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, interactive whiteboard.
Current control type	Midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)

3.2.2.6. Graph Theory

Brief description of the subject	The correct approach to solving programming problems includes the following steps: Formulation of the task and correct preparation of its report; Creating an algorithm to solve the problem; Writing a program

	based on the developed algorithm; Entering a program into a computer, analyzing and configuring it; Receiving the results of the program and checking their correctness; Analysis of the task and selection of equipment and optimal methods for solving it; Designing an algorithm solution based on the selected data; Conducting a comparative analysis and selecting an algorithm for solving experimental problems.
Type of activity	lectures, practical classes, laboratory work, independent work of students under the guidance of a teacher.
Language studies	Tajik, Russian.
Competencies that a student must develop in the process of mastering this subject	• **Skills in working with information:** entering, searching, storing, analyzing and processing information on a computer and using it to solve practical and complex problems; • **Skill in working with graphical environments:** using graph environments, networks and various computer devices for modeling and analysis; • **Programming skills:** for computer science specialists – the ability to develop programs and algorithms for working with information and graph systems.
The learning outcomes that a student should achieve when studying a subject	A student who has completed this course should: **Know:** • the need to study the subject, the basic concepts, objectives of the subject, the historical stages of its emergence and formation, as well as the connection with professional, natural, mathematical and technical sciences; • features of the structures of various data and algorithms applied to them; • methods for assessing the complexity and efficiency of algorithms; • a systematic and scientific approach to creating large programs with complex data. **Be able to:** • correctly formulate and present programming tasks; • create algorithms for solving problems; • write programs based on developed algorithms; • enter a program into a computer, analyze and correct it; • receive program results and analyze their correctness; • analyze the tasks set and select equipment and optimal methods for solving them; • design a solution algorithm based on the selected data; • conduct a comparative analysis and select an algorithm for solving experimental problems. **Master:** • analytical thinking skills; • theoretical and practical research skills; • ability to collaborate with colleagues.

List of sections and topics of the subject	• Introduction to the subject and basic concepts • Classification of data structures • Operations with data structures • Data types with a linear structure • Linear linked lists, cyclic and multilists • Algorithms for processing data with a linear structure • Sorting, array sorting algorithms • Files and working with them • Data types with non-linear structure • The concept of a tree, types, structure and display methods • Graph, basic concepts and definitions • Graph Algorithms • Optimization algorithms
Educational and technical means of providing the subject	Teaching aids, personal computer, projector, interactive whiteboard.
Current control type	Midterm exams (P-1, P-2).
Form of assessment of the final learning outcome in the subject	Exam (test - computer)