MINISTRY OF HIGHER EDUCATION, SCIENCE AND INNOVATION

TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES

NAMED AFTER MUHAMMAD AL–KHWARIZMI

MODULE HANDBOOK

Educational Program

BA 60611000 – Telecommunication technologies (Telecommunications)

Tashkent 2024

Table A – Curriculum of BA 60611000 – Telecommunication technologies (Telecommunications)

1st semester	2nd semester	3rd semester	4th semester	5th semester	6th semester	7th semester	8th semester
PRG101 Programming 1 lectures 2/1 practical sessions 6 ECTS	PRG102 Programming 1 lectures 2/1 practical sessions 6 ECTS	EGS201 Engineering graphics 2/1 lectures 1 practical session 6 ECTS	MPS201 Microproces-sors 2/1 lectures 1 practical session 6 ECTS	ICT301 Information coding theory 2/1 lectures 1 practical session 6 ECTS	WNW301 Wireless networks 1 lecture 1/0 practical session 4 ECTS	PRI401 Programming in info communications 2/1 lectures 1 practical session 6 ECTS	QPR402 Qualification Practice 2 6 ECTS
PHY101 Physics I 1 lectures 1 practical sessions and laboratory 6 ECTS	PHY102 Physics I 1 lectures 0/1 practical sessions and laboratory 4 ECTS	CSF201 Fundamentals of Cyber Security 2/1 lectures 1 practical sessions 6 ECTS	AIF201 Fundamentals of artificial intelligence 2/1 lectures 1 practical sessions 6 ECTS	SAS301 Signals and systems 2 lectures 1 practical session 8 ECTS	EMS301 Embedded management systems 2/1 lectures 1 practical session 6 ECTS	*Elective Subject* ITS407/ITS408 2/1 lectures 1 practical sessions 6 ECTS	GQW403 Graduation Qualification Work 14 ECTS
MTH101 Calculus 2/1 lectures 1 practical sessions 6 ECTS	MTH102 Differential equations 1 lectures 0/1 practical sessions 4 ECTS	DSA201 Data structure and algorithms 2/1 lectures 1 practical sessions 6 ECTS	Electromagnetic fields and waves 2/1 lectures 1 practical session 6 ECTS	IMP301 Image processing 2/1 lectures 1 practical session 6 ECTS	IDP301 Individual project 2/1 practical sessions 4 ECTS	*Elective Subject* ITS409/ITS410 2/1 lectures 1 practical sessions 6 ECTS	*Elective Subject* ITS415/ITS416 2/1 lectures 1 practical sessions 6 ECTS
AWR101 Academic writing 2/1 practical sessions 4 ECTS	MTH103 Discrete structures 1 lectures 0/1 practical sessions 4 ECTS	EAC201 Electronics and circuits I 2/1 lectures 1 practical sessions 6 ECTS	EAC202 Electronics and circuits II 2/1 lectures 1 practical sessions 6 ECTS	*Elective Subject* ITS303/ITS304 2/1 lectures 1 practical sessions 6 ECTS	QPR301 Qualification Practice 1 6 ECTS	*Elective Subject* ITS411/ITS412 2/1 lectures 1 practical sessions 6 ECTS	*Elective Subject* ITS417/ITS418 1 lectures 0/1 practical sessions 4 ECTS
FRL101 Foreign language I 2/1 practical sessions 4 ECTS	FRL101 Foreign language II 2/1 practical sessions 4 ECTS	MTH204 Probability and statistics 2/1 lectures 1 practical sessions 6 ECTS	*Elective Subject* ITS201/ITS202 2/1 lectures 1 practical sessions 6 ECTS	*Elective Subject* GEN301/GEN302 1 lectures 0/1 practical sessions 4 ECTS	*Elective Subject* GEN303/GEN304 1 lectures 0/1 practical sessions 4 ECTS	*Elective Subject* ITS413/ITS414 2/1 lectures 1 practical sessions 6 ECTS	
HUM101 The newest History of Uzbekistan 1 lectures 1 seminars 4 ECTS	HUM102 Religious studies 1 lectures 1 seminars 4 ECTS				*Elective Subject* ITS305/ITS306 2/1 lectures 1 practical sessions 6 ECTS		
	HUM103 Philosophy 1 lectures 1 seminars 4 ECTS						
6 exams	7 exams	5 exams	5 exams	5 exams	4 exams, Course project Practice Report	5 exams	2 exams, Practice Report, State Attestation
30 ECTS	30 ECTS	30 ECTS	30 ECTS	30 ECTS	30 ECTS	30 ECTS	30 ECTS
TOTAL: 240 ECTS							

Subjects included in the curriculum of the educational program is divided into 6 main blocks, which are highlighted in the appropriate color:

Languages — General — Math and Science

Humanities — Fundamental — Core

Table B – Elective subjects for the Educational program BA 60611000 – Telecommunication technologies (Telecommunications)

№	Code	1th subject	2nd subject
1.	ITS201/ITS202	Subscriber Access Networks	Fiber optic communication lines
2.	GEN301/GEN302	Power supply of information communication systems	Life safety
3.	GEN303/GEN304	Pedagogy. Psychology	Ecology
4.	ITS303/ITS304	Data communications	Fundamentals of network programming
5.	ITS305/ITS306	Info-communication systems and networks	Telecommunications Network Management
6.	ITS407/ITS408	Virtual network technologies	Modeling and Simulation of Networks
7.	ITS409/ITS410	Introduction to IMS	Next generation convergence networks
8.	ITS411/ITS412	Network Smart Devices Software	Programming structure in telecommunications
9.	ITS413/ITS414	Switching and routing	Future Networks
10.	ITS415/ITS416	Exploitation and services of telecommunication networks	Multimedia transmission in IT networks
11.	ITS417/ITS418	IoT in Telecommunication networks	Theory of Teletraffic

Syllabusses

1. Humanities

<table>
<tr><td colspan="2">1.1. The latest history of Uzbekistan</td></tr>
<tr><td>Semestr:</td><td>1</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Mahkamova Nodira Raxmanovna</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Secondary</td></tr>
<tr><td>ECTS:</td><td>4</td></tr>
<tr><td>Pre-requisities</td><td>-</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>120</td></tr>
<tr><td>Lecture</td><td>30</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>60</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>Understanding the essence and content of the historical path traversed by the state during the years of independence, the significance of the changes that have occurred in the modern history of Uzbekistan</td></tr>
<tr><td>Goal:</td><td>reveal the essence and content of the fact that Uzbekistan is one of the regions that have made a great contribution to the development of world civilization, that the Uzbek people have a rich historical past and priceless cultural heritage, important changes in the Republic of Uzbekistan during the years of independence, to reveal the essence and content of fundamental reforms , as well as the study of the subject should contribute to students' awareness of their place in society, social lifestyle, self-awareness of young people, awareness of such concepts as personality, citizen.</td></tr>
<tr><td>Objective:</td><td>Make an excursion into the rich historical past, in particular into the history of Uzbek statehood, reveal the essence and content of the history of Uzbekistan at the end of the 20th – beginning of the 21st centuries, explain to students the difficult socio-political and economic situation that developed in Uzbekistan on the eve and in the first years of independence, reveal the essence of the state management, socio-economic, political reforms, transformations in the spiritual sphere, highlight the main directions of the foreign policy of the Republic of Uzbekistan during the years of independence, reveal the main essence of the Action Strategy and the Development Strategy of New Uzbekistan, educate students in the spirit of devotion and love for the Motherland, as well as form them national pride and spirit.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Know and understand the essence and content of the historical path traversed by the state during the years of independence, the significance of the changes that have occurred in the modern history of Uzbekistan
LO 2. From the standpoint of historicism and objectivity, understand such processes as the integration of Uzbekistan into the world community, ensuring security, interethnic harmony and interreligious tolerance, the place and increase in the authority of the Republic of Uzbekistan in international rankings and indices</td></tr>
</table>

<table>
<tr><td></td><td>LO 3. Have the skills to study the problems of the modern history of Uzbekistan, apply the idea of national independence in strengthening the worldview, be able to express your attitude to the processes taking place around you, understand the place of history in the development of the worldview of society and people and be able to connect the events of today with important events of history;
LO 4. Have a deep knowledge of the modern history of Uzbekistan, have your own scientific opinion on spiritual, national and universal issues and be able to substantiate them, have an active life position based on the ideas of national independence.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "INSERT", "Fishbone" method, "I know, I found out, I want to know" hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-10)</td><td>30</td><td rowspan="2">40</td><td rowspan="3">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction. Subject, goals and objectives of the academic discipline “Modern History of Uzbekistan”, its theoretical and methodological principles.
- Formation of Uzbek statehood and stages of its development.
- Socio-political processes in Uzbekistan on the eve of achieving independence.
- Historical significance of the formation of the independent Republic of Uzbekistan. A unique path of Uzbekistan to freedom and progress.
- Formation of the foundations of a democratic civil society in Uzbekistan, political reforms.
- Socio-economic changes in Uzbekistan during the years of independence.
- Spiritual and cultural progress in Uzbekistan during the years of independence.
- Republic of Karakalpakstan during the years of independence.
- Uzbekistan and the world community.
- From action strategy to development strategy.</td></tr>
<tr><td>Literature:</td><td>1. Action strategy on five priority areas of development of the Republic of Uzbekistan in 2017-2021. - Tashkent: Spirituality, 2017. 2. History of independent Uzbekistan. Responsible editor A. Sabirov. - Tashkent: Academy, 2013. 3. New history of Uzbekistan. Project manager and editor. M.A. Rakhimov. - Tashkent: Literary sparks, 2018. 4. The latest history of Uzbekistan. Editors: R.H. Murtazayeva, A.A. Ermetov, A.A. Odilov. - Tashkent, 2023. 5. "Development Strategy". Decree of the Republic of Uzbekistan No. PF-60 dated 28.01.2022.</td></tr>
</table>

<table>
<tr><td colspan="2">1.2. Religious Studies</td></tr>
<tr><td>Semestr:</td><td>2</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Kasimova Zumrad Sabirzhanovna</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Secondary</td></tr>
<tr><td>ECTS:</td><td>4</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>120</td></tr>
<tr><td>Lecture</td><td>30</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>60</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>Gives an idea of religion, helps students develop their worldview positions. By mastering this discipline, the student gains the skills to communicate with people of different ideological positions. Religious studies through its means contributes to the realization of freedom of conscience, that is, the choice of religion or free thought.</td></tr>
<tr><td>Goal:</td><td>Is to form theoretical knowledge about the content and essence of religion in the minds of students and youth, about the religious image of the world, about the relationship of religious and philosophical views, about the process of globalization and modern religious movements, about the formation of skills in the fight against the negative consequences of such concepts as religious fanaticism , extremism and terrorism, the struggle for the security of the state and society</td></tr>
<tr><td>Objective:</td><td>In accordance with the state educational standard of higher professional education are to form students’ ideas about: the subject and social functions of religion in their historical development; about the main historical types of religious worldviews; about the main directions of modern religion; about religious views on the crisis of modern civilization and ways out of it.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. The student will learn to demonstrate knowledge of the main stages of the historical development of religion, its main directions and the trends of its functioning in the modern world;
LO 2. Studying the history of the development of religious teachings, the formation of knowledge and the ability to distinguish the original content of religion from its false interpretations;
LO 3. The ability to determine the causes of extremism and terrorism, and a socio-philosophical analysis of its consequences;
LO 4. Formation of logical and critical thinking skills in relation to religious and secular processes;
LO 5. Prevention of religious fanaticism and application of acquired theoretical knowledge in practical life;
LO 6. Student will have the ability to form ideological immunity against various religious ideas, to express his free and fair attitude towards their evil intentions.
LO 7. Formation of students’ skills in using acquired knowledge in independent learning.
LO 8. The student will master the skills of perceiving and analyzing texts with philosophical and religious content, techniques for conducting discussion and polemics,</td></tr>
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<tr><td></td><td>skills of public speaking and written, reasoned presentation of one’s own point of view, skills of analyzing the modern religious situation in the world.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "INSERT", "Fishbone" method, "I know, I found out, I want to know" hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-10)</td><td>30</td><td rowspan="2">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Final control</td><td>Oral presentation</td><td colspan="2">10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- The importance of religion as a phenomenon of social culture
- National religions
- Zoroastrianism
- Buddhism
- Christianity
- Islam
- Dogmatic directions and schools of Islamic religion
- The role of the Hanafi madhhab in the history of Central Asia
- Religious organizations operating in Uzbekistan
- Modern religious movements and sects
- Social danger of spreading religious beliefs
- in cyberspace.
- Political and social danger of missionary and proselytism
- History and directions of religious fundamentalism,
- radicalism and terrorism
- The experience of the world community in the fight against extremism and
- terrorism
- The meaning of achieving the unity of secular knowledge and religious faith</td></tr>
<tr><td>Literature:</td><td>1. Muratov D., Alimova M., Karimov J. Religious studies, textbook. - Tashkent, "Navroz" publishing house, 2019. - 264 p. 2. Rakhimdzhanov D., Ernazarov O. Introduction to religious studies. Study guide. - T.: Publishing House "National Society of Philosophers of Uzbekistan", 2018. - 304 p. 3. Isoqjanov R. Comparative religious studies. Study guide. - T.: OOO "Complex print", 2020. - 198 p. 4. Kamilov D. Religious studies. Study guide. - T.: Lesson Press, 2021. -128 p. Methodological manual of "Religious Studies"./Sh. Alimova. - T. 2018. -140 p.</td></tr>
</table>

<table>
<tr><td colspan="2">1.3. Philosophy</td></tr>
<tr><td>Semestr:</td><td>2</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Abdullayeva Ziyoda Nabiyevna</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Secondary</td></tr>
<tr><td>ECTS:</td><td>4</td></tr>
<tr><td>Pre-requisities</td><td>-</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>120</td></tr>
<tr><td>Lecture</td><td>30</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>60</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
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<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>Worldview and its historical forms, philosophical thoughts in the stages of development of Eastern and Western philosophical thinking, "Philosophy of Being", its philosophical analysis, philosophical understanding of the world, its problems, "Philosophy of Knowledge", forms and levels of knowledge, basic laws and categories of philosophy content, science of logic, its object of research, laws and forms of thinking, their structure and the foundations of its understanding, society, value, culture, human problem, moral categories, ideas about sophistication, globalization and global problems, etc. took place.</td></tr>
<tr><td>Goal:</td><td>It is to create a generalized system of students' worldview and show a person's place in it, to form a person's cognition, socio-political, ethical, aesthetic and other relations to the world, and to teach the skill of correct thinking in the process of logical reasoning.</td></tr>
<tr><td>Objective:</td><td>Is to equip young people with philosophical knowledge based on the achievements of modern science, and to develop self-awareness and correct thinking skills, skills and qualifications in them.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
students know the essence of philosophical knowledge, laws, and categories related to the development of nature, society, and human thinking; they can reveal the role and importance of a person in life by forming a personal attitude towards them;
They will have information about the characteristics and laws of philosophical thinking;
They study the leading ideas, scientific and spiritual heritage of Eastern and Western philosophy;
They should be able to understand the methodological importance of philosophy in professional activity, the role of analytical and synthetic, logical thinking in global processes;
They will have an idea about the essence of the reforms being carried out in Uzbekistan;
By studying philosophy, they should understand the essence of social and political processes in the life of society;
They should be able to evaluate socio-political processes from the point of view of philosophical and systematic thinking and should be able to collect, store and use information about the development of society;</td></tr>
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<table>
<tr><td></td><td>Logical analysis of information, observes information related to his professional activity based on analytical and synthetic thinking and should make independent decisions based on observational thinking;
They should be able to independently acquire new knowledge, improve it and systematically organize their work on the basis of scientificity and creativity;
They should know how to express their thoughts and views in a constructive and logical manner based on the rules of the literary language orally and in writing.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "INSERT", "Fishbone" method, "I know, I found out, I want to know" hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-10)</td><td>30</td><td rowspan="2">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Final control</td><td>Oral presentation</td><td colspan="2">10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>MODULE 1. PHILOSOPHY AND LOGIC
- Philosophy and its role in society
- Stages of development of philosophical thinking: Eastern philosophy
- Stages of development of philosophical thinking: Western philosophy
- Being (ontology) and the philosophy of development
- Philosophy of knowledge (epistemology)
- Logic.
- Forms of thought: understanding, judgment and conclusion.
- Philosophy of society
- Philosophy of Man (Philosophical Anthropology)
- Philosophy of values (axiology)
MODULE 2. THE PHILOSOPHY OF MORALS AND ELEGANCE. CORRUPTION IS A GLOBAL PROBLEM TODAY
- Moral philosophy (Ethics)
- Philosophy of elegance (Aesthetics)
- Philosophy of globalization and sustainable development
- World experience of fight against corruption
- Anti-corruption policy of Uzbekistan</td></tr>
<tr><td>Literature:</td><td>1. Davronov Z., Shermuhamedova N, Kahharova M, Nurmatova M, Husanov B, Sultonova A. Philosophy. - Tashkent: TMU, 2019. 2. Madaeva Sh. Shermuhamedova N. and others. Philosophy is a study guide. - Tashkent: 2019. 3. Muhammadjonova L.A. Abdulla Sher, Shodimetova G. Moral philosophy. - Tashkent: Vneshinvestprom, 2023
Saifnazarov I. Mukhtorov A., Sultanov T., Usmanov F. Philosophy. Textbook. - T.: Innovative development publishing house - printing house, 2021.- 424 p. 4. Saifnazarov I.S., Abdullakhanova G.S., Ernazarov D.Z. Philosophy (Logic, Ethics, Aesthetics). Textbook for higher educational institutions. LAMBERT Academic Publishing RU. 2019. -134 pages. 5. Shermuhamedova N. Philosophy. - Tashkent: Idris Abdurauf Nashr, 2021. p. 667</td></tr>
</table>

2. Languages

<table>
<tr><td colspan="2">2.1. Foreign language I (English language)</td></tr>
<tr><td>Semestrs:</td><td>1</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Safarova Fotima Isamiddinovna, Abduvakhabova Dilnoza Nurmakhamatovna</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Secondary</td></tr>
<tr><td>ECTS:</td><td>4</td></tr>
<tr><td>Pre-requisities</td><td>-</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>120</td></tr>
<tr><td>Practical lessons</td><td>48</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>72</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>English course will encourage students to improve their general English and learn to use English language according to their specialty. Moreover, they will learn IT terms a strong grammar syllabus with the specialist vocabulary students need to succeed in their area and the course includes tasks that covers 4 skills (listening, reading, speaking and writing) of learning language. The course includes topics such as Jobs and professions, IT acronyms, Computer hardware and computer software, websites, website development, database basics, data storage and back up, E- commerce, transactions, Network, its types, network range and speed, software repair, hard ware repair, security solutions.</td></tr>
<tr><td>Goal:</td><td>The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in implementing English language in IT sphere.</td></tr>
<tr><td>Objective:</td><td>The course forms the knowledge and skills necessary to understand and express ICT-related knowledge in a foreign language.
This course prepares students to communicate in English in their future professional activities.
Expands vocabulary related to ICT and IT, in particular, develops listening comprehension, speaking, reading and writing skills.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. understand and use familiar everyday expressions and simple expressions;
LO 2. introduce himself and others, ask and answer questions about personal information such as address of residence, place of study and work, family, daily routine;
LO 3. provide information about computer hardware and software;
LO 4. know the lexicon of computer hardware and software;
LO 5. distinguish between word groups and parts of speech;
LO 6. make simple and complex sentences using present, past and future tenses;
LO 7. read a simple text and understand its content;</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;</td></tr>
</table>

<table>
<tr><td></td><td>- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Midterm control</td><td>Practical Assignments 1-2</td><td>20</td><td rowspan="2">50</td><td rowspan="3">100</td></tr>
<tr><td>Independent work</td><td>30</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of practical lessons:</td><td>- Jobs and professions. Working in the IT industry. Meeting people: Introducing yourself and others
- Jobs in IT: Describing your job.
- Schedules: Describing your daily routine.
- Spelling: IT acronyms
- Computer systems. Computer hardware:
- Computer software:
- Working with computers.
- Computer usage: Understand computer usage.
- Websites. Website purpose
- Website analytics
- Website development
- The best websites
- Databases. Database basic: Understanding database product.
- Data Processing: Describing data processing steps.
- Data storage and back up
- E-commerce. E-commerce Companies
- E-commerce feature
- Transaction security: Talking about security. Networks.
- Network system Types of network
- Network range and speed
- IT support. Fault diagnosis: Understanding faults.
- Hardware repair: Using toolkits and making repairs.
- Security solutions: Describing security solutions.
- Reporting incidents: Reporting a security incident.</td></tr>
<tr><td>Literature:</td><td>Maja Olejniczak. “English for Information Technology” 1 Vocational English Course Book, Pearson, 2011.</td></tr>
</table>

<table>
<tr><th colspan="2">2.2. Foreign language II (English language)</th></tr>
<tr><td>Semestrs:</td><td>2</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Safarova Fotima Isamiddinovna, Abduvakhabova Dilnoza Nurmakhamatovna</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Secondary</td></tr>
<tr><td>ECTS:</td><td>4</td></tr>
<tr><td>Pre-requisities</td><td>Foreign language I (English language)</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>120</td></tr>
<tr><td>Practical lessons</td><td>48</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>72</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>English course will encourage students to improve their general English and learn to use English language according to their specialty. Moreover, they will learn IT terms a strong grammar syllabus with the specialist vocabulary students need to succeed in their area and the course includes tasks that covers 4 skills (listening, reading, speaking and writing) of learning language. The course includes topics such as working in the it industry, it systems. data communication, databases, internet, web design, software development, IT solutions.</td></tr>
<tr><td>Goal:</td><td>The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in implementing English language in IT sphere.</td></tr>
<tr><td>Objective:</td><td>The course forms the knowledge and skills necessary to understand and express ICT-related knowledge in a foreign language. This course prepares students to communicate in English in their future professional activities. Expands vocabulary related to ICT and IT, in particular, develops listening comprehension, speaking, reading and writing skills.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. understand and use familiar everyday expressions and simple expressions;
LO 2. introduce himself and others, ask and answer questions about personal information such as address of residence, place of study and work, family, daily routine;
LO 3. provide information about computer hardware and software;
LO 4. know the lexicon of computer hardware and software;
LO 5. distinguish between word groups and parts of speech;
LO 6. make simple and complex sentences using present, past and future tenses;
LO 7. read a simple text and understand its content;</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);</td></tr>
</table>

<table>
<tr><td></td><td>- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Midterm control</td><td>Practical Assignments 1-2</td><td>20</td><td rowspan="2">50</td><td rowspan="3">100</td></tr>
<tr><td>Independent work</td><td>30</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of practical lessons:</td><td>- Working in IT. IT jobs and duties.
- IT organisations.
- IT workplace rules. Meetings
- IT systems. System specifications
- GUI operations. Multimedia hardware
- Operating systems
- Data communication .Internet browsing
- Networks
- Mobile computing. Email
- Administration.Spreadsheets and formulae
- Data base and system administration
- Peripherals
- Choice.Web hosting
- IT costs
- Product research. Making recommendations
- Interactions.Enterprise social media
- Video conferencing
- E-commerce. Training users
- Development. Requirements analysis
- Website design and architecture
- Software development.Project management.
- IT solutions.Investigations
- Diagnosis
- Solutions. Your future in IT.</td></tr>
<tr><td>Literature:</td><td>David Hill: “English for Information Technology” 2 Vocational English Course Book, Pearson 2012.</td></tr>
</table>

<table>
<tr><th colspan="2">2.3. Academic writing</th></tr>
<tr><td>Semestr:</td><td>1</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Abdullaeva Simela Khristoforovna, Medentseva Natalya Petrovna</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Secondary</td></tr>
<tr><td>ECTS:</td><td>4</td></tr>
<tr><td>Pre-requisities</td><td>-</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>120</td></tr>
<tr><td>Practical works</td><td>48</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>72</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>The course provides mastery of the main features of the scientific style of speech, the study of the most common genres of oral and written academic discourse, both educational and scientific, the formation of skills in creating written and oral educational academic texts based on an idea of their goals, structure, stylistic features, genre differences , mastery of the basic principles of communication in an academic environment. During the course, the features of such genres will be discussed: abstract, abstract, review, special attention will be paid to learning how to write a text, based on the existing rules for creating a thematic text</td></tr>
<tr><td>Goal:</td><td>The purpose of teaching the subject “Academic writing “ is to apply specialist language knowledge – vocabulary and terms in students, correct and logical composition of sentences and texts, formation of speech etiquette and knowledge, skills and qualifications in the skills of eloquence, to prepare an educated, ingenious, oral and written literacy mature specialist in the specialty.</td></tr>
<tr><td>Objective:</td><td>- to introduce the features of academic genres (abstract, analytical review, etc.); - increase the level of scientific communication (written and oral); - to teach the rules of structuring texts for presentation purposes; - to learn the rules for using graphic organizers.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Possession of skills in writing, editing and processing various types of texts and information.
LO 2. Conducting a literature review on the topic.
LO 3. Abstracting scientific and popular science texts.
LO 4. Structuring presentations.
LO 5.Writing analytical texts of various genres.
LO 6.Transformation of information from one type to another (graphic, text, etc.)
LO7. Able to distinguish the structure and content of an academic text</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;</td></tr>
</table>

<table>
<tr><td></td><td>- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Midterm control</td><td>Practical Assignments 1-2</td><td>20</td><td rowspan="2">50</td><td rowspan="3">100</td></tr>
<tr><td>Independent work</td><td>30</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Academic writing and information. Types of information.
- Text and its types. Text-forming means of communication.
- Principles of text rubrication. Plan. Types of plan.
- Abstract. Types of notes.Note-taking methods.
- Functional speech styles.
- Annotation. Annotation Types. Lexico-grammatical cliches for annotation.
- Essay. Types of essays.
- Abstract as a genre of secondary text. Types of abstracts. Structure and language clichés for abstracts.
- Scientific review and course work.Coursework structure
- Report. Structure of the report.
- Project. Project characteristics.
- Theses. Types of theses.
- Review. Types of reviews. Review structure.
- Presentation speech as a type of public speech. Presentation structure.
- Representation of facts, objects, processes and conclusions in scientific text.
- Creation of research text. Selecting a topic. Citation. Paraphrase.</td></tr>
<tr><td>Literature:</td><td>Literature 1. Korotkina I. B. Academic writing: process, product and practice Textbook for universities. Moscow: Yurayt, 2021 2. Kuvshinskaya Yu.M., Zevakhina N.A. , Akhapkina Ya.E., Gordienko E.I. Academic writing from research to text. Textbook and workshop for universities. Moscow: Yurayt 2022 3. Jerald Alred, Charles Brusaw, Walter Oliu. Hahdbook of technical writing. New York, Copyright 2003. 4. Stephen Bailey. Akademic writing. Handbook for international student`s. London, 2015 5. Beaufort A. College writing and beyond: A new framework for university writing instruction. Logan, Utah: Utah State University Press, 2007. 6. Irvin L. What Is “Academic” Writing? // http://wac.colostate.edu/books/writingspaces1/irvin--what-is-academic-writing.</td></tr>
</table>

3. Math and Sciences

<table>
<tr><td colspan="2">3.1. Calculus</td></tr>
<tr><td>Semestr:</td><td>1</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Chay Zoya Sergeevna, Islamova Odila Abduraimovna</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>ECTS:</td><td>6</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>Calculus is a branch of mathematics focused on the study of change and motion. It is divided into two main branches: differential calculus and integral calculus. Calculus is fundamental to many fields, including physics, engineering, economics, and biology, as it provides tools for modeling and analyzing dynamic systems.</td></tr>
<tr><td>Goal:</td><td>The purpose of studying calculus is to develop a deep understanding of how quantities change and accumulate, providing essential tools for solving problems in science, engineering, economics, and beyond. Calculus forms the foundation for advanced study in mathematics and its applications in other disciplines, allowing students to model and solve complex problems involving dynamic systems.</td></tr>
<tr><td>Objective:</td><td>To master the fundamental concepts of differential and integral calculus, including limits, derivatives, integrals, and their applications, for analyzing and understanding change and motion in various contexts.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Familiarization with the basic definitions and theorems of the subject “Calculus“
LO 2. The study of the basic concepts and methods of the subject “Calculus“
LO 3. Formation of problem-solving abilities based on theoretical knowledge.
LO 4. Ability to solve mathematical problems in the main sections of higher mathematics.
LO 5. The study of the basics of integral and differential calculus, complex numbers, functions of several variables, the theory of numerical and functional series, checking the convergence of a series, decomposition of functions into Taylor and Maclaurin series, Fourier series.
LO 6. Obtaining skills in calculating multiples, curvilinear and surface integrals.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);</td></tr>
</table>

<table>
<tr><td></td><td>- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-3)</td><td>25</td><td rowspan="2">37</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>12</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">13</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>-Complex numbers: algebraic, trigonometric and exponential forms of a complex number, and actions on them.
-The concept of a numerical sequence. The limit of the sequence. The concept of a function. The limit of the function. Calculating the limit of the function.
-The 1st and 2nd are wonderful limits. The equivalence of infinitesimal functions. Comparison of infinitesimal functions.
-The continuity of the function. Classification of function breakpoints.
-The concept of a derivative function. Calculation of the derivative of the function. Higher-order derivatives.
-The Lopital rule. The differential of the function. The main theorems of differential calculus (Theorems of Rolle, Lagrange and Cauchy).
-The study of functions using a derivative and the construction of its graph (critical points, extremum, concavity and convexity, asymptotes).
-Primitive. The indefinite integral. Integration methods.
-Integration of fractional rational and irrational functions.
-Integration of trigonometric functions.
-The concept of a definite integral. The mean value theorem. The Newton-Leibniz formula. Applications of a certain integral.
-Improper integrals of the I and II kind. Convergence of improper integrals.
-Numerical series.
-Functional series. Power series. The radius and area of convergence of the power series.
-Fourier series and its applications.
-A function of two variables. The domain of definition, the graph, the limit and the continuity of the function of two variables. Partial derivatives.
-The complete differential of a function of many variables. Partial derivatives and differentials of higher orders.</td></tr>
<tr><td>Literature:</td><td>Literature. 1. Robert Adams., Christopher Essex., Calculus: A Complete Course 9th edition. Pearson 2018. 2. George Thomas., Joel Hass., Christopher Heil., Przemyslaw Bogacki., Maurice Weir., José Zuleta Estrugo., Calculus Early Transcendentals 15th edition. Pearson 2024. 3. James Stewart., Stephen Kokoska., Calculus: Concepts and Contexts 5th edition. Cengage Learning 2023.</td></tr>
</table>

3.2. Physics I	
Semestr:	1
Date of last modification:	31.08.2023
Teachers:	Abdurakhmanov Kahar Pattakhovich, Bakhronov Khayot Nurovich
Component:	Compulsory
Cycle:	Secondary
ECTS:	6
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 40 Practical works / 20 Laboratory / 10 SAW (Student autonomous work) / 110 Form of final control / Exam Final assessment method / Testing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes
Short content:	The content of basic physical phenomena and laws, the fundamental unity of the laws of physics, the importance of physical science in the development of technology, fundamental concepts, laws of physical science related to parts of mechanics, molecular physics, thermodynamics, electromagnetism, vibrations and waves are studied.
Goal:	Training and familiarization of students with physical processes and laws, their scientific foundations, physical concepts and competitors necessary for solving theoretical and practical engineering problems.
Objective:	- formation of a scientific approach and understanding of the world, theoretical knowledge, practical skills and physical processes; - learning to draw conclusions by analyzing the essence of physical laws; - train students to apply the acquired knowledge and skills in their professional activities.
Learning outcome:	As a result of mastering the subject, the student must: • Have an idea and knowledge of the essence of basic physical phenomena and laws, the fundamental unity of the laws of physics, the possibility of their further development, the importance of physics in the development of technology; • Be able to logically approach the solution of physical problems, make theoretical calculations and evaluate numerical values when studying physical processes and phenomena; keep abreast of new discoveries in the field of physics, acquire theoretical knowledge that provides the ability to use the principles of physics in their field of specialization and have the skills to apply them; • Have the ability to analyze physical processes and make decisions based on theoretical and practical knowledge obtained from physics in future professional activities.
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities; - communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods); - case-study method (analysis of situations);

<table>
<tr><td></td><td>- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works</td><td>15</td><td rowspan="3">41</td><td rowspan="4">100</td></tr>
<tr><td>Laboratory work</td><td>8</td></tr>
<tr><td>Independent work</td><td>18</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">9</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Subject of physics. Kinematics of translational and rotational motion of a material point.
- Dynamics of a material point.
- Rotational motion of a rigid body.
- Law of conservation of energy in mechanics
- Relativistic mechanics.
- Molecular physics
- Thermodynamics.
- Electrical interactions.
- Work of the electrostatic field during charge transfer
- Dielectrics and conductors in an electric field
- Electricity.
- A magnetic field. Biot-Savart-Laplace Law.
- Laws of Lorentz and Ampere. Hall effect.
- Magnetic properties of matter
- The phenomenon of electromagnetic induction.</td></tr>
<tr><td>Literature:</td><td>Literature 1. Q.P.Abdurakhmanov, V.S.Xamidov, N.A.Akhmedova. "PHYSICS" Textbook. Tashkent. 2018. 2. Physics: Principles with Applications 6th Edition by Douglas C. Giancoli , 2014. 3. I.I.Savelev. The course is general physics. Roof 1,2,3. Moscow, 2018. 4. Serway R.A., Jewett J.W. Physics for Scientists and Engineers with Modern Physics, 8ed., Brooks Cole, 2010.5. Kh.M.Kholmedov, B.Ibragimov, Kh.N.Karimov. Methodical guide for practical training in physics. "Mechanics" part 1. TUIT, 2020.6.A.S.Ganiyev, Kh.N.Bakhronov, I.O.Jumaniyazov. Methodical guide for practical training in physics. " Electromagnetism " part 3. TUIT, 2020.</td></tr>
</table>

<table>
<tr><td colspan="2">3.3. Physics II</td></tr>
<tr><td>Semestr:</td><td>2</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Abdurakhmanov Kahar Pattakhovich, Bakhronov Khayot Nurovich</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>ECTS:</td><td>4</td></tr>
<tr><td>Pre-requisities</td><td>Physics I</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>120</td></tr>
<tr><td>Lecture</td><td>20</td></tr>
<tr><td>Practical works</td><td>20</td></tr>
<tr><td>Laboratory</td><td>10</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>70</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>Creation of a theoretical base in physics for future engineers, formation of a scientific approach and worldview in explaining theoretical knowledge, practical skills and physical processes, physics of vibrations and waves, optics, fundamentals of quantum mechanics, solid state physics, contact phenomena, atomic and nuclear physics.</td></tr>
<tr><td>Goal:</td><td>Training and familiarization of students with physical processes and laws, their scientific foundations, physical concepts and competitors necessary for solving theoretical and practical engineering problems.</td></tr>
<tr><td>Objective:</td><td>- formation of a scientific approach and understanding of the world, theoretical knowledge, practical skills and physical processes; - learning to draw conclusions by analyzing the essence of physical laws; - train students to apply the acquired knowledge and skills in their professional activities.</td></tr>
<tr><td>Learning outcome:</td><td>As a result of mastering the subject, the student must:
LO 1. Have an idea and knowledge of the essence of basic physical phenomena and laws, the fundamental unity of the laws of physics, the possibility of their further development, the importance of physics in the development of technology;
LO 2. Be able to logically approach the solution of physical problems, make theoretical calculations and evaluate numerical values when studying physical processes and phenomena; keep abreast of new discoveries in the field of physics, acquire theoretical knowledge that provides the ability to use the principles of physics in their field of specialization and have the skills to apply them;
LO 3. Have the ability to analyze physical processes and make decisions based on theoretical and practical knowledge obtained from physics in future professional activities.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);</td></tr>
</table>

<table>
<tr><td></td><td>- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works</td><td>15</td><td rowspan="3">41</td><td rowspan="4">100</td></tr>
<tr><td>Laboratory work</td><td>8</td></tr>
<tr><td>Independent work</td><td>18</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">9</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Oscillatory movements.
- Damped and forced mechanical vibrations. Electromagnetic vibrations.
- Wave processes.
- Superposition of waves.
- Electromagnetic waves.
- Light emission
- Light diffraction
- Dispersion and polarization of light
- Quantum optics
- Linear spectra of atoms
- Solid state physics
- Proprietary semiconductors
- Impurity semiconductors
- Contact phenomena
- Physics of the atomic nucleus</td></tr>
<tr><td>Literature:</td><td>Literature 1. Q.P.Abdurakhmanov, V.S.Xamidov, N.A.Akhmedova. "PHYSICS" Textbook. Tashkent. 2018. 2. Physics: Principles with Applications 6th Edition by Douglas C. Giancoli , 2014. 3. I.I.Savelev. The course is general physics. Roof 1,2,3. Moscow, 2018. 4. Serway R.A., Jewett J.W. Physics for Scientists and Engineers with Modern Physics, 8ed., Brooks Cole, 2010.5. Abdurakhmanov K.P., Ochilova O., Tohirov U.H., Khaidarov K.B.. A methodological guide to practical classes in physics. Part 4. Harmonic vibrations, mechanical and electromagnetic vibrations, mechanical and electromagnetic waves. Tashkent, 2021.6. Imamov E., Rakhmatullayeva M., Mukhamedaminova L. and others, A methodological guide to practical classes in physics. Part 6. Solid state Physics. Atomic and nuclear physics. Tashkent, 2021.</td></tr>
</table>

3.4. Differential Equations	
Semestr:	2
Date of last modification:	31.08.2023
Teachers:	Mamatov Abdugani Ermamatovich, Safarov DJurabek Shakarovich
Component:	Compulsory
Cycle:	Core
ECTS:	4
Pre-requisities	Calculus
Workload:	**Types of classes** / **Hours** Total / 120 Lecture / 30 Practical works / 18 SAW (Student autonomous work) / 72 Form of final control / Exam Final assessment method / Testing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes
Short content:	Differential equations course involves solving mathematical equations that describe the relationship between a function and its derivatives. They are essential in modeling various physical systems and phenomena, including physics, engineering, biology, and economics. There are two main types of differential equations: ordinary differential equations (ODEs), which involve functions of a single variable and their derivatives, and partial differential equations (PDEs), which involve functions of multiple variables and their partial derivatives.
Goal:	The purpose of studying differential equations is to equip students with the mathematical tools necessary to model, predict, and analyze the behavior of real-world systems that change over time. This knowledge is essential for understanding natural phenomena, designing engineering systems, and conducting scientific research.
Objective:	To understand and solve equations that describe the relationship between a function and its derivatives, enabling the modeling and analysis of dynamic systems in various fields such as physics, engineering, biology, and economics.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Familiarization with the basic definitions and theorems of the subject “Differential equations“ LO 2. Study of the basic concepts and methods of the subject “Differential equations“ LO 3. Obtaining skills in the application of mathematical concepts and studied methods of analysis. LO 4. Ability to solve mathematical problems in the main sections of the differential equation. LO 5. Obtaining skills for solving an ordinary first-order differential equation and higher-order differential equations of various types. LO 6. Obtaining skills for solving differential equations and systems of linear differential equations by the Laplace transform method.
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning;

<table>
<tr><td></td><td>- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-3)</td><td>25</td><td rowspan="2">37</td><td rowspan="3">100</td></tr>
<tr><td>Independent work (1-2)</td><td>12</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">13</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to the subject. Differential equations with separable variables.
- Homogeneous and reducible to homogeneous differential equations. Application to applied tasks.
- Linear differential equations. Solution of linear differential equations by Lagrange and Bernoulli methods. Application to applied tasks.
- Bernoulli's equations.Equations in full differentials. Integrating multipliers.
- The differential equation is unresolved with respect to the derivative. The Lagrange and Clerault equations.
- Higher-order differential equations admitting a decrease in order.
- Linear differential equations of higher orders. Vronskian. Fundamental solutions. Basic theorems.
- Linear homogeneous differential equations with constant coefficients. The characteristic equation.
- Linear inhomogeneous differential equations with constant coefficients with a special right-hand side.
- Differential equations of the second order and their solution using the method of variation of arbitrary constants. The Ostrogradsky-Liouville formula.
- Approximate methods for solving differential equations (using mathematical packages).
- A system of differential equations. Methods of solutions.
- Original and image. Laplace transformations.
- Basic properties of the Laplace transform.
- Solving differential equations and systems of differential equations by the method of operational calculus.</td></tr>
<tr><td>Literature:</td><td>Literature 1. Khasanov Compiled A.B., An introduction to the theory of ordinary differential equations, Turan-Press 2019. 2.Yuzhov A.Q., Mirzakarimov E.M., Ordinary differential equations in the Maple system, Tashkent 2013. 3. Norbert Euler. A First Course in Ordinary Differential Equations.bookboon.com G. Black Mike, Mike Dunn, Programming Android with Kotlin, O'reilly Media, 2021.</td></tr>
</table>

<table>
<tr><th colspan="2">3.5. Probability and Statistics</th></tr>
<tr><td>Semestr:</td><td>3</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Qalandarov Utkir Namozovich, Islamova Odila Abduraimovna</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>ECTS:</td><td>6</td></tr>
<tr><td>Pre-requisities</td><td>Differential Equations</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>Probability and statistics course is branch of mathematics dealing with data, uncertainty, and the analysis of random phenomena. Probability theory provides a mathematical framework for quantifying the likelihood of events and understanding random processes. Statistics involves collecting, analyzing, interpreting, and presenting data. The course is essential foundamentally for students.</td></tr>
<tr><td>Goal:</td><td>The purpose of studying probability and statistics is to prepare students to handle data and uncertainty in scientific research, engineering, business, and everyday life. This subject provides the skills necessary to collect, analyze, and draw meaningful conclusions from data, enabling informed decision-making and effective problem-solving in a wide range of fields.</td></tr>
<tr><td>Objective:</td><td>To learn the principles of probability theory and statistical methods for analyzing, interpreting, and making decisions based on data, with an emphasis on understanding randomness and variability in various contexts.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Familiarization with the basic definitions and theorems of the subject “Probability and statistics “
LO 2. The study of the basic concepts and methods of the subject “Probability and statistics“
LO 3. Obtaining skills in the application of mathematical concepts and studied methods of analysis.
LO 4. Mastering the skills of representation and allocation of continuous and discrete models
LO 5. Information-related process analysis skills.
LO 6. Increases the giftedness of students, manifests the skills of logical and algorithmic thinking in students.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;</td></tr>
</table>

<table>
<tr><td></td><td>- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-3)</td><td>25</td><td rowspan="2">37</td><td rowspan="3">100</td></tr>
<tr><td>Independent work (1-2)</td><td>12</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">13</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>
- The subject and tasks of Probability and Statistics. Random events. The space of elementary events. Operations on events. Elements of combinatorics.
- Probability definitions. Statistical, classical, geometric definition of probability. Determination of probability when the space of elementary events is countable. Kolmogorov's axioms.
- Theorems of addition and multiplication of probabilities. Conditional probability. Theorems of addition of probabilities of joint and incompatible events. A complete group of events. Opposite events. The probability of occurrence of at least one event. Dependent and independent events. Theorems of multiplication of probabilities of dependent and independent events.
- Conditional probability. The formula of total probability. Probabilities of hypotheses (assumptions). The Bayes formula.
- A sequence of independent tests. Bernoulli's scheme. The Bernoulli formula. Poisson's theorem. Local and integral theorems of Moivre–Laplace. The most probable number of occurrences of an event in the Bernoulli scheme. Experience with multiple events in the Bernoulli scheme.
- Random variables. Types of random variables. Ways to set them.
- The main numerical characteristics of random variables. Mathematical expectation, variance, mean square deviation, initial and central moments of the kth order, mode, median.
- The most common distributions are of the discrete type. Bernoulli distribution. Binomial, geometric and Poisson distributions, negative binomial distribution, hypergeometric distribution.
- The most common distributions are of the continuous type. Uniform, exponential, and normal distributions. The law of three sigma. Asymmetry and excess. Chi square distribution.
- A system of two random variables. The law (matrix) of the probability distribution of a discrete two-dimensional random variable. The distribution function and its properties. The distribution density of a continuous two-dimensional random variable and its properties
- Numerical characteristics of a random vector. The coefficient of covariance. The correlation coefficient and its properties. Two-dimensional normal and uniform distributions.
- The law of large numbers. The central limit theorem. Chebyshev's inequality. The law of large numbers for a sequence of independent random variables. Chebyshev's theorem. Bernoulli's theorem. The central limit theorem for identically distributed random variables, Lyapunov's theorem, Laplace's theorem.
</td></tr>
</table>

	- The main tasks of mathematical statistics. The subject of mathematical statistics. Primary sampling analysis. The variation series. Graphs of the variation series. The empirical distribution function. Polygon, histogram. Numerical characteristics of the sample - Statistical estimates of unknown distribution parameters. The concept of statistics and statistical evaluation. Evaluation properties: non-bias, consistency, efficiency. Disadvantages of point estimates. Methods of finding estimates: the method of moments, the method of maximum likelihood. - Interval estimates. Confidence interval, confidence probability (reliability). Confidence intervals. The concept of confidence probability. The confidence interval and the accuracy of the estimate. The confidence interval for the mean value of the normal distribution for unknown and known cases of standard deviation σ. The confidence interval for the σ^2 variance of the normal distribution.Determination of the sample size n. - Statistical hypotheses. Types of statistical hypotheses. Errors of the I and II kind. The power of the criterion. The critical area. The stages of testing statistical hypotheses. Testing hypotheses about the average value of the normal distribution with a known and unknown standard deviation σ, testing hypotheses about the variance of the normal distribution. - The criteria for Pearson and Kolmogorov's agreement. Verification of the statistical hypothesis about the type of unknown distribution using Pearson's χ^2 agreement criterion and Kolmogorov's agreement criterion - Correlation analysis. Tasks and types of correlation. The main tasks of correlation analysis. The linear correlation coefficient and its properties. - Regression analysis. The equation of paired regression. Types of regression. The least squares method. The average approximation error.. Coefficient of determination - Nonlinear regression equations. Multidimensional regression and correlation. Nonlinear regression equations. OLS for estimating the parameters of multidimensional regression. Regression equation at standardized scales. Average elasticity coefficients. - Analysis of variance. The problem statement and the essence of the analysis of variance. Models of univariate and multifactorial analysis of variance. Schemes of variance analysis.
Literature:	1. Robert Hogg., Elliot Tanis., Dale Zimmerman., Probability and Statistical Inference, 10th edition. Pearson 2019. 2. Pappu Kousalya., Probability, Statistics and Random Processes Pearson 2013. 3. Richard A., Johnson., Probability and Statistics for Engineers 9th edition (Global Edition). Pearson 2017. 4. Morris DeGroot ., Mark Schervish ., Instructor's Solutions, Manual for Probability and Statistics 4th edition. Pearson 2012. 5. Michael Akritas., Probability & Statistics with R for Engineers and Scientists Pearson 2016.

3.6. Discrete Structures	
Semestr:	2
Date of last modification:	31.08.2023
Teachers:	Ismailova Lemara Rafatovna, Turgunov Abrorjon Makhamatsolievich
Component:	Compulsory
Cycle:	Core
ECTS:	6
Pre-requisities	-
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Testing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes
Short content:	Discrete structures course will encourage you to understand an introduction to discrete structures, sets, subsets, basic operations on sets, ordered sets, Cartesian product of sets, binary relations and relation matrices, types of relations, basic rules of combinatory, permutations without repetition, permutations and placements, Boolean algebra, the concept of reasoning, Boolean functions, generality and accessibility quantifiers, the laws of logic, construction of the truth table of logical functions, methods for minimizing logical networks, Carnot cards, basic concepts of graph theory, Euler and Hamilton graphs, forest, trees, tree properties, oriented graph, adjacency matrix of a directed graph, route, chain, cycle in directed graphs, algorithms for finding the shortest path.
Goal:	The purpose of mastering the discipline is to give students theoretical knowledge and practical skills in learning Discrete structures.
Objective:	-understanding the fundamentals of Discrete structures; -studying sets, subsets, basic operations on sets, ordered sets, Cartesian product of sets, binary relations and relation matrices, types of relations; -developing practical skills in basic rules of combinatory, permutations without repetition, permutations and placements; -analyzing Boolean functions, generality and accessibility quantifiers, the laws of logic, construction of the truth table of logical functions, methods for minimizing logical networks, Carnot cards; -studying basic concepts of graph theory, Euler and Hamilton graphs, forest, trees, tree properties, oriented graph; -exploring modern trends adjacency matrix of a directed graph, route, chain, cycle in directed graphs, algorithms for finding the shortest path
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understand fundamentals of Discrete structures. LO 2. Understand the sets, subsets, basic operations on sets, ordered sets, Cartesian product of sets, binary relations and relation matrices, types of relations LO 3. Possess skills in basic rules of combinatory, permutations without repetition, permutations and placements. LO 4. Use boolean functions, generality and accessibility quantifiers, the laws of logic, construction of the truth table of logical functions, methods for minimizing logical networks, Carnot cards.

<table>
<tr><td></td><td>LO 5. Use basic concepts of graph theory, Euler and Hamilton graphs, forest, trees, tree properties, oriented graph.
LO 6. Perform configuration of matrix of a directed graph, route, chain, cycle in directed graphs, algorithms for finding the shortest path.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical assignment (PA1, PA2, PA3)</td><td>20</td><td rowspan="3">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Personal assignment</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2"></td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introductions. Discrete structures and examples
- Sets. Operation on sets. Subsets.
- Sorted sets. Cartesian products. Properties of Cartesian products.
- Relations. Binary relations and their matrix. Types of relations. Equivalent relations.
- Mappings and functions. Originality, images and mapping in a limited set.
- Combinatory. Basic rules of combinatory. Permutations, placement, combinations.
- Boole's algebra. The concept of an utterance. Binary identities of propositional logic.
- Boole's functions. Equivalence of formulas. Community and existence quantifiers.
- The laws of logic. Building Truth Tables for Logic Functions. Normal forms. Maximum normal forms. Binary logic gates. Application of binary logic gates.
- Analysis and synthesis problems in logical circuits. Logical networks.
- Minimizing logical networks. Karnaugh map. Application of predicates as a mathematical model of feedback.
- Basic concepts of graph theory. Methods for defining graphs. Adjacency and Incident Matrices. Graph isomorphism.
- Routes, chains, cycles. Euler and Hamiltonian graphs. Planar graphs.
- Euler's formulas for plane graphs. Homeomorphism.
- Trees. Forest. Properties of trees. Spanning tree. Minimum spanning tree. Root tree.
- Directed graph. Digraph. Adjacency matrix for the digraph.
- Routes, chains, and loops for digraphs. Shortest Path Algorithms</td></tr>
<tr><td>Literature:</td><td>Literature 1. Mathematical logic and discrete mathematics. T.: "Teacher", Toraev Kh, 2003. 2. Discrete mathematics for programmers, Tekhnosphere, M., Haggarty R., 2003. 3. Discrete mathematics - M.: "Lan", Shevelev Yu.P., 2008. 4. Discrete Math. “Phoenix”, Aseev G.G., Abramov O.M., Sitnikov D.E., 2003 5. Discrete mathematics - Taganrog Radio Engineering University, Taganrog, Kulabukhov S.Yu., 2001. 6. Problems and exercises in discrete mathematics. M.: Nauka., Gavrilov G.P., Sapozhchenko A.A., 2005. 7. Discrete mathematics theory, problems, applications. - M. Erussalimsky Ya.M., 2002.</td></tr>
</table>

4. General

<table>
<tr><td colspan="2">4.1. Power supply for infocommunication systems</td></tr>
<tr><td>Semestr:</td><td>5</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Amurova Natalya Yurievna</td></tr>
<tr><td>Component:</td><td>Elective</td></tr>
<tr><td>Cycle:</td><td>Secondary</td></tr>
<tr><td>ECTS:</td><td>4</td></tr>
<tr><td>Pre-requisities</td><td>-</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>120</td></tr>
<tr><td>Lecture</td><td>30</td></tr>
<tr><td>Practical works</td><td>18</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>72</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>The development of students' collaborative critical thinking in the context of power supply of infocommunication systems is ensured through the analysis of electrical power systems and the study of power equipment, which allows students to apply theoretical knowledge to analyze and optimize complex systems, identifying and solving technical problems in practice.
Creative design of innovative energy solutions aimed at developing efficient and reliable energy systems and devices requires students to be able to apply engineering and design knowledge to create technically sound and innovative solutions.</td></tr>
<tr><td>Goal:</td><td>The acquisition of creative, design and engineering experience by students is achieved through practical work with power equipment, as well as analysis of technical documentation, which contributes to the deepening of their technical competencies and the development of professional skills necessary for effective work in the field of power supply of infocommunication systems.</td></tr>
<tr><td>Objective:</td><td>- Technical competence: understanding and application of electrical power systems principles, working with technical documentation and modeling programs; - Analytical Competence: critical analysis and assessment of electrical power systems, selection of optimal technical solutions; - Communicative and collaborative competence: teamwork, effective communication and shared decision making in electrical projects.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Analyze and evaluate the parameters of power supply of infocommunication facilities.
LO 2. Design power supply system is taking into account the requirements of reliability and energy efficiency.
LO 3. Use and interpret technical documentation and electrical standards.
LO 4. Apply methods and technologies to reduce electricity losses in infocommunication systems.
LO 5. Develop and implement solutions for integrating renewable energy sources into power supply systems.
LO 6. Manage relay protection and automation systems for electrical power systems..</td></tr>
</table>

Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities; - communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods); - case-study method (analysis of situations); - game technologies, in which students participate in business, role-playing, simulation games; - information and communication (including distance learning) technologies. In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.
Assessment of the student's knowledge:	

Type of task		**Number of points (max)**		**Total**
Current control	Practical works (1-10)	20	40	100
	Independent work	10		
	Oral presentation	10		
Mid-term control	Written work	10		
Final control	Exam (Testing)	50		

Topics of lectures:	- Organization of power supply in information and communication systems. - Quantities and parameters characterizing electrical energy. Units. Basic laws. DC and AC power supply systems. - Primary and secondary sources of power supply. Renewable and non-renewable energy sources. - Solar energy. Information about solar energy. Types of solar devices. Solar collectors - Analysis of the development of wind energy devices. Environmental aspect. - Mechanisms and forms of organization and management of processes in electrical stations and substations of power supply systems of infocommunication facilities. - The role of devices for transmitting and distributing electrical energy of infocommunication objects. - Transformation and distribution of electrical energy. Essential elements. Single and three-phase transformers, structure and principle of their operation. - Rectifiers and converters for power supply of infocommunication facilities. - Uninterrupted power supply. - Devices for controlling energy efficiency and resource efficiency in information and communication systems. - Relay protection and automation of electrical power systems - Methods and devices for reducing electrical energy losses at facilities and infocommunication devices. - Accounting and control of production and consumption of electrical energy in infocommunication systems. ASKUE system. - Climate control devices for infocommunication systems. Security of service and power supply
Literature:	1. The Essential Guide to Power Supplies. Edited by Gary Bocock. Publisher: XP Power; First Edition (January 1, 2014). Language: English. Paperback: 156 pages. ISBN-10: 1634433432. ISBN-13: 978-1634433433. 2. Paul Scherz, Simon Monk. Practical Electronics for Inventors. Third Edition. p 1120. Copyright © 2013 by The McGraw-Hill Companies. ISBN: 978-0-07-177134-4. MHID: 0-07-177134-4. 3. David Cook. Robot Building for Beginners, Third Edition. Copyright © 2015 by David Cook. ISBN-13 (pbk): 978-1-4842-1360-5. ISBN-13 (electronic): 978-1-4842-1359-9. 4. Batteries in a Portable World - A Handbook on Rechargeable Batteries for Non-Engineers" Isidor Buchmann. Cadex Electronics Inc.; 4th edition (2016). ISBN-10: 0968211844, ISBN-13: 978-0968211847.

<table>
<tr><td colspan="2">4.2. Life safety</td></tr>
<tr><td>Semestr:</td><td>5</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Eshmuradov Dilshod Elmuradovich</td></tr>
<tr><td>Component:</td><td>Elective</td></tr>
<tr><td>Cycle:</td><td>Secondary</td></tr>
<tr><td>ECTS:</td><td>4</td></tr>
<tr><td>Pre-requisities</td><td>-</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of lessons</th><th>Hour</th></tr>
<tr><td>Total</td><td>120</td></tr>
<tr><td>Lecture</td><td>30</td></tr>
<tr><td>Practical work</td><td>18</td></tr>
<tr><td>SAW (Student Autonomous Work)</td><td>72</td></tr>
<tr><td>Final control form</td><td>Exam</td></tr>
<tr><td>Final evaluation method</td><td>Test</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>This course consists of lectures, practical classes and independent work of students aimed at in-depth study of theoretical knowledge with the help of practical skills. Life safety is the creation of normal human life conditions, protection of him and the environment (production, environment, everyday life) from dangerous and harmful factors of a natural and man-made nature.</td></tr>
<tr><td>Goal:</td><td>The course "Life Safety" provides basic concepts and definitions in the production and performance of work in private life. Defines visual concepts in the field of electrical safety, fire safety, electromagnetic safety, and also provides the necessary basis for the application of various types of lighting and noise effects on the human body and the environment.</td></tr>
<tr><td>Objective:</td><td>Distinguish ergonomic features of workplaces (light, noise, vibration, microclimate).</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Have an idea of the harmful effects of radiation on the human body and the environment
LO 2. Distinguish types, means of fire safety systems, as well as classify buildings by fire hazard
LO 3. Distinguish between methods and means of human protection in emergency situations
LO 4. He will get an idea of the main directions of the labor legislation of the Republic of Uzbekistan, protection of employees, current benefits
LO 5. Learns about modern electrical safety systems and the mechanisms of the effect of electricity on the human body</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, lessons are mainly conducted in active and creative forms. Among the effective pedagogical methods and technologies that help students actively participate in the search and management of knowledge, it is worth noting the acquisition of independent problem-solving experience:
- problem-based and project-based educational technology;
- educational and scientific activity technologies;
- communication technologies (discussion, press conference, brainstorming, educational debates and other active forms and methods);</td></tr>
</table>

<table>
<tr><td></td><td>- case-study method (situation analysis);
- game technologies in which students participate in business, role-playing, simulation games;
- information and communication (including distance education) technologies.
In order to develop critical thinking among students, methods such as "Prediction with open questions", "Cluster", "Mutual discussion", "Know-I-want-to-learn", "INSERT", practical exercises, etc. gamification and others are actively used during practical training.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-10)</td><td>20</td><td rowspan="3">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>-The main content, purpose and objectives of the science of safety of life activities.
- Ergonomics of production buildings.
- Types, systems and features of lighting.
- The effect of noise and vibrations on the human body.
- The effect of electromagnetic fields on the human body.
- Ionizing radiation in telecommunication enterprises.
- Electrical safety: the effect of electric current on the human body, the resistance of the human body to electric current.
- The main factors of damage to a person from electric current, methods of protection against exposure to electric current.
- Electrical device protection tools.
- First aid in case of emergency.
- First aid for injuries and wounds.
- Legal and organizational foundations of the safety of life activities.
- Fire safety.
- Emergencies, their types and characteristics.
- Negative impact of the production microclimate.</td></tr>
<tr><td>Literature:</td><td>1. Ecology and life safety: A textbook for university students / ed. L. A. Muravey, 2016. 2. Safety and ecology of life activities. Sapaev M.S., Kadyrov F.M. Tutorial, Tashkent - "contact person" -2019, 276p. 3. O.D.Rakhimov, I.X.Siddikov, M.O.Murodov, Safety of life activities. Ecology. Textbook for Bachelor's degree courses in higher education. T.: "The liaison", 2017-332 p.</td></tr>
</table>

<table>
<tr><td colspan="2">4.3. Pedagogy. Psychology</td></tr>
<tr><td>Semestr:</td><td>6</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Yusupova Zamira Zaripovna, Zakirova Madina Rinatovna</td></tr>
<tr><td>Component:</td><td>Elective</td></tr>
<tr><td>Cycle:</td><td>Secondary</td></tr>
<tr><td>ECTS:</td><td>4</td></tr>
<tr><td>Pre-requisities</td><td>-</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>120</td></tr>
<tr><td>Lecture</td><td>30</td></tr>
<tr><td>Practical works</td><td>18</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>72</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>This training course is an analysis of the tasks specified in paragraph 14 of the decision of the President of the Republic of Uzbekistan № - 4851 of October 6, 2020 and the analysis and training of reforms being introduced to bring the education system of the Republic of Uzbekistan to the level of world standards. focused on the study of advanced strategic practices.</td></tr>
<tr><td>Goal:</td><td>To be able to apply educational methods in the teaching of technical sciences and in-depth training of individual and psychological characteristics of a person.</td></tr>
<tr><td>Objective:</td><td>- The maskur course consists of 2 parts; 1. In the pedagogy section, the development of pedagogy as a science, the methods used in the educational process, and the scientific foundations of advanced pedagogical technologies are covered. 2. The development of the science and its developed areas as a science are covered in the section of psychology. Motive as a driving force of the cognitive process, individual psychological characteristics of a person are scientifically explained. Purpose and strategy of engineering psychology. The tasks of engineering psychology are covered.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Students will get an idea of the scientific research works of thinkers in Central Asia and Europe.
LO 2. They will have knowledge about the "Strategy of actions for further development of the Republic of Uzbekistan" and reforms in the education system.
LO 3. Students will be able to show their abilities in innovative activity during the educational process, in the correct qualitative assessment of the pedagogue.
LO 4. They study the character, abilities and temperament of an IT specialist.
LO 5. They can acquire the qualities of management and leadership in education and production.
LO 6. Students learn the operator's activities in the "Man-machine" system in the educational process.
LO 7. Information-psychological security studies the manifestations and sources of threats.</td></tr>
</table>

<table>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- application of pedagogical technologies in the process of education;
- pedagogical scientific research methods;
- study of personality and psychological methods (questionnaire, interview, observation, experiment, laboratory, test and sociometric methods) ;
- case-study method (analysis of situations);
- through the methods of psychotraining, students try themselves as holders of various professions;
- information and communication (including distance learning) technologies.
In order to develop logical thinking among students, methods such as "Brainstorming", "Cluster", "Problematic education", "Know-I-want-to-learn", "INSERT", practical exercises, gamification and others are actively used during practical training.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-10)</td><td>20</td><td rowspan="3">40</td><td rowspan="5">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- History and theory of pedagogy.
- Person as an object and subject of education.
- Educational methodology and advanced pedagogical technologies.
- Psychology as a science. Tasks and research methods of psychology. Interrelationship and branches of psychology with other sciences.
- Cognitive processes. Activity and its types. The role of psychological knowledge in human activity. Motive and motivation. Motivation of social behavior. Conscious and unconscious motives.
- Individual psychological characteristics of a person (character, ability, temperament). Communication and its types. Psychology of interpersonal relations.
- Engineering psychology as a branch of labor psychology.
- Labor regime and its psychological essence. Quality of labor and psychotechnological issues of its provision.
- Subject of engineering psychology. Purpose and strategy of engineering psychology. Tasks of engineering psychology.
- Research methods and general features in engineering psychology. Psychological methods. Physiological methods. Mathematical methods. Imitation methods.
- Features of classification of "man-machine" system. Operator in the "man-machine" system.
- Human-Machine Collaboration. Sensorimotor requirements in work.
- Psychological information security and social development.
- Manifestations and sources of threats to the information and psychological security of the individual, society and the state.
- Psychological self-protection of a person in the conditions of open mass information systems.</td></tr>
<tr><td>Literature:</td><td>1. B.M. Umarov. Psychology. Textbook - T., 2012. 2. F. Mominov, Sh. Barotov and others. Information psychological security in open information systems. Textbook. - T.: "Science and technology", 2013. 3. S.K. Ganiyev, M.M. Karimov, K.A. Tashev. Information security. Textbook, Tashkent-2017.4. T.A. Fugelova. Engineering psychology. Textbook, Moscow-2019. 5. S.V. Andrievskaya. Engineering psychology, pedagogy and team management. Methodological recommendations for seminar classes, Novopolotsk, Belarus – 2022. 6. Oktam Shamsiyev. Labor and engineering psychology. Textbook, Tashkent-2024.</td></tr>
</table>

4.4. Ecology	
Semestr:	6
Date of last modification:	31.08.2023
Teachers:	Saidova Gulchexra Alisherovna
Component:	Elective
Cycle:	Secondary
ECTS:	4
Pre-requisities	-
Workload:	**Types of classes** / **Hours** Total / 120 Lecture / 30 Practical works / 18 SAW (Student autonomous work) / 72 Form of final control / Exam Final assessment method / Testing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes
Short content:	The main goal of environmental education is the formation of a conscious attitude to environmental problems among all segments of the population, including students of higher educational institutions. The course "Ecology", taught in universities, should serve to form the scientific worldview of students and direct them to practical activities.
Goal:	Requirements for knowledge, skills and abilities of students in teaching this subject: - It is necessary to know the science of ecology and its tasks, the causes of environmental problems, environmental factors and their impact on organisms, ecosystems and the conditions for their sustainability, the current state of the natural environment and emerging environmental problems, the impact of scientific and technological progress on the environment: - based on our national beliefs and values, to have the skills of reasonable, economical use of land, water, air and natural resources, any damage to nature can have extremely dangerous consequences for human life.
Objective:	Technical competence: understanding and applying the principles of rational environmental management, working with environmental legislation, modeling environmental situations; - Analytical competence: critical analysis and assessment of environmental systems, selection of the optimal resource saving strategy; - Communicative and collaborative competence: teamwork, effective communication and shared decision making in environmental projects.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Anow the basic patterns of functioning of living organisms, ecosystems at various levels of organization, the biosphere as a whole and their. LO 2. Be able to analyze problems associated with anthropogenic (technogenic) impact on the environment. LO 3. Have knowledge and skills in the field of environmental protection. LO 4. Know the concepts, strategies and practical tasks of sustainable development in various countries and the Republic of Uzbekistan.

	LO 5. To form in students a comprehensive, objective and creative approach to discussing the most pressing and complex problems of ecology, environmental protection and sustainable development.
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities; - communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods); - case-study method (analysis of situations); - game technologies, in which students participate in business, role-playing, simulation games; - information and communication (including distance learning) technologies. In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.
Assessment of the student's knowledge:	

Type of task		**Number of points (max)**		**Total**
Current control	Practical works (1-10)	20	40	100
	Independent work	12		
	Oral presentation	8		
Mid-term control	Written work	10		
Final control	Exam (Testing)	50		

Topics of lectures:	- Ecology course, goal, task, structure and history - The doctrine of the biosphere - Ecology of ecosystems - Environmental factors and their classification - Atmosphere and its protection - Protection of water resources - Preservation of the lithosphere - Natural resources and their rational use - Pollution of the environment with various wastes - Problems of environmental protection in the Republic of Uzbekistan. - Pollution of industrial cities and their impact on the environment - Negative impact of the Aral Sea tragedy on the environment. - Universal environmental problems. Regional environmental problems. - The main directions of environmental safety. Environmental assessment. - The sphere of communication and its impact on the environment. Environmental monitoring.
Literature:	1. Karimov I.A. Uzbekistan on the threshold of the 21st century: a threat to security. Conditions for stability and guarantees of development. Uzbekistan 1997. 2. Abirkulov K.N., Kurbonniezov R. Fundamentals of ecology. Urgench. UDU, 1999. 3. Rafikov A.A., Abirkulov K.N., Khodzhimatov A.N. Ecology, textbook-T. 2004. 4. Holliev I., Ikromov A. Ecology. Textbook.-T.2001. 5. Tokhtaev A.S. Ecology. Textbook.-T.1998. 6. Yormatova D.Yu. Industrial Ecology - T.2007. 7. Abirkulov K.N., Abdulkosimov A., Khamdamov Sh. Social ecology, textbook-T.2004.. 8. Nigmatov A. Ecological law of the Republic of Uzbekistan. Textbook-T.2004. 9. Environmental protection. Laws and rules. Justice 2002

5. Fundamental

<table>
<tr><td colspan="2">5.1. Programming I</td></tr>
<tr><td>Semestr:</td><td>1</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Ishniyazov Odil Olimovich, Shobdarov Elbek Bekkadir uli</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Secondary</td></tr>
<tr><td>ECTS:</td><td>6</td></tr>
<tr><td>Pre-requisities</td><td>Calculus</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>30</td></tr>
<tr><td>Practical works</td><td>42</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>The purpose of teaching science is to teach students the fundamental concepts of programming languages and algorithmic methods, to solve practical problems related to various fields, to teach logical thinking, to create applications in various programming environments and to develop their skills in practice.</td></tr>
<tr><td>Goal:</td><td>The aim of training is to teach students fundamental concepts and methods of algorithmic programming languages, solving practical problems related to various fields, logical thinking, formation of skills to create applications in various programming environments and their application in practice.</td></tr>
<tr><td>Objective:</td><td>- formation of optimization thinking; - development of mathematical and algorithmic intuition in solving problems encountered in practice; - formation of basic knowledge in the field of algorithmization and programming; - mastering analytical and numerical methods of solving applied problems.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Understand and use basic programming concepts, linear, branching and iterative structures, functions and properties of arrays, files and strings.
LO 2. Will have the ability to critically analyze and evaluate the achievements of modern science, solve research and practical problems, including creating new ideas in interdisciplinary fields.
LO 3. Must have the skills to develop a software product with a user-friendly interface based on a functional and object-oriented approach to programming using modern syntax of programming languages to solve specific problems.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);</td></tr>
</table>

<table>
<tr><td></td><td>- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-10)</td><td>30</td><td rowspan="2">40</td><td rowspan="3">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>-Basic concepts of algorithms and programming. Algorithm properties and expression methods. Introduction to Programming. Compiler types. Identifier and their types.
-Structure of programming languages. Organization of linear algorithms and calculation of algebraic expressions using mathematical library functions.
-Branching and selection operators. Networking operators and their operation procedure. Ternary operator. Unconditional transition operator.
-Repetition operators. Parameterized repetition operator (for). Preconditional and postconditional repeating operators (while and do while)
-Functions. Function description. Recursive functions. Reload functions. Organization of user library.
-One-dimensional arrays. Static arrays. Methods for sorting and searching array elements. Methods of performing various operations on arrays.
-Multidimensional arrays. Static arrays. Methods for sorting and searching array elements. Methods of performing various operations on arrays.
-Working with pointers and dynamic memory. Dynamic arrays and their use as function parameters. Memory allocation functions.
-Strings and extended characters (in the Char category).
-String standard functions and manipulation of strings using them.
-Strings and extended characters (in the String category). String standard functions and manipulation of strings using them.
-Working with files. Files and streams. Text files, binary files. Special functions for working with files.
-Fundamentals of object-oriented programming. Class and object concepts. Constructors.
-An array of objects. Relationships between classes.
-Encapsulation and inheritance. Management of appeal to members of the basic class.
-Polymorphism. Virtual function. Abstract class.</td></tr>
<tr><td>Literature:</td><td>1. Muminov B.B. Programming 1. Textbook. – T.: “Nihol print”, 2021. – 280 b. 2. Muminov B.B. Programming 2. Textbook. – T.: “Nihol print”, 2021. – 604 b. 3. Nazirov Sh.A., Qobulov R.V., Bobojanov M.R., Raxmanov Q.S. Language C and C++. – T.: “Successor- publishing house” LLC, 2013. – 488 p. 4. Abdullayeva Z. Sh., Ishniyazov O.O. Programming I and Programming II tutorial, 2022,141 p. 5. Xaydarova M.Y., Mallayev O.U., Abdullayeva Z.SH., Sattarov A. B. Methodological manual for performing laboratory work on the subject “Programming in C++ (1 part) TUIT, Tashkent 2017. 145 p.</td></tr>
</table>

<table>
<tr><td colspan="2">5.2. Programming II</td></tr>
<tr><td>Semestr:</td><td>2</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Ishniyazov Odil Olimovich, Shobdarov Elbek Bekkadir uli</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>ECTS:</td><td>6</td></tr>
<tr><td>Pre-requisities</td><td>Programming I</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>30</td></tr>
<tr><td>Practical works</td><td>42</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>The purpose of teaching science is to teach students the fundamental concepts of programming languages and algorithmic methods, to solve practical problems related to various fields, to teach logical thinking, to create applications in various programming environments and to develop their skills in practice.</td></tr>
<tr><td>Goal:</td><td>The purpose of teaching the subject is to teach students the concept of object-oriented programming principles of programming languages and the advanced capabilities of programming languages, user interface capabilities in a modern programming environment, and the ability to solve practical problems related to various fields.</td></tr>
<tr><td>Objective:</td><td>The task of science is to accept technological innovations for student programmers, acquire theoretical knowledge, practical skills, a methodological approach to events and processes related to various fields, as well as form a scientific worldview, solve issues of technical knowledge using modern programming. languages and apply their methods in their professional activities.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Knowledge of concepts of classes and objects, containers, encapsulation, inheritance, polymorphism, abstract concepts, features of programming in a GUI environment and can use them.
LO 2. will have the ability to critically analyze and evaluate the achievements of modern science, solve research and practical problems, including creating new ideas in interdisciplinary fields.
LO 3. Must have the skills to analyze small projects used in industry and develop user-friendly software products based on simple and optimal solutions to complex problems.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);</td></tr>
</table>

<table>
<tr><td></td><td>- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-10)</td><td>30</td><td rowspan="2">40</td><td rowspan="3">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Working with templates in object-oriented programming. Template concept and their use. Methods of creating function templates, class templates and their use.
- Containers (Collections). STL libraries. Container classes. Linear containers (array, vector, deque, list, forward_list).
- Associative containers. Associative containers (set, map, multiset, multimap).
- Container adapters. Stack, queue, priority_queue. Algorithms for working with containers.
- Working with numeric classes. Numerical classes and working with them (complex, vallaray, slice, gslice, etc.).
- Programming in the Visual Studio environment. Menus and toolbars in the Visual Studio environment.
- Programming in a GUI environment. Programming in a GUI environment. Menus and toolbars in a GUI environment.
- Working with components. Component concept and properties. Working with forms.
- Working with components. Component concept and properties. Data input and output components.
- Working with components. Components for branching and selection. Components for working with arrays.
- Graphical capabilities in a GUI environment. Components for drawing straight lines and various geometric figures.
- Graphical capabilities in a GUI environment. Graphical state, build images and function graphs (Chart) in GUI environment.
- Working with dialog boxes. Dialog windows and their configuration, control elements in the GUI environment.
- Working with dialog boxes. Connecting dialog boxes and creating message boxes in a GUI environment.
- User interface in GUI environment. Work with small projects</td></tr>
<tr><td>Literature:</td><td>1. Muminov B.B. Programming 1. Textbook. – T.: “Nihol print”, 2021. – 280 b. 2. Muminov B.B. Programming 2. Textbook. – T.: “Nihol print”, 2021. – 604 b. 3. Nazirov Sh.A., Qobulov R.V., Bobojanov M.R., Raxmanov Q.S. Language C and C++. – T.: “Successor- publishing house” LLC, 2013. – 488 p. 4. Horton I.-Beginning Visual C++ 2012/ I.Horton. Published simultaneously in Canada.–2016. –P. 988. 5. Mallayev O.U., Qurbonov N.M., Xaydarova M.Yu. Creating small projects in Visual C++ // “Communicator”. UzRO and OMTV, 2019, 224 p. 6. Bjarne Stroustrup. Programming: Principles and Practice Using C++ (2nd Edition). Person Education, Inc. 2014. second printing, January 2015. 7. J.Axmadaliev, R.Xoldorboev Methodical guide to learning C++ programming language (2015).</td></tr>
</table>

<table>
<tr><th colspan="2">5.3. Engineering graphics</th></tr>
<tr><td>Semestr:</td><td>3</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Modullayev Jahongir Sobir ugli</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>ECTS:</td><td>6</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>To the planimetric image (drawing) of spatial objects research and study of transition laws is considered Representing a spatial body on a plane, that is, to create a planimetric image of it laws of the geometric modeling process study Interrelationships of spatial body elements from its planimetric image back to its spatial position research and study of transplant laws. Learning the laws of space shooting from a model.</td></tr>
<tr><td>Goal:</td><td>The purpose of teaching the subject - "Engineering graphics" is to connect various three-dimensional objects in space and their relationships, based on graphic models of space in the form of two-dimensional drawings on a plane, with the help of computer graphics programs and tools. It is to provide the level of knowledge required by the educational standard, corresponding to the profile of the course on increasing and developing drawing and designing skills.</td></tr>
<tr><td>Objective:</td><td>The purpose of the subject is to teach students the fundamentals of 3D modeling for design, drawing editing techniques, working with complex objects, drawing annotations, drawing management tools, utilities, and 3D printing.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. To acquaint the student with the origin of drawing geometry, its development history and practical importance.
LO 2. To develop constructive-geometric thinking in students and to form their design ability.
LO 3. Development of spatial imagination, that is, memory imagination in students.
LO 4. Development of thinking, creativity and talent.
LO 5. Research and study methods of solving geometric problems related to a spatial body on its flat image.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);</td></tr>
</table>

<table>
<tr><td></td><td>- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-10)</td><td>20</td><td rowspan="3">30</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>5</td></tr>
<tr><td>Oral presentation</td><td>5</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">20</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Enter. Rules for preparing drawings.
- Geometric designs.
- Orthogonal projection of geometric shapes.
- Geometric objects.
- Projection methods.
- Application software packages widely used in engineering graphics.
- Basic commands for drawing.
- Drawing tools and drawing. Settings.
- Manage object properties. Basic editing tools.
- Drawing and editing complex objects.
- Sizing of mechanical drawings.
- Isometric drawings.
- Blocks and mechanical assembly.
- Fundamentals of 3D modeling in engineering graphics.
- 3D modeling methods in engineering graphics.</td></tr>
<tr><td>Literature:</td><td>1. D.U.Sabirova, Chizma geometriya va muhandislik grafikasi, uquv qullanma; Uz R Oliy va urta maxsus ta’lim vazirligi. - T. : Fan va Texnologiya, 2019.2. Sh.Sh.Allamova, Muhandislik grafikasi fanidan laboratoriya ishlarini bajarish uchun uslubiy qullanma, Muxarrirlik nashr - 2019.3. Douglas Smith, Antonio Ramirez, Ashleigh Fuller. A Multidisciplinary Guide to Drafting Theory and Practice with Video Instruction, Technical Drawing 101 with AutoCAD 2020. SDC Publications. 4.Shameer S.A., AutoCAD Exercises For Beginners: Designers WorkBook For Practice, Paperback – Large Print, January 24, 2021. 5.Dym, C. L. and Little, P. Engineering Design: A Project-Based Introduction 4th Edition, John Wiley and Sons, 2015. 6. Clive L. Dym, David C. Brown. Engineering Design. Cambridge university press, 2012. 7.David Salomon The Computer Graphics Manual Springer-Verlag London Limited New York, 2011. 8. Josef Albers, “Interaction of Color” by 2020.</td></tr>
</table>

<table>
<tr><th colspan="2">5.4. Cybersecurity fundamentals</th></tr>
<tr><td>Semestr:</td><td>3</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Karimov Abdukodir Abdisalomovich, Eshniyozov Temur Tulqinjon ugli</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>ECTS:</td><td>6</td></tr>
<tr><td>Pre-requisities</td><td>-</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>The Cybersecurity fundamentals course introduces students to the fundamentals of cyber security, fundamentals of cryptography, access control, network and computer security, information security threats and effective methods and tools to combat them. The course helps students understand the importance of the process of management and administration in the context of information security, social issues such as personal confidentiality, social engineering problems, cyber ethics, human security, etc.</td></tr>
<tr><td>Goal:</td><td>The purpose of mastering the discipline is to provide students with with knowledge, skills and competence in solving issues related to cyber security of information systems and information resources in professional activities..</td></tr>
<tr><td>Objective:</td><td>Have an idea about the legal, organizational and technical aspects of information security, the principles of information security; Perform simple “tie-butterfly” and rejection tree analysis methods; Possess skills in using threat analysis and prevention tools;</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO.1 Describe the basic concepts of cyber security;
LO.2 Explain the international, national and departmental regulatory framework in the field of cyber security;
LO.3 Demonstrate an understanding of confidentiality, integrity, and usability;
LO.4 Explain the main types of threats to cyber security and the methods and methods of combating them;
LO.5 Analysis of methods of violation of confidentiality, integrity and usability of information;
LO.6 To have the skills to use information protection methods and tools;
LO.7 Implementation of cryptography, access control, network and computer security.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;</td></tr>
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<tr><td></td><td>- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-10)</td><td>20</td><td rowspan="3">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction, cybercrime, cyber law and cybersecurity.
- Human security, architecture, strategy and policy of cybersecurity.
- Basic concepts of cryptography and it’s history.
- Symmetric cryptosystems, Asymmetric cryptosystems.
- Data Integrity Methods, Disk and file encryption. Methods of secure deletion of data.
- Identification and authentication tools, Logical access control to the data.
- Physical data protection, computer networks and network security issues.
- Network security tools, Wireless network security.
- Risk management, the concept of accessibility. Backup, restore and event logging.
- Software security issues, computer viruses and problems of protection from viruses.
- Account protection, protection against social engineering.
- Learn how to assess risks in cyber security.
- Learning how classic encryption algorithms work, how to encrypt data using the TrueCrypt program.
- Learn how to install and configure a password-based authentication mechanism in an operating system (Windows OS), conduct a reconnaissance attack.
- Building network security using the Network Screen tool, a secure Wi-Fi wireless network.
- Learning to restore data using special software tools, Installing virus protection on personal computers.
- Learn how to manage password usage, how to collect data from social networks.</td></tr>
<tr><td>Literature:</td><td>Literature 1. S.K. Ganiyev, A.A. Ganiyev, Z.T. Xudoyqulov. Cybersecurity Fundamentals: methodical handbook, -T.: “Nihol print” OK, 2021. – 224 p. (Uz.) 2. S.K. Ganiyev, Z.T. Xudoyqulov, N.B. Nasrullayev. Cybersecurity Fundamentals: methodical handbook, -T.: «Mahalla va oila nashriyoti», 2021. -240 p. (Ru.) 3. S.K. Ganiyev, M.M. Karimov, K.A. Tashev. Information security. –T.: “FAN va texnologiya”, 2016, 372 p. (Uz.) 4. M.Stamp. Information security. Principles and Practice. Second Edition. ISBN 978-0-470-62639-9. 2011. 5. Shangin V.F. “Integrated information protection in corporate systems”, Tutorial. M.: FORUM - INFRA-M. 2019. 591 p. (Ru.)</td></tr>
</table>

5.5. Data structures and algorithms	
Semester:	3
Date of last modification:	31.08.2023
Teachers:	Mukhsinov Shamil Shavkatovich, Buriev Yusuf Absamat ugli
Component:	Compulsory
Cycle:	Core
ECTS:	6
Pre-requisities	Programming II
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Testing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes
Short content:	Data Structures and Algorithms course is a fundamental subject in computer science that focuses on the study of organizing and manipulating data efficiently. Data structures are the way data is organized and stored in a computer's memory, while algorithms are the step-by-step instructions for solving a specific problem.
Goal:	The purpose of "Data Structures and Algorithms" course is to provide a solid foundation in organizing, storing, and manipulating data efficiently in computer programs.
Objective:	-Understanding the fundamental data structures and their properties to effectively store and organize data;-learning various algorithms for searching, sorting, and manipulating data to solve real-world problems;-analyzing the performance of algorithms and data structures to make informed choices for optimizing code efficiency;-developing problem-solving skills by applying data structures and algorithms to solve complex computational problems;-enhancing software development capabilities by writing efficient and scalable code that can handle large datasets and perform tasks quickly.
Learning outcome:	After studying the discipline, students should be able to: LO 1. To be able to use data types correctly, to acquire the skills of using the technology of their creation. LO 2. Understand and apply properties of linear data structures. LO 3. Understand and apply the properties of static data structures. LO 4. Get an idea of List" type data structures. Ability to implement lists statically and dynamically. LO 5. To have an idea about the characteristics of dynamic data structures, to be able to use them LO 6. Be able to explain and apply the properties of non-linear data structure.
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities;

<table>
<tr><td></td><td>- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-10)</td><td>24</td><td rowspan="2">34</td><td rowspan="3">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">16</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Data types and algorithms. Abstract structures of information. Development and analysis of algorithms. Data and stages of their expression. Data structure classification.
- Overview of data structures. Configured data types: arrays, vectors, records, collections, and pointer types.
- Recursion and its application in programming. Recursive algorithms, their analysis. Examples of recursion.
- Data search algorithms. The concept of search and its function. Linear search. Binary search. Efficiency and optimization of search methods.
- Data sorting algorithms. The concept of sorting and its function. Strict sorting methods.
- Linear data structures. Linear containers. Iterators and their types
- Linearly linked lists. Understanding Linked Lists. Logical representation of linearly linked lists
- Stack, Queue and Dec. Represent stack, queue, and declaration using a linearly linked list.
- Priority queues. Dictionaries and their implementation
- Tree data structures. Definitions and properties of tree data structures. Classification of trees. Tree view.
- Binary search tree. Algorithms for adding elements, deleting elements and searching in a binary search tree.
- Balanced Binary Trees. Balancing algorithms: general and specific balancing algorithms. AVL tree.
- Binary trees in heap tree form. Description of heap tree structure. Heap tree execution algorithms. Heap training methods and efficiency
- Algorithms for working with graphs. Graph representation methods: joint matrix and relationship matrix. Adjacency list and arc list
- Graph visualization algorithms. Breadth first search (BFS) algorithm. Depth-first search (DFS) algorithm</td></tr>
<tr><td>Literature:</td><td>Literature 1. Shukla, Rajesh K. Data Structures Using C and C++ : monograph - New Delhi : Wiley India, 2012. - 502 p. [45 ex.] 2. Kruse, Robert L. Data Structures and Program Design in C : monograph. - New Delhi: Dorling Kindersley (India) Pvt. Ltd., 2012. - 607 p. [25 ex.]3. Wirth, Niklaus. Algorithm and structure dannyx. Textbook - 2nd ed., ispr. - M.: DMK Press, 2012. - 272 p. [1 ex.]</td></tr>
</table>

5.6. Electronics and circuits I	
Semestr:	3
Date of last modification:	31.08.2023
Teachers:	Saidov Kamoladdin Nuraddinovich, Sattarov Khurshid Abdishukurovich
Component:	Compulsory
Cycle:	Core
ECTS:	6
Pre-requisities	Physics II
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Testing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes
Short content:	The theoretical concepts of the course are mainly learned through exercises and labs of increasing complexity to achieve all the concepts covered. Circuits and Electronics Science consists of Circuit Theory and Basic Topics of Electronics, which are the basic concepts that an ICT major should be familiar with.
Goal:	Gaining a thorough understanding of the subject will enable students to construct circuits and electronics with systematic academic knowledge and circuit theory and fundamental electronic topics make up practical abilities.
Objective:	Learning the principles of electronics and semiconductors; studying the foundational subjects of electronics; gaining hands-on experience with circuit and electronics theory; assessing and maximizing ICT performance; and investigating current integrated circuit trends and technologies.
Learning outcome:	*After studying the discipline, students should be able to:* LO1. The relationship between an electric current and voltage in passive elements to determine and learning. LO2. Measuring instruments to learning and use various generators. LO3. Learns to calculate currents and voltages in passive and active elements in an electric circuit. LO4. The number of equations needed to analyze and learns to determine the topology of an electrical circuit and determine the minimum. LO5. Learn to find ways to analyze an electrical circuit. LO6. An explores the relationship between mathematical terms and understanding the first- and second-order circuit`s. LO7. Learns transient and steady-state electronic analysis of the Laplace transform. LO8. Learns to simulate system state in transient and steady state. LO9. We know how to connect semiconductor devices in electric circuits and how to use them depending on their function.
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning;

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<tr><td></td><td>- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-10)</td><td>25</td><td rowspan="3">40</td><td rowspan="5">100</td></tr>
<tr><td>Independent work</td><td>7</td></tr>
<tr><td>Oral presentation</td><td>8</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to Electronics and Circuits 1. The purpose and tasks of science;
- Electronic circuit simulators.
- An analysis of direct current and electric circuits;
- Calculating electric circuits and direct current;
- The main quantities of sinusoidal current and characterizing it;
- Characteristics of electrical circuits under the influence of a sinusoidal signal;
- Mutual induction circuits;
- Quadrupoles and filters;
- Transient processes in the electric circuit;
- The device operation of semiconductor and physical foundations;
- Contact phenomena in semiconductors;
- Semiconductor diodes;
- Bipolar transistors;
- Multilayer semiconductor devices;
- Field transistors (FT);</td></tr>
<tr><td>Literatures:</td><td>1. A.A. Tulyaganov, S.S. Parsiev, V.A. Tulyaganova, U.M. Abdullayev. Theory of electrical circuits. (tutorial), Communicator, 2018, 144 p. 2. X.K.Aripov, A.M. Abdullayev, N.B. Alimova, Electronics and circuit engineering (textbook) Tashkent.: « Communicator», 2017, 376 p. 3. Aripov X.K., Abdullaev A.M., Alimova N.B., “Schematic” (textbook), Tashkent. « The boston of thought», 2013, 447 p. 4. Ron Mancini, Amps For Everyone, 2002, Texas Instruments. 5. X.K. Aripov, A.M. Abdullayev, N.B. Alimova, Electronics (textbook) Tashkent, « Science and technology», 2011, 428 p. 6. Thomas F. Schubert, Jr., Ernest M. Kim. Fundamentals of Electronics Book 1: Electronic Devices and Circuit Applications, 2014,</td></tr>
</table>

<table>
<tr><td colspan="2">5.7. Electronics and circuits II</td></tr>
<tr><td>Semestr:</td><td>4</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Saidov Kamoladdin Nuraddinovich, Sattarov Khurshid Abdishukurovich</td></tr>
<tr><td>Component:</td><td>Elactive</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>ECTS:</td><td>6</td></tr>
<tr><td>Pre-requisities</td><td>Electronics and circuits I</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>Computer networks course will encourage you to understand an computer network construction principles, technologies and devices, local, network design issues in computer programs, network management methods, basic network protocols, data routing processes, network software and hardware security.</td></tr>
<tr><td>Goal:</td><td>The goal of teaching subject - modern information and communication technologies belong to a complex class of systems, which are made up of electrical circuits of different complexity.</td></tr>
<tr><td>Objective:</td><td>The system is one of the important issues in the study of the form of electronic devices. This is the science of telecommunication technologies, computer engineering electronic devices used in the types, characteristics, their structure, properties and complex issues of technological devices, which they create using mexanizim work and study consists of removing sxemotexnik to include.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO1. Necessary to have knowledge about the current role of integrated circuits, the applications of integrated circuits in nanoelectronics, functional electronics, bioelectronics.
LO2. Necessary to have knowledge of the stages, technologies, basic and passive elements of the preparation of integrated circuits performing various tasks.
LO3. Necessary to have knowledge of amplifier circuits based on transistors of their basic characteristics and parameters.
LO4. Necessary to have knowledge about the application of amplifiers and their types on radiotechnical devices, the determination of the technical parameters of integrated circuit amplifiers.
LO5. Able to determine the parameters and characteristics of the amplifiers being used in radio equipment.
LO6. Able to find the results of the transmission characteristic of integrated circuits by connecting measuring instruments.
LO7. Able to electronically analyze the state of logical elements circuits; he is able to assemble circuits.
LO8. Able to connect amplifiers, stable current generators, operation amplifier, optrons in electrical circuits, as well as apply them depending on the task.</td></tr>
</table>

<table>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-10)</td><td>25</td><td rowspan="3">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>7</td></tr>
<tr><td>Oral presentation</td><td>8</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>-Electronics and Scheme 2 subject, content and methods;
-Electrical signal amplifiers;
-The effect on the characteristics of feedback and its strengthening devices;
-Schemes for connecting bipolar transistors and modes of operation of transistors in amplifier stages;
-Schemes for connecting field transistors and modes of operation of transistors in amplifier stages;
-Multi-cascade amplifiers. Power amplifiers;
-Integrated circuit preparation technology. Active and passive elements of the integrated circuit;
-Darlington pair. Wilson current view scheme;
-Analog integrated circuits. Stable current generator (SCG) scheme;
-Constant voltage level shift device;
-Fixed current amplifiers (FCA);
-Operation amplifier;
-Logical elements. Transfer characteristics of logical elements;
-Simple inverter Transistor-transistor logic. Transistor-transistor logic with complex inverters and Shottky barriers;
-Integral injective logic. Connected emitters logic;
-Logical elements made in a metal dielectric semiconductor transistor;
-Complementary inverters. Optrons;</td></tr>
<tr><td>Literature:</td><td>1. H.K.Aripov, M.A.Abdullaev, N.B.Alimova, Electronics and schematics (Textbook) Tashkent.: " Communicator ", 2017 y, 376 p. 2. H.K.Aripov, A.Abdullaev, N.B.Alimova, Toshmatov Sh.T. “Schematics” (textbook), Tashkent, "The boston of thought", 2013, 447 p. 3. K.Aripov, M.A.Abdullaev, N.B.Alimova, H.H.Bustanov, Sh.T. Toshmatov. Digital logic devices design. Textbooks. –T.: "Communicator", 2017, 396 p. 4. H.K.Aripov, A.M.Abdullaev, N.B.Alimova, H.H.Bustanov, It Doubles.V.Obyedkov, Sh.T. Toshmatov. Electronics (textbook) Tashkent.: "Science and technology", 2011, 428 p. 5. Multisim User Guide. National Instruments, 2007. 6. Robert L. Boyleastad. Introductory Circuit analysis. 2014.Pearson Education Limited, 1091p. 7. Behzad Razavi. Fundamentals of Microelectronics.2nd edition.2014 John Wiley-Sons. 932 p.</td></tr>
</table>

<table>
<tr><th colspan="2">5.8. Electromagnetic fields and waves</th></tr>
<tr><td>Semestr:</td><td>4</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Shakhobiddinov Alisher Shopatkhiddinovich, Khudayberganov Jurabek Davlatboyevich</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>ECTS:</td><td>6</td></tr>
<tr><td>Pre-requisities</td><td>Physics II</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Laboratory works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Short content:</td><td>The course “Electromagnetic fields and waves” studies the fundamentals of electrodynamics, the design and construction of transmission lines, microwave paths and units, and fiber-optic communication links, which are widely used in telecommunications systems today.</td></tr>
<tr><td>Goal:</td><td>The purpose of the course is to give students the necessary level of knowledge on the devices of transmission lines, microwave paths and nodes, as well as initial knowledge in the field of fiber-optic communication lines used in modern telecommunications systems.</td></tr>
<tr><td>Objective:</td><td>The course consists of the following main sections: fundamentals of the theory of the electromagnetic field, electrodynamics, radiation and propagation of electromagnetic waves, directional electromagnetic waves and guiding systems, linear microwave devices.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Formation of general concepts of electrodynamics.
LO 2. Understanding the theory of Maxwell's equations.
LO 3. Familiarization with solutions to problems using Maxwell's equations.
LO 4. Gaining concepts about the purpose of transmission lines.
LO 5. Studying the principles of operation of measuring lines, nodes and microwave paths.
LO 6. Study of the design features of cavity resonators, bridges and other microwave devices.
LO 7. Familiarization with measurements of parameters and characteristics of transmission lines, directional couplers and microwave paths.
LO 8. Gaining knowledge in the field of solving problems when calculating the main parameters of transmission lines and microwave devices using the basic equations of electrodynamics.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;</td></tr>
</table>

<table>
<tr><td></td><td>- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Labaratory works</td><td>25</td><td rowspan="3">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>7</td></tr>
<tr><td>Oral presentation</td><td>8</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction. EMF concepts. EMF vectors, media parameters, material equations.
- Boundary conditions at the interface between media. Boundary conditions on the surface of an ideal conductor.
- EMF operators. Maxwell's first, second, third and fourth equations.
- Maxwell's equation system for a monochromatic field. Dielectric loss tangent.
- Homogeneous and inhomogeneous wave equations.
- Energy and power of EMF. Flow and flux density. EMF energy balance. Umov–Poynting theorem.
- Plane wave. Parameters (characteristics) of a plane wave.
- Elementary electric emitter. Structure of the EI field.
- Characteristics of EI directionality. Power and radiation resistance.
- Types of polarization (linear, circular, elliptical, normal and parallel polarization)
- Brillouin's concept. Field structure under normal and parallel polarization. Biplanar waveguide
- Guided wave analysis. Characteristics (parameters) of directed waves.
- Rectangular waveguide and its main characteristics (parameters
- Round waveguide and its main characteristics (parameters.)
- Coaxial waveguide and its main characteristics (parameters.)
- Symmetrical, unbalanced and strip transmission lines. Measuring transmission lines.
- Transmission line communication elements: pin, loop, hole.
- Directional coupler, its parameters
- Transmission line coordination. Matched loads.
- Elements of the microwave path: Kinks, bends, twists. Microwave bridges. Kinds.
- Volumetric resonator. Types of cavity resonators
- Dielectric waveguide and light guide. Methods for implementing fiber-optic communication elements</td></tr>
<tr><td>Literature:</td><td>1. Ю.В.Пименов, В.И.Вольман, Technical electrodynamics – M.Radio and Communications,2022. 2. Е.Р.Милютин, Основы Technical electrodynamics, St. Petersburg, Lan, 2022. 3. Pimenov Yu.V., Volman V.I. , Technical electrodynamics, - M: Radio and Communication, 2002. 4. O.I. Falkovsky, Technical electrodynamics, St. Petersburg, Lan, 2009. 5. Lebedev I.V. Equipment and devices of ultra-high frequencies in 2 volumes, vol. 1. - M.: Gosenergoizdat, 1970. 6. Sazonov D.M., Gridin A.N., Mishustin B.A. Microwave devices. / Ed. D.M. Sazonova. - M.: Higher School, 1981. 7. Volman V.I., Pimenov Yu.V., Technical electrodynamics, - M: Svyaz, 1971.</td></tr>
</table>

5.9. Fundamentals of artificial intelligence	
Semestr:	4
Date of last modification:	31.08.2023
Teachers:	Nurmurodov Javohir Nurmurod ug‘li
Component:	Compulsory
Cycle:	Core
ECTS:	6
Pre-requisities	Programming II, Probability and Statistics
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Testing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes
Short content:	It is one of the main directions of modern programming and is designed to develop a set of algorithms that force computers and technical devices to think and act like humans. In this, students will study the basic concepts of artificial intelligence, their application in any field, game theory, search agents, object recognition and machine learning algorithms, and the application of artificial neural networks. acquires knowledge.
Goal:	The purpose of teaching science is to develop the skills and abilities to develop artificial intelligence technologies and methods, the theoretical and practical foundations of the computational processes of machine learning algorithms, which are widely used today, and the development of algorithms that force machines to think like humans and make decisions like humans. .
Objective:	-to have concepts of artificial intelligence; -mathematical and software support of automated and computer systems; -in higher education, retraining and professional education institutions; -in offices and organizations whose activities are related to information protection.
Learning outcome:	After studying the discipline, students should be able to: LO 1. In the process of analyzing the subject area, in which areas to use artificial intelligence and to improve it in those areas. LO 2. Building software tools and artificial neural network algorithms for developing machine learning algorithms. LO 3. Gain skills in machine learning model development skills. LO 4. Must be proficient in applying common machine learning techniques and developing own reasoning algorithms.
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities;

<table>
<tr><td></td><td>- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- Information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-10)</td><td>20</td><td rowspan="3">40</td><td rowspan="5">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to science: artificial intelligence basics and applications
- History of artificial intelligence
- Intelligent agents
- Solving problems in artificial intelligence
- Find solutions using classic search
- Theory of games
- Logical agents
- Knowledge presentation issues
- Definition of vague knowledge
- Probabilistic decision-making
- Development and use of expert systems
- Representation of knowledge in expert systems
- General recursion rule
- Types of machine learning
- Artificial neural networks</td></tr>
<tr><td>Literature:</td><td>1. Bekmuratov Q.A. Sun’iy intellekt [Text] : uquv qullanma Q. A. Bekmuratov.-T. : Aloqachi, 2019. - 312 b. - Adabiyotlar: 300 b.- 48 (adadi 100) экз.- ISBN 978-9943-5804-8-0 : 65150 sum ГРНТИ УДК 28.23004.8(075.8). 2. O. Campesato. Artificial Intelligence, Machine Learning and Deep Learning. ISBN: 978-1-68392-467-8. 2020. – 339 c. 3. Sirojiddin Komolov, Sherzod Raxmatov: Sun’iy intellekt asoslari. Mashinaviy uqitish. Toshkent – 2019. 4.Хайкин С. Нейронные сети: полный курс. 22е изд. пер. с англ.- М. Изд. дом «Вильямс» 2006-452с. 5.Richard E. Neapolitan Xia Jiang. Artificial Intelligence: Chapman va Hall/CRC 2018 - 480 c. ISBN 13: 9781138502383. 6.Laurence Moroney. AI and Machine Learning for Coders: UReilly Media 2020-390c. ISBN 13: 9781492078197.</td></tr>
</table>

6. Core

<table>
<tr><td colspan="2">6.1. Microprocessors</td></tr>
<tr><td>Semestr:</td><td>4</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Abaskhanova Khalima Yunusovna</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>ECTS:</td><td>6</td></tr>
<tr><td>Pre-requisities</td><td>Programming II, Electronics and circuits II</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>Independent work</td><td>108</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>The course is designed for undergraduate students to learn about microprocessors and their structure, principles of operation, processor command system and methods of data exchange, creating programs in a high-performance programming language and configuring them in hardware, building communication systems based on microprocessors and microcontrollers, in which information teaches the theoretical basis of knowledge on the implementation and organization of exchange principles.</td></tr>
<tr><td>Goal:</td><td>The purpose of the discipline is to teach students about microprocessors and their structure, principle of operation, processor command system and data exchange methods, to create programs in a high-performance programming language and configure them in hardware support, to build communication systems based on microprocessors and microcontrollers, to exchange information in them. It consists of teaching and creating skills of theoretical foundations of knowledge on implementation and organization of principles.</td></tr>
<tr><td>Objective:</td><td>The objective of the discipline to create knowledge about microprocessor systems, to create practical skills for creating microprocessor systems using high-level programming languages and testing them on the basis of hardware.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Microprocessor and microprocessor system concepts and terms. Basics of types, structure and operation of microprocessor systems. The role of microprocessor systems in the field of communication, stages of development and prospects. Microprocessor system types and stages of development. General structure of a microprocessor. Structure of a microprocessor system. Principle of microprocessor system operation.;
LO 2. Bus types of microprocessor systems. Their functions. Types of information exchange based on buses. Basic devices of microprocessor systems and their functions. Microprocessor registers and memory segments. Types of operating modes of microprocessor systems. Data exchange methods of microprocessor systems. Architecture of microprocessor systems and their analysis.;
LO 3. Programming languages and their command system. Programming environments and microprocessor systems software. Simple programming processes. Complex programming processes. Part programming. Organization of data input and output;</td></tr>
</table>

<table>
<tr><td></td><td>LO 4. Microcontroller concept. Concept of microprocessor and microcontroller. Controller concept. The structure of the central processor. Architecture of microcontrollers, processor core and memory. Microcontroller software. Microcontroller command system. The structure of the processor center and features of the command system of microcontrollers
LO 5. Organization of memory in microcontrollers and working with it, use of stack and external memories in microcontrollers. Special functions to increase the capabilities and quality of microcontroller-based systems.
Basic stages of designing and developing devices and systems based on microcontrollers, hardware and software configuration methods. Microcontrollers power saving modes. Additional modules of clock generators, watchdog timers and microcontrollers.
LO 6. To be able to write a program in a modern programming language, to organize input and output of data; to be able to research the special functions of improving the quality of the system and expanding its capabilities on the basis of microprocessors and microcontrollers; design and development of digital devices based on microprocessors and microcontrollers; should know how to configure hardware and software together;
LO 7. Creating software for microprocessor systems, being able to use basic tools and configuration tools for creating programs for microprocessor systems; assembly and programming of devices based on microprocessors and microcontrollers; programming of memory and time management processes, development of algorithms;
LO 8. To be able to select methods of creating and configuring software for workflows of digital devices;
LO 9. To know the tools for creating software for automatic control of technological processes and their configuration and organization;</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-10)</td><td>30</td><td rowspan="2">40</td><td rowspan="3">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Microprocessor and microprocessor system concepts and terms, types, structure, principles of operation, buses and information exchange cycles.
- The structure and functions of the main devices of microprocessor systems. Operating modes and architecture of microprocessor systems.
- Structure of the processor.
- Addressing methods.
- Microprocessor systems software.
- Creating a program in a microprocessor-based programming environment.
- Microcontrollers. Microcontroller concept, memory and processor core.</td></tr>
</table>

	- Organization of microcontrollers, organization of their communication with the external environment. - Organization and structure of data input and output ports of microcontrollers. - Organizing the connection of the microcontroller with time and external environment. - Auxiliary hardware of microcontrollers. Design features of digital devices based on microcontroller. - Software design for microcontrollers. Designing devices on microcontrollers. - Getting to know the interfaces of instrumental environments. Creating simple programs for microprocessor systems in the interfaces of instrumental environments. Creating complex programs for microprocessor systems in the interfaces of instrumental environments. - Learning to design digital logic devices. - Learning to design systems based on microprocessors. Design of microcontroller systems. - Creation of software for microcontroller systems. Integration of hardware and software of microcontroller systems.
Literature:	1. Abaskhanova H.Yu., Amirsaidov U.B. Microprocessors. Study guide for higher educational institutions. "Fan va texnologiyalar". Tashkent-2017. - 272 p. 2. Abaskhanova H.Yu., Mirzaeva M.B., Parsiev S.S Microprocessor. Study guide for higher educational institutions. "Hihol print". Tashkent-2021. -200 p. 3. Abaskhanova H.Yu., Baltayev J,.B., Yaronova N.V. Microprocessor devices of radio communication, a textbook for higher educational institutions. "IMPRESS MEDIA". Tashkent-2023. -347 p.

6.2. Information coding theory	
Semestr:	5
Date of last modification:	31.08.2023
Teachers:	Qodirov Azamat Almat ug‘li
Component:	Compulsory
Cycle:	Core
ECTS:	6
Pre-requisities	Fundamentals of Cyber Security
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 3 questions, the first 2 of which are from 15 points, the third from 20 points, the questions consist of 2 Parts: 2 theoretical questions and 1 practical question. Total exam time 80 minutes
Short content:	Information and coding theory is the study of the properties of codes and their respective fitness for specific applications. Codes are used for data compression, cryptography, error detection and correction, data transmission and data storage. Codes are studied by various scientific disciplines—such as information theory, electrical engineering, mathematics, linguistics, and computer science—for the purpose of designing efficient and reliable data transmission methods. This typically involves the removal of redundancy and the correction or detection of errors in the transmitted data.
Goal:	The course is designed for undergraduate students and teaches the principles of encoding and decoding information with noisy codes, dictionary compression algorithms, modulation, reliability and adaptation in data transmission systems.
Objective:	This course examines theoretical questions in information and coding theory such as information size, entropy, redundancy, performance, information descriptions of discrete sources, coding in discrete and noisy channels, error models, classification and parameters of noisy coding. This science creates a necessary basis for studying the characteristics of the development of noisy coding bases in modern methods of information transmission.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Acquire knowledge about information and coding theory in modern information infrastructure LO 2. Have knowledge about the quality indicators of data transmission networks and systems and their requirements; LO 3. Have knowledge about the importance of information descriptions of discrete information sources; LO 4. Know the general principles of building an access network;
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities;

<table>
<tr><td></td><td>- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-10)</td><td>20</td><td rowspan="3">40</td><td rowspan="5">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Written)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction. The role and importance of information and coding theory in modern information infrastructure. Basic concepts of science (information, message, signal) Quality indicators of data transmission networks and systems and their requirements.Standards of computer networks.
- Informational descriptions of discrete message sources. Volume of information. Entropy. Redundancy. Productivity.
- Shannon's theorem in discrete message sources. Shannon-Fano, Huffman compression algorithms. Dictionary encoding methods (LZ77, LZ78)
- Data compression (text, audio, video). Lossy and lossless compression methods. Compression algorithms in modern modems.
- Measures, methods, classification and requirements for increasing reliability in telecommunication systems
- Shannon's theorem in noisy discrete channels. Error models. Classification and parameters of noise-immunity coding
- Linear and block codes. Hamming, cyclic codes.
- Goley and Fire codes.
- BChX and Reed-Solomon codes.
- Convolutional, LDPC and Turbo codes.
- Use of noise-immunity codes in telecommunications.
- General principles of construction of subscriber access network. Classification, structure and capabilities of modems.
- Protocols and interfaces used in modems. Modulation and demodulation methods.
- Wired and wireless data transmission technologies
- Principles of adaptation in data transmission systems</td></tr>
<tr><td>Literature:</td><td>1. Abbas El Gamal, Young-Han Kim Network Information Theory. Cambridge University Press, 2011. 2. Tracey Ho Network Coding: Introduction. Cambridge University Press, 2008. 3. Djuravev P.X., Djabbarov Sh. Yu., S.O. Maxmudov, J.B. Baltayev. Information and Coding Theories.T.: ” Communicator”.2018, 296 p. 4. R.X. Djuraev, Sh.Yu. Djabbarov, B.M. Umirzakov. Network protocols. Study guide.T.: ” Communicator”.2018, 144 p. 5. Давронбеков Д.А. Methods for assessing the reliability of digital elements of radio systems. – Т.: ТИТУ, 2017. – 168 p. 6. S.K. Ganiyev. Information theory and coding. Text of lectures. TITU, 2014. 7. N.B. Usmanova Information transmission systems and networks. Study guide. Tashkent TITU. 2006</td></tr>
</table>

6.3. Optical communication systems	
Semester:	5
Date of last modification:	31.08.2023
Teachers:	Mirazimova Gulnora Khasanovna, Tursimuratov Saparniyaz Salauatovich
Component:	Compulsory
Cycle:	Core
ECTS:	8
Pre-requisities	Pyhsics, Subscriber access network
Workload:	**Types of classes** / **Hours** Total / 240 Lecture / 60 Practical works / 36 SAW (Student autonomous work) / 144 Form of final control / Exam Final assessment method / Testing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes
Short content:	Optical communication systems course will encourage you to understand light-based data transmission principles, fiber optics technologies, modulation techniques, light sources and detectors, network design, system performance analysis, signal processing methods, advanced applications, and future industry trends.
Goal:	The purpose is to develop students' knowledge and skills in optical communication systems, focusing on design, operation, devices, networks, and information transmission quality and security.
Objective:	- understanding light-based data transmission principles; - studying fiber optics technologies; - developing practical skills in modulation techniques; - analyzing and optimizing system performance; - exploring light sources and detectors; - examining network design and signal processing methods; - investigating future trends in optical communication systems.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understand principles of light-based data transmission in optical communication systems. LO 2. Master fiber optics technologies for data transmission. LO 3. Develop skills in modulation techniques for optimizing signal transmission. LO 4. Analyze and optimize system performance in optical communication networks. LO 5. Acquire knowledge of light sources and detectors used in optical communication. LO 6. Design network architectures and employ signal processing methods in optical communication systems.
Teaching methods:	In the credit system of education, classes prioritize active and creative teaching methods. Effective pedagogical approaches focus on fostering students' active engagement in knowledge discovery and management, particularly through independent problem-solving experiences that enhance their ability to apply and integrate knowledge: - problem- and project-based learning; - educational and research activities - communication technologies (discussion, debates); - case-study analysis - simulation and role-playing games - information and communication technologies.

	To cultivate critical thinking in practical classes, instructors utilize methods such as "Prediction with open questions," "Cluster," "Cross-discussion," "Know-Want to Know-Learned," "INSERT," and hands-on activities. Additionally, gamification techniques are employed to engage students actively, encouraging exploration and application of knowledge in dynamic learning environments.
Assessment of the student's knowledge:	<table><tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr><tr><td rowspan="2">Current control</td><td>Practical works (1-10)</td><td>30</td><td rowspan="2">40</td><td rowspan="3">100</td></tr><tr><td>Independent work</td><td>10</td></tr><tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr><tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr></table>
Topics of lectures:	- Introduction. Optical communication systems, basic definitions and concepts, history of development, characteristics, principle of construction and classification. - Classification of fiber-optic communication systems. The basic structure and principle of the fiber optic system. - Optical fiber and cables. - Basic physical parameters of optical fiber. - Fiber optic communication cables. - Passive elements of optical communication systems. - Items to transfer and reception of optical signals. Optical signal transmitters. - Optical signal receivers. - Linear path of optical communication systems. Linear codes of optical communication systems. - Basic devices used in the linear path of optical communication systems. Optical repeaters, their types. - Optical amplifiers. - Optical communication systems. Optical communication systems of synchronous digital hierarchy. - Fiber optic transmission systems with wavelength division. - Optical access networks. - Classification of optical access network and requirements for its basic parameters. - Technologies of passive optical communication networks. - Synchronization of optical communication systems and networks. - Information security of optical communication systems and networks. - Design of optical communication systems and networks. - Features of the planning of optical communication lines, multiplexed and divided by wavelength. - Technical operation of optical communication systems. - Operating standards for digital fiber-optic communication systems. - Methods and means of measurement in optical communication systems and networks. - Reflectometers and spectrum analyzers used in measuring optical transmission lines, and measurement methods.
Literature:	Literature 1. Yunusov N.Yu., Isayev R.I., Mirazimova G.Kh. Fundamentals of optical communication. Ministry of Higher and Secondary Special Education of the Republic of Uzbekistan - T.: NMIU named after Cholpon, 2014. - 368 pages. 2. Govind P.Agrawal. Fiber-optic communication systems. Third edition. A.John Willey & Sons, Inc., Publication. 2005. – 563 p. 3. Mirazimova G.Kh. Fundamentals of optical communication: study guide/Ph.D., docent Isaev R.I. under the responsible editorship. - TUIT, 2006. 4. “Mirazimova G.Kh., Yunusov N.Yu. Optical communication systems. Methodical manual for performing laboratory work. T.: "Alokachi", 2017. - 196 pages.

6.4. Wireless Networks	
Semestr:	6
Date of last modification:	31.08.2023
Teachers:	Alimdjanov Xayot Farxadovich
Component:	Compulsory
Cycle:	Core
ECTS:	4
Pre-requisities	Subscriber access network
Workload:	**Types of classes** / **Hours** Total / 120 Lecture / 30 Practical works / 18 SAW (Student autonomous work) / 72 Form of final control / Exam Final assessment method / Testing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes
Short content:	In accordance with the requirements for the mandatory minimum content of the curriculum in the subject "Wireless Networks", it must include: principles and technologies for organizing wireless communications, methods for allocating channels, their difference from TC channels, technical concepts for constructing wireless communications. communication networks, spectrum extension systems, methods of signal separation using optical and radio communications, as well as principles of constructing wireless local networks.
Goal:	The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in building wireless networks.
Objective:	Successful completion of this course allows students to prepare for independent work in the field of design, operation, setup and repair of wireless networks used in the fields of communications and broadcasting, as well as in the research departments of organizations that produce and supply wireless networks, communication equipment on the market of Uzbekistan.
Learning outcome:	After studying the discipline, students should be able to: LO 1. knows the features and types of narrowband and broadband wireless communication systems LO 2. knows how to organize and plan wireless networks LO 3. knows the architecture of wireless communication networks and their areas of application. LO 4. acquires skills in solving communication problems and solving them in wireless networks LO 5. have skills in calculating parameters of wireless communication networks LO 6. has skills in wireless network design
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities;

<table>
<tr><td></td><td>- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-10)</td><td>20</td><td rowspan="3">40</td><td rowspan="5">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Written)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Connection to wireless networks. Methods of wireless signal transmission. Classification of wireless data transmission technologies.
- Features of radio wave propagation. Features of radio wave propagation. Classification of radio frequencies.
- Antennas in wireless networks. Basic concepts and definitions. Operating principles and design of antennas. Unique features of microwave antennas. Commercial antennas.
- Methods of connecting to the transmission medium in wireless networks. Multiple access by frequency, time and code. Organization of duplex mode in wireless networks.
- Types of signal modulation in wireless networks. Manipulations in digital radio communication systems. Amplitude (ASK), frequency (FSK) and phase shift keying (BPSK).
- Types of multi-order modulations. Quadrature phase shift keying (QPSK) and quadrature amplitude modulation (QAM).
- Radio relay and satellite communications. Satellite navigation. General principles for constructing radio relay lines. Block diagrams of digital radio relay stations.
- The evolution of cellular communication systems from 1G to 5G. Development of mobile communications from the 1G generation to the 5G generation.
- Third generation cellular communication systems 3G. 3G cellular communication systems. 3G network concept. CDMA2000 technology.
- 4G is the fourth generation of cellular communication systems. OFDM is an orthogonal frequency division multiplexing technology.
- 5G wireless standards in action. Development of mobile networks based on 5G technologies. 5G network architecture. Opinions on the transition from LTE to 5G
- Wi-Fi technology (IEEE 802.11). History of Wi-Fi technology. Wi-Fi technology certification. Organization of wireless local networks.
- Basic concepts of IEEE 802.11 standards. Spread spectrum technologies. MIMO and Beamforming technologies. Advantages and disadvantages of Wi-Fi technology. Using Wi-Fi Mesh systems.
- WiMAX standard (IEEE 802.16). The evolution of last mile wireless technologies. Architecture of the IEEE 802.16 standard. Comparison of mobile and fixed WiMAX.
- Features of various wireless communication technologies. Data transmission technology using ultra-wideband signals (UWB). Application areas of ultra-wideband signals.</td></tr>
<tr><td>Literature:</td><td>1. D.A.Davronbekov, U.T.Aliyev. Simsiz tarmoqlar. Darslik, T: ”Aloqachi”, Tashkent, 2022. 2. D.A.Davronbekov, Sh.U.Pulatov, U.T.Aliyev, M.O.Sultonova. «Simsiz keng polosali texnologiyalar». Darslik. T: ”Aloqachi”, 2017. 3. A.X. Abdukadirov, D.A. Davronbekov. Mobil aloqa tizimlarining 4G avlodi. Uquv qullanma, T: 2015. 4. Ibraimov R.R., Davronbekov D.A., Sultonova, M.O., Tashmanov E.B., Aliev U.T. Darslik/ Simsiz aloqa tizimlari va dasturlari. T: ”Aloqachi”, 2017. 5. D.A.Davronbekov, U.T.Aliev. Teleradioeshittirishda uzatish va qabul qilish qurilmalari: darslik. T.: “Aloqachi”, 2019</td></tr>
</table>

6.5. Multimedia communication networks	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Normatova Dilbar Turgunovna, Raximov Abdugofur Olimjon ugli
Component:	Compulsory
Cycle:	Core
ECTS:	6
Pre-requisities	Probability and Statistics , Wireless Networks, Optical communication systems
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 3 questions, the first 2 of which are from 15 points, the third from 20 points, the questions consist of 2 Parts: 2 theoretical questions and 1 practical question. Total exam time 80 minutes
Short content:	The discipline " Multimedia communication networks " is focused at the theoretical and practical theoretical knowledge on architecture and design of modern high-speed multimedia converged networks, modern concepts of transport network and access networks, signaling protocols and scenarios of equipment interaction during data exchange, as well as practical skills in designing an MCN network of various levels for the Triple-Play service.
Goal:	The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in building multimedia communication networks.
Objective:	To provide students with knowledge about the principles of building telecommunication networks based on multimedia, its structural elements, modern concepts of building transport and access networks, switching nodes for various purposes, alarm systems, services for multimedia communication networks and modern multimedia applications, multimedia traffic parameters and modeling methods, design standards and the main types of multimedia communication networks.
Learning outcome:	After studying the discipline, students should be able to: LO1. Principles of development (evolution) of telecommunication technologies, requirements for the global information infrastructure and modern communication networks, the concept and features of building multimedia communications, classes of multimedia traffic and its parameters, parameters of the quality of services for the transmission of multimedia traffic LO 2. Understand the reference model of interaction of open systems, types of media and technologies for information transmission, transport and telecommunication technologies used by multimedia communication network. LO 3. To distinguish the types of services for multimedia communication networks, the specifics of their organization, types of modern multimedia applications, standards of multimedia communication networks, protocols of multimedia networks LO 4. To determine the possibilities of building next-generation multimedia converged networks, their equipment, configuration using the example of a training network consisting of a ZTE ZXSS10 SS1b Softswitch, a ZTE ZXR105952E IP switch, an NMS server (network management server), IP terminals and other devices.

<table>
<tr><td></td><td>LO 5. To choose, for a specific example of a network, various technologies used in the construction of multimedia networks in order to increase the efficiency of operating systems, to analyze the problems encountered in the management of multimedia communication networks.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-10)</td><td>30</td><td rowspan="2">40</td><td rowspan="3">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- The concept of multimedia communication networks.
- Architecture of information transmission and distribution systems. Multilevel communication architecture.
- Primary telecommunication signals and their parameters. Logarithmic units of measurement.
- Principles of digital signal generation. The main digital channel, standard digital streams.
- The reference model of open systems interaction (OSI model) and the physical layer of a telecommunications network.
- Transmission systems, transport networks, modern concepts of building transport networks.
- Synchronization in telecommunication networks.
- The general structure and functions of the switching node
- Alarm systems in telecommunications
- Principles of building international, urban and rural telephone networks
- The main traffic parameters of multimedia communication networks.
- Services for multimedia communication networks
- Guaranteed service model. Quality of service in multimedia communication networks
- Transport telecommunication technologies of multimedia communication network – synchronous digital hierarchy, wave sealing (WDM, DWDM, CWDM)
- Technologies of the channel, network and transport layers – technologies of IP networks, ATM, Ethernet. Multiprotocol label switching MPLS
- Modern multimedia applications. Triple-Play services.
- VoIP technology. IPTV
- Standards of multimedia communication networks.
- Multimedia communication network management
- Modeling of multimedia communication networks
- Convergent networks.</td></tr>
</table>

Literature:	1. R.I.Isayev, D.X.Ibatova. Multimedia communication networks. Textbook. T.: "Communicator",2019y. 302p . 2. R.I.Isayev. Multimedia communication networks. Tutorial. Tashkent: " Communicator ", 2017. 320 s..3. V.V.Velichko, YE.A.Subbotin, V.P.Shuvalov, A.F.Yaroslavsev. Telecommunication systems and networks.Vol. 3. Multiservice networks. - Moscow, Hotline – Telecom. 2005. 592p. 4 Jenq-Neng Hwang. Multimedia Networking. – NewYork, 2009. 570p. 5. S.A.Sadchikova, M.B.Abdujapparova. Multiservice networks based on IMS. (Textbook).T.:“ Communicator”, 2021.

<table>
<tr><td colspan="2">6.6. Image processing</td></tr>
<tr><td>Semestr:</td><td>5</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Mirzayev Namoz, Jaumitbaeva Mexriban</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>Credit point:</td><td>6</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Testing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>This module covers the fundamentals of signal processing and perception: investigating how sounds, images and videos can be processed and analysed alongside the fundamentals of how the human auditory and visual perception system functions (e.g., how your eyes and ears work with your brain). Concepts such as data encoding and compression are provided with practical application of understanding signals in terms of their frequency components, relating to their time and spatial components (e.g., audio frequency components or the spatial frequency of an image).</td></tr>
<tr><td>Goal:</td><td>The purpose of the subject is to form in students general concepts of digital processing of audio signals and images, digital signal models, distortions, processing of audio signals in the time and frequency domains, filtering, coding, digitalization methods, compression, segmentation, calculation of characteristic features, recognition, formation of information on the practical application of methods and algorithms for digital processing of audio signals and images.</td></tr>
<tr><td>Objective:</td><td>-Knowledge of technologies and processes of digital processing of audio and video;
-Knowledge of processes and methods of digital processing of images and sound;
-Ability to analyze the current state of IT applications;
-Ability to analyze the main models used in voice and image recognition.</td></tr>
<tr><td>Learning outcome:</td><td>On successful completion of this module, the student should:
-Be familiar with various signal processing concepts, such as frequency analysis using Fourier Transforms;
-Have gained experience in programmatically processing signals (including both signals and images);
-Have gained an understanding of how humans perceptive signals and how this affects the computational signal processing we perform;
-Understand the issues that arise when designing and building signal processing pipelines.</td></tr>
</table>

<table>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works</td><td>10</td><td rowspan="3">30</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">20</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction. The concept of information processing. The main directions of development of modern information processing technologies.
- Fundamentals of sound processing. Sound theory. Digitalization. Discretization. The concept of noise. Jitter. Loudness. The concept of digital sound processing.
- Systems, selection and quantization. Principles of digital sound. Continuous-time systems. Theorem of choice. Spectral representations of discrete time. Discrete-time systems. Transition from a continuous-time system to a discrete-time system. Quantization.
- Delays and consequences. Audio and video delays and their causes. Linear and nonlinear delays of sound effects.
- Digital filters. Audio and image filters. MP3 audio filters, JPEG image filters and additional filter packages.
- Sound analysis. Sound modeling. Short-time Fourier transform. Linear coding. Spectral modeling. Time models. Nonlinear models. Physical models.
- Audio players in Windows operating system.
- Rearrange sound in Mac OS. MacPlayer software.
- Sound compression methods.
- Compression and decompression.
- File types for storing audio signals. AU, VOC, FIFF and FIFF-C file formats. Music file formats. Working with WAVE files.
- Determining static properties of images.
- Organizing image pixels based on pixel transformation.
- Spatial filtering of images.
- Boolean transform – logical operations as morphological operations.
- Filtering images in the frequency domain.</td></tr>
<tr><td>Literature:</td><td>Burger V., Burge M.J. Digital Image Processing: An Algorithmic Introduction Using Java. - New York: Springer, 2007. - 564 p. Digital Image Processing. Signal Processing and an Algorithmic Approach [Text]: monograph / D. Sundararajan. - New York: Springer, 2017. - 468 p. R. Gonzalez., R. Woods., S. Eddins. Digital processing is carried out graphically in the MATLAB environment. Sh. T. Kasimova, Sh. Chulliev, B. Boymurodov. Methodical methodology of laboratory work on the subject "Sound and Image Processing" Tashkent 2021.</td></tr>
</table>

6.7. Embedded management systems	
Semestr:	6
Date of last modification:	31.08.2023
Teachers:	Abaskhanova Halima Yunusovna
Component:	Compulsory
Cycle:	Core
ECTS:	6
Pre-requisities	Data structures and algorithms
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Testing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes
Short content:	This course provides the necessary foundation for learning about embedded management systems, creating embedded management systems using high-level programming languages, and testing them based on hardware.
Goal:	The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in embedded management systems.
Objective:	-embedded management systems and their structure; -operating systems of modern embedded systems; -organization of microcontrollers; -parallel information processing tools; -hardware means of direct access to memory; -the principle of designing and operating software tools of the embedded system; -methods of information exchange; -creating programs in a high-performance programming language and configuring them in hardware support, -implementation and organization of the principles of information exchange in them, organization of means of connecting system devices with the control object.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Gains an understanding of control systems and embedded control systems. LO 2. Gain knowledge of hardware and software of real-time embedded systems. LO 3. Acquire practical skills in solving problems in the design of embedded systems and hardware design. LO 4. Digital devices can choose ways to create and configure software for workflows. LO 5. Knows the tools for creating software for automatic control of technological processes and their configuration and organization.
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities; - communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods); - case-study method (analysis of situations);

<table>
<tr><td></td><td>- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-10)</td><td>30</td><td rowspan="2">40</td><td rowspan="3">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to the science of embedded control systems and their software.
- Embedded management systems, their classification and main features.
- Main features of embedded control systems: real-time mechanisms in embedded systems.
- Structural principles of modern embedded systems. The main components are hardware and software.
- Structural principles of hardware support of embedded management systems.
- Structural principles of hardware support of embedded management systems.
- Structural principles of hardware support of embedded management systems.
- Hardware design tools for embedded management systems and their capabilities.
- Analysis of modeling issues of control systems to be embedded.
- Software design of embedded control systems: organization of system and application software.
- Software of embedded management systems. Embedded operating systems.
- Instrumental tools for designing embedded management systems software.
- Principles of hardware and software testing of embedded control systems.
- Fields of application of embedded management systems. IoT principles and and IT/OT convergence. Principles of standardization of IoT.
- Principles of IoT organization: WSN, SCADA, RFID, M2M.</td></tr>
<tr><td>Literature:</td><td>1. Abaskhanova H.Y., Amirsaidov U.B. Microprocessors. Study guide for higher educational institutions. "Science and technologies". Tashkent - 2017. - 272 p. 2. Abaskhanova H.Y., Mirzaeva M.B., Parsiev S.S Microprocessor. Study guide for higher educational institutions. "Hihol Print". Tashkent - 2021. -200 p. 3. Abaskhanova H.Y., Baltayev J,.B., Yaronova N.V. Microprocessor devices of radio communication, a textbook for higher educational institutions. "IMPRESS MEDIA". Tashkent - 2023. - 347 p.</td></tr>
</table>

6.8. Subscriber access networks	
Semestr:	4
Date of last modification:	31.08.2023
Teachers:	Normatova Dilbar Turgunovna, Almardanov Mukhriddin Khurram ugli
Component:	Elective
Cycle:	Core
ECTS	6
Pre-requisities	Physics
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Midterm control, Exam
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 3 questions, the first 2 of which are from 15 points, the third from 20 points, the questions consist of 2 Parts: 2 theoretical questions and 1 practical question. Total exam time 80 minutes
Short content:	The discipline "Subscriber access networks" is focused at the theoretical and practical theoretical knowledge on architecture and design of subscriber access networks and optical communication lines. The course is devoted to the study of the structural elements of the subscriber access network, xDSL, FTTx, PON fixed broadband access technologies, the main parameters of optical fibers and cables, types of subscriber access networks, optical fiber components, multiplexing devices and applied technologies. consists in teaching the issues of synchronization and management in optical connection networks, interfaces of subscriber access networks, optical connection networks and their implementation in practice.
Goal:	The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in Subscriber access networks.
Objective:	-understanding the fundamentals of network technologies; -studying network protocols -developing practical skills in network configuration and management; -Knowing the purpose and structure of the subscriber access network, digital and packet switching methods of building digital transmission systems; methods of building optical networks (AON, xPON); know how to develop (plan) an optical access network project based on the characteristics of multiplexer equipment and their network capabilities in various configurations.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Knows how to understand and analyze an appropriate reference model of the interaction of open systems, environments and technologies for information transfer, transport and telecommunication technologies used by mass media networks; LO 2. To distinguish the types of services for multimedia communication networks, their organization features, fiber optic cables and optical transmission/reception modules used in the access network; LO 3. Ability to determine planned information load and required switch operation using standard methodology; selection of optical fiber components and modules necessary for transmission of optical signals; determine the size of cable products and equipment; provision of emergency situations in the planned network and measures to eliminate them with redundant means;

<table>
<tr><td></td><td>LO 4. To be able to choose different technologies used in the construction of multimedia access networks in order to improve the efficiency of the use systems, to analyze the problems that have arisen in the management of multimedia access networks;
LO 5. Acquisition of optimal structural and topological construction of convergent multimedia subscriber access networks, selection of optimal options of technologies used in their construction, calculation of optical transmission sections; replenishment with equipment and cable products; to be able to perform a comparative analysis of technical solutions for network configuration and choose products for its implementation.
LO 6. Mastering the skills of creating signal diagrams in the provision of various services of optical communication networks.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-8)</td><td>20</td><td rowspan="3">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Written)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to subscriber access networks. Goals and objectives of the course. The concept of an access network. The composition of a subscriber section of a telephone network. The difference between a broadband access network and a narrowband one
- Methods of connecting to the Internet.
- Broadband network services - general description of Triple-Play service and types of TriplePlay services. Implementation of services "high-speed Internet access", "telephone communication", broadband multimedia applications.
- Telecommunication lines used in the access network. General concepts of the communication line. Copper communication lines. Optical communication lines. Radio channels.
- Overview of access network data transmission channels - cable communication channels, construction of data transmission networks using radio channels, IEEE 802.11 wireless networks, wireless optical channels. Comparison of the capabilities of wired, radio and fiber optic channels.
- Current state and development prospects of the access network in the converged NGN network. Evolution of the NGN access network. Current state and development prospects. Methods of upgrading the access network for migration to a broadband network.
- Classification of technologies used in access networks. Principles of construction and technologies of wired access networks. Standards of wired and wireless access networks Digital subscriber lines. Family of xDSL technologies. Set of DSL services. ADSL modem, ADSL filter. Digital subscriber line access multiplexer DSLAM. Broadband remote access router BRAS.
- Principles of construction of broadband wireless access networks.</td></tr>
</table>

	- Modulation methods used in data transmission in broadband networks. Modulation systems and multi-level signal transmission. Phase manipulation – implementation of a modulator, demodulator, spectrum of FM signals and error characteristics. Quadrature-amplitude modulation, amplitude-phase modulation with carrier suppression. - Introduction to optical access networks. Component base of optical access networks. - Designs and materials of fiber-optic cables. - Types of designs, main elements of fiber-optic cables. Designs of fiber-optic cables. - Construction and installation of fiber-optic communication lines. Features and organization of construction of fiber-optic communication lines. Laying and suspension of optical cables. Optical connectors, designs of OK couplings and features of their installation. - Technologies and equipment for multiplexing in optical access networks. Plesiochronous digital hierarchy PDH. SDH-synchronous digital hierarchy. Asynchronous transmission mode ATM. Multiplexing of Ethernet frames. - Wavelength-Code Division Multiplexing. Wavelength-Code Division Multiplexing Technology. WWDM, CWDM, DWDM Wavelength Multiplexing. OCDMA Code Division Multiplexing. - PON multiplexing technologies (APON, BPON, EPON, GPON, 10GPON). Optical access network user and service node interfaces. User and node interface in the optical access network. UNI user interfaces. Provision of SNI node interface services. Optical access network control and synchronization interfaces. - Optical access network synchronization and control. Clock synchronization principles. Synchronization in a digital cyclic transmission network. Synchronization in frames, cells and packets transmission networks. PON network synchronization features. Optical subscriber access network management. Security tasks in optical access networks. - Access network testing methods and tools. Copper wire testing methods and tools. Methods and means for testing fiber optic lines. - Principles of designing an optical multimedia access network. Selecting the topology and technology of a wired optical connection network. Calculating the load to determine the types of devices and interfaces. Selecting devices and cable products. Scheme for organizing interactions. Equipment for devices and cable products. - Methods for upgrading an access network for migration to a converged access network in the Republic of Uzbekistan. Comparison of characteristics of optical access structures. FTTC, FTTB, FTTH. Development of an access network based on MSAN equipment (FTTC). MSAN multiservice subscriber access node. Development of an access network based on mini-MSAN equipment (FTTB-xDSL). Overview of the architecture of a passive optical network (PON). - Fundamentals of technical operation of optical access networks. Organization of technical operation of fiber optic communication lines. Operational and technical requirements for fiber optic communication lines. Planning, monitoring and ensuring work on the technical operation of fiber optic communication lines. Repair of fiber optic communication line structures. Protection of fiber optic communication line cable structures and emergency recovery operations. Telecontrol, service communications and power supply of the equipment of the linear tract of the optical fiber communication lines. Methods of measuring fiber-optic communication lines.
Literature:	Literature 1. Leonid G. Kazovsky, Ning Cheng, Wei-Tao Shaw, David Gutierrez, Shing-Wa Wong. Broadband optical access networks. John Wiley & Sons, Inc. 2011. ISBN 978-0-470-18235-2. 2. Fokin V.G. Design of optical access network: study guide/Federal State Budgetary Institution of Higher Professional Education "SibSUTI". - Novosibirsk, 2012. - 312 p.3. N.Yunusov, R.Isayev, G.X.Mirazimova. Optik aloqa asoslari. -T.:Chulpon nomidagi NMIU, 2014, 368 bet. ISBN 978-9943-05-684-8.

6.9. Fiber optic communication lines	
Semester:	4
Date of last modification:	31.08.2023
Teachers:	Mirazimova Gulnora Khasanovna, Tursimuratov Saparniyaz Salauatovich
Component:	Elective
Cycle:	Core
Credit point:	6
Pre-requisities	Physics, Subscriber access networks
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Midterm control, Exam
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 3 questions, the first 2 of which are from 15 points, the third from 20 points, the questions consist of 2 Parts: 2 theoretical questions and 1 practical question. Total exam time 80 minutes
Short content:	Fiber optic communication lines course covers the principles of light transmission through optical fibers, fiber types and characteristics, light sources and detectors, modulation techniques, signal processing, network design, performance analysis, and future trends. It emphasizes hands-on experience and practical skills for designing and managing fiber optic communication systems.
Goal:	The purpose is to equip students with comprehensive knowledge and practical skills in fiber optic technology, including light transmission principles, system design, performance analysis, and the latest advancements, preparing them for roles in designing and managing fiber optic communication systems.
Objective:	- understand the principles of light transmission in optical fibers; - learn about different types of optical fibers and their characteristics; - study the operation of light sources and detectors used in fiber optics; - design and analyze fiber optic communication systems; - Explore the latest trends and advancements in fiber optic technology; - develop practical skills through hands-on labs and projects.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understand the principles of building general communication networks, the structure of linear paths, and the structural design of fiber-optic transmission lines. LO 2. Know and apply the basics of transmitting information over fiber-optic communication lines, including the methods for calculating the parameters of optical fibers and cables. LO 3. Acquire skills in the practical application of design rules for fiber-optic communication lines for various purposes within communication networks. LO 4. Understand and apply the basic rules for designing optical communication lines and international standards. LO 5. Be able to analyze the results obtained during the study and construction of fiber-optic communication lines.
Teaching methods:	In the credit system of education, classes prioritize active and creative teaching methods. Effective pedagogical approaches focus on fostering students' active engagement in knowledge discovery and management, particularly through independent problem-solving experiences that enhance their ability to apply and integrate knowledge:

<table>
<tr><td></td><td>- problem- and project-based learning;
- educational and research activities
- communication technologies (discussion, debates);
- case-study analysis
- simulation and role-playing games
- information and communication technologies.
To cultivate critical thinking in practical classes, instructors utilize methods such as "Prediction with open questions," "Cluster," "Cross-discussion," "Know-Want to Know-Learned," "INSERT," and hands-on activities.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-8)</td><td>20</td><td rowspan="3">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Written)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction. Brief information about the history and prospects for the development of optical communications.
- Optical transmission systems, communication lines, linear paths.
- Basic principles of operation of fiber light guides. Optical fiber parameters.
- Basic physical parameters of optical fiber.
- Types of cable. Classification, characteristics and materials. Designs and materials of fiber-optic cables.
- Basic provisions for the design and features of the manufacturing technology of fiber-optic cables.
- Construction and installation of fiber-optic communication lines.
- Fundamentals of technical operation of fiber-optic communication lines.</td></tr>
<tr><td>Literature:</td><td>Literature 1. Isaev R.I., Radjapova R.N., Atametov R.K. Telecommunications transmission systems (textbook). - T., "Science and technology", 2011.2. Yunusov N.Yu., Isayev R.I., Mirazimova G.Kh. Fundamentals of optical communication. Ministry of Higher and Secondary Special Education of the Republic of Uzbekistan - T.: NMIU named after Cholpon, 2014. - 368 pages. 3. Isaev R.I., Karimova U.N., Rachmonova G.S. Metrology, standardization and certification (textbook). - T., "The liaison", 2017, 612 P. 4. Isaev R.I., Eibatova D.X. Multimedia communication networks (textbook). - T., "The liaison", 2019, 304 P.</td></tr>
</table>

6.10. Data communications	
Semestr:	5
Date of last modification:	31.08.2023
Teachers:	Allamuratova Zamira Jumamuratovna, Abaskhanova Khalima Yunusovna
Component:	Elective
Cycle:	Core
ECTS:	6
Pre-requisities	Data structure and algorithms
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Laboratory works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	Data communications course will encourage you to understand data communications, protocols and standards, physical layer, analog and digital transmission, bandwidth, data link layer and its protocols.
Goal:	The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in data communications.
Objective:	-introduction to Data Communications; -protocols and standards; -physical layer; -digital signals; -digital transmission; -analog Transmission; -bandwidth Utilization; data Link Layer; -data Link Protocols; -error Detection and Correction; -Media Access Control (MAC); -wireless LAN; -mobile networks overview; -mobile networks and other wireless networks.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Explores the methods of information transmission. LO 2. Understands the process of transferring data on the Internet. LO 3. Gains an understanding of the protocols and standards of data exchange. LO 4. Explores ways to increase network bandwidth. LO 5. Learns modern methods of data collection, sorting, processing, and transmission in information communication.
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities; - communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods); - case-study method (analysis of situations); - game technologies, in which students participate in business, role-playing, simulation games; - information and communication (including distance learning) technologies.

	In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.
Assessment of the student's knowledge:	

Type of task		**Number of points (max)**		**Total**
Current control	Laboratory works	30	40	100
	Independent work	10		
Mid-term control	Written work	10		
Final control	Exam (Writing)	50		

Topics of lectures:	- Introduction to Data Communications - Protocols and standards - Physical layer - Digital signals - Digital transmission - Analog Transmission - Bandwidth Utilization - Data Link Layer - Data Link Protocols - Error Detection and Correction - Media Access Control (MAC) - Wireless LAN - Mobile Networks Overview - Mobile Networks and other Wireless networks
Literature:	1. Buhrouz A.Forouzan, Data Communications and Networking fourth edition NewYork, NY 10020, 2007. ISBN-13 978-0-07-296775-3. 2. Rachna Jain; Kanta Prasad Sharma; Rana Majumdar; Dac-Nhuong Le, "Data Communication and Information Exchange in Distributed IoT Environment," in *Evolving Networking Technologies: Developments and Future Directions*, Wiley, 2023, pp.41-54, doi: 10.1002/9781119836667.ch3. 3. Kay Vu; Jian A. Zhang; Xiaojing Huang; Yingjie J. Guo, "Frequency-Hopping MIMO Radar-based Data Communications", *Joint Radar Communications uchun signallarni qayta ishlash* , IEEE, 2024, pp.275-294, doi: 10.1002/9781119795568.ch10.

6.11. Fundamentals of network programming	
Semestr:	5
Date of last modification:	31.08.2023
Teachers:	Akhmedova Khusniya Khusanovna, Berdimuradov Mirzohid Samidulla ug‘li
Component:	Elective
Cycle:	Core
ECTS:	6
Pre-requisities	Programming 2
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Laboratory works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	Teaching the basics of network programming includes lectures and laboratory sessions, video lectures, presentations, and tasks and independent assignments based on the credit system of education. Theoretical and practical information on the topics indicated in the lectures and laboratory works is given, the procedure for performing laboratory works and calculating the results is explained. Students study the educational materials of science independently, tests, laboratory works are performed by students individually
Goal:	The purpose of teaching the subject - to provide students with the theoretical basis of network programming knowledge, the basic concepts and principles of network programming, and the ability to teach and create programs that work on the network.
Objective:	-to create knowledge about network programming, to create TCP and UDP client-server network programs, to work with databases on the network, to program servlets on servers, to create practical skills on creating dynamic web pages on servers
Learning outcome:	After studying the discipline, students should be able to: LO 1. Student will learn about the basics of programming, client-server architecture, network protocols. LO 2. Learns network programming tools and programming languages, the principles of organizing information exchange on a network. LO 3. Learn and use protocols in network programming, Internet addresses (URLs and URIs) in network programming, and the JSON data exchange format. LO 4. Learn and use CORBA architecture and IDL, Asynchronous JavaScript and XML (AJAX) technology LO 5. Have skills in socket-based network programming, using classes in network programming LO 6. Learn the skills to create an e-mail network program, work with a database on the network LO 7. Will have skills in programming servlets on servers, creating dynamic web pages on servers

<table>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Laboratory</td><td>30</td><td rowspan="2">40</td><td rowspan="3">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Theoretical foundations and concepts of network programming
- Client-server networking software based on TCP and UDP sockets.
- Internet addresses (URLs and URIs) and JSON data exchange format in network programming, HTTP in network programming
- Program file transfers over the network (FTP and TFTP). Creating an email networking program
- Asynchronous JavaScript and XML (AJAX) technology. JavaFX capabilities in network programming
- Secure Sockets in Network Programming. Multithreading and Multiplexing in the network.
- Distributed client-server applications (RMI, CORBA). Working with a database on the network.
- Programming servlets on servers. Technology for creating dynamic web pages on servers
- Creating a TCP and UDP client-server network programs.
- Creating a multicast socket-based application.
- Working with Internet addresses and the JSON data exchange format
- Working with hypermats on the network.
- Creating a program that works on the basis of multitasking in the network
- Creating servlets on servers
- Creating dynamic web pages on servers</td></tr>
<tr><td>Literature:</td><td>1. Computer networking: a top-down approach. James F. Kurose, Keith W. Ross. -6th yed. 2013. Pearson Yeducation, Inc., publis’hing as Addison-Wesley. –899 p. 2.TCP/IP protocol suite. Behrouz A. Forouzan. -4th yed. Publis’hed by McGraw-Hill, a business unit of The McGraw-Hill Companies, Inc., 2010. 1029 p. 3.JavaFX Working with JavaFX UI Components Release 8. Alla Redko, Irina Fedortsov. 2014 4.Distributed SystemsConcepts and Design. Fifth Edition. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair. 2012.</td></tr>
</table>

<table>
<tr><th colspan="2">6.12. Info-communication systems and networks</th></tr>
<tr><td>Semestr:</td><td>6</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Berdimuradov Mirzohid Samidulla ug‘li, Utegenov Akhmet Alisher uli’</td></tr>
<tr><td>Component:</td><td>Elective</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>ECTS:</td><td>6</td></tr>
<tr><td>Pre-requisities</td><td>Modeling of Info-communication systems</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Writing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes</td></tr>
<tr><td>Short content:</td><td>Info communication systems and networks course will encourage you to learn the main characteristics of info communication systems and networks, the analysis of the characteristics of data flow through the network, methods of optimizing network structures, mathematical models for calculating the parameters of data flow through the network.</td></tr>
<tr><td>Goal:</td><td>The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in understanding the characteristics of information communication networks and systems.</td></tr>
<tr><td>Objective:</td><td>-understanding the architecture of info communication network structures, -studying the organization of data transmission in information communication networks, -analyzing the methods of optimization of info communication networks, -evaluation the quality of transmission of channels, -exploring the generating models of info communication networks.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Imagining about the architecture of the information communication network, network structures.
LO 2. Understanding the principles of data transmission organization in information communication networks.
LO 3. Possess skills to determine the methods of optimization of info communication networks, characteristics of channel throughput.
LO 4. Possess skills to calculate time probability characteristics.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);</td></tr>
</table>

<table>
<tr><td></td><td>- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-10)</td><td>30</td><td rowspan="2">40</td><td rowspan="3">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Information communication systems and networks, basic concepts and construction methods. Network topology and characteristics.
- Data flow and characteristics in information communication networks.
- Methods of data flow routing in information communication networks. Identify shortcuts. Dijkstra method.
- Methods of data flow routing in information communication networks. Identify shortcuts. Dijkstra method.
- Calculation of the main characteristics of information communication networks. Data flow intensity. Load calculation.
- Calculation of the main characteristics of information communication networks. Data flow intensity. Load calculation.
- Management of information communication networks. Traffic management in information communication networks.
- Public service models. Mathematical models for calculating time-probability characteristics (VEX) of data flow.
- Public service models. Mathematical models for calculating time-probability characteristics (VEX) of data flow.
- Infocommunication network resources. Communication channel throughput. Data transmission technologies.
- Methods for calculating viability and reliability parameters of the infocommunication network.
- Optimization and analysis of information communication network structures. Network optimization criteria.
- Optimization and analysis of information communication network structures. Network optimization criteria.
- Providing quality service (QoS) to users in information communication networks.
- The role of software tools in monitoring information communication networks.</td></tr>
<tr><td>Literature:</td><td>Literature 1. Goldshtein B.S.: Infocommunication networks and systems. - SPb.: BXV-Peterburg, 2019. - 208 p. 2. K.E. Samuilov, N.V. Serebrennikova, A.V. Chukarin, N.V. Yarkina. An extended map of the processes of a telecommunications company. Textbook, M.: RUDN, 2008. – 183 p. 3. Velichko V.V. and others. Telecommunication systems and networks. Volume 3. Multiservice networks. - M.: Hotline – Telecom, 2005. 4. Dymarsky Ya. S., Krutyakova N.P., Yanovsky G.G. Communication network management: principles, protocols, applied tasks. - M: ITC "Mobile Communications", 2003.</td></tr>
</table>

6.13. Telecommunications Network Management	
Semestr:	6
Date of last modification:	31.08.2023
Teachers:	Akhmedova Khusniya Khusanovna, Abaskhanova Halima Yunusovna
Component:	Elective
Cycle:	Core
ECTS:	6
Pre-requisities	Embedded management systems
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Laboratory works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	The task of cource is to create knowledge about the basics of network management, analysis of network structures, network management methods, network characteristics, criteria for managing telecommunication networks, as well as the formation of practical skills in network design methods based on network management systems
Goal:	The purpose of teaching the subject is to train students in the basics of telecommunications network management, the structures and characteristics of networks, the characteristics of data flows transmitted over the network, the construction and analysis of telecommunications network management system skills.
Objective:	-understanding the fundamentals of basics of telecommunications network management; -studying network protocols -developing practical skills in network configuration and management; -analyzing and optimizing network performance; -troubleshooting network issues; -exploring modern trends and technologies in networking.
Learning outcome:	After studying the discipline, students should be able to: LO 1.Understanding of the structure and main characteristics of telecommunication networks. LO 2. Gain skills in the general concept of building a telecommunications network management system LO 3. Learns and uses common data management protocols and services in network management. LO 4. Studies the principles of service quality management in telecommunication networks LO 5. Studies network management methods, principles of organizing data transmission in the network LO 6. Acquires skills in working with new technologies used in telecommunications network management systems

<table>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Laboratory</td><td>30</td><td rowspan="2">40</td><td rowspan="3">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to the basics of telecommunications network management. Basic concepts and characteristics of telecommunication networks.
- Structure and main characteristics of telecommunication networks.
- General concept of building a telecommunications network management system.
- Dynamic management of network resources.
- ITU-T recommended standards, protocols, communication network management interfaces
- Concept, structure, functions and protocols of TMN Network layer. Network protocols. Network layer protocols (IP, ICMP)
- Quality of Service (QoS) in IP Networks Routing (static and dynamic). Routing protocols (RIP, OSPF, BGP)
- Control systems, general structure and features of the OSS/BSS class Application layer protocols (HTTP, FTP, SMTP, DNS).
- Application of the e-TOM principle in the management of telecommunication networks and services.
- Fundamentals and principles of TINA architecture Network Management and Monitoring. Tools and methods for network monitoring
- Concepts of distributed control (CORBA)Internet of Things (IoT). 5G networks. SDN (Software-Defined Networking)</td></tr>
<tr><td>Literature:</td><td>Literature 1. Computer Networking: This Book Includes: Computer Networking for Beginners and Beginners Guide (All in One). Rassel Scott, 2019. 2. A Top-Down Approach: Computer Networking, James F. Kurose, Keith W. Ross 2017. Pearson Education Limited. 3. Computer Networks, Fourth Edition. Andrew S. Tanenbaum. Publisher; Prentice Hall, 2011. 4. “Computer networks. Principles, technologies, protocols: A textbook for university students, Fifth Edition” N.A. Olifer, V.G. Olifer, St. Petersburg, Peter, 2016.</td></tr>
</table>

6.14. Virtual network technologies	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Lazarev Amir Pishembayevich
Component:	Elective
Cycle:	Core
Credit point:	6
Pre-requisities	Cybersecurity fundamentals
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Midterm control, Exam
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 3 questions, the first 2 of which are from 15 points, the third from 20 points, the questions consist of 2 Parts: 2 theoretical questions and 1 practical question. Total exam time 80 minutes
Short content:	The discipline “Virtual Network Technologies” provides students with theoretical and practical knowledge on creating virtual machines and components of virtual networks, organizing and managing virtual local networks, virtual private networks and software-defined networks (SDN), network functions virtualization (NFV), as well as skills installing and configuring VirtualBox, Hyper-V and VMware ESXi hypervisors, creating a virtual machine, working with virtual disks, performing network settings, creating a virtual switch and virtual router.
Goal:	The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills on the structure of virtual network technologies.
Objective:	-understanding of the basics of virtualization; -study of hypervisors; -development of practical skills in setting up and managing virtual network components; -analysis and optimization of network performance; -study of modern trends and technologies in the field of network technologies.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Acquires knowledge about development trends in virtual network technologies, virtualization technologies, principles of organizing virtual machines, virtualization platforms, virtual network components; Knowledgeable of Network Function Virtualization (NFV) architectures and applications, management and data layer virtualization issues, and NFV services. LO 2. Has knowledge of organizing virtual local networks and virtual private networks, managing and monitoring traffic in them; LO 3. Has an understanding of the basics of organizing software-defined networks (SDN), principles of architecture and construction, security issues; LO 4. Knowledgeable of Network Function Virtualization (NFV) architectures and applications, management and data layer virtualization issues, and NFV services; LO 5. Knows how to create/configure a virtual machine in Hyper-V, VirtualBox and VMware ESXi hypervisors, has the skills to configure virtual network parameters; LO 6. Has skills in installing and configuring Kerio Control on VMware ESXi, creating traffic rules on a Proxy server and managing users, building a secure network based on VPN.

<table>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-10)</td><td>20</td><td rowspan="3">40</td><td rowspan="5">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Written)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- -Trends in the development of virtual network technologies;
- - Principles of organizing virtual machines;
- - Technology, components, services and VDI application scenarios;
- - The concept of virtual network components and the basis of their operation;
- - Principles of organization and management of virtual local networks;
- - Traffic management and monitoring in virtual networks;
- - Virtual private networks (VPN);
- - Basics of SDN organization;
- - Network management level;
- - OpenFlow protocol;
- - Scenarios and possibilities for implementing SDN;
- - Security issues in SDN;
- - NFV architectures and applications;
- - NFV services;
- - Global resource management.</td></tr>
<tr><td>Literature:</td><td>Савельев, А. О. Решения Microsoft для виртуализации ИТ-инфраструктуры предприятий: курс / А. О. Савельев; Национальный Открытый Университет "ИНТУИТ". – Москва: Интернет-Университет Информационных Технологий (ИНТУИТ), 2011. – 277 с.
N.M. Mosharaf Kabir Chowdhury and Raouf Boutaba, A Survey of Network Virtualization, Technical Report: CS-2008-25, October 15, 2008.
John Wiley & Sons, Inc. Network Virtualization For Dummies®, 2nd VMware Special Edition, Copyright © 2018 by John Wiley & Sons, Inc., Hoboken, New Jersey.
William Stallings, Foundations of Modern Networking SDN, NFV, QoE, IoT, and Cloud ISBN-13: 978-0-13-417539-3. Copyright © 2016 by Pearson Education, Inc.
Hassan Habibi Gharakheili. The Role of SDN in Broadband Networks, ISBN 978-981-10-3479-4. Springer Nature Singapore Pte Ltd. 2017</td></tr>
</table>

6.15. Modeling and Simulation of Networks	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Amirsaidov Ulugbek Baburovich, Qodirov Azamat Almat ug‘li
Component:	Elective
Cycle:	Core
Credit point:	6
Pre-requisities	Data structures and algorithms
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Laboratory works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Midterm control, Exam
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 3 questions, the first 2 of which are from 15 points, the third from 20 points, the questions consist of 2 Parts: 2 theoretical questions and 1 practical question. Total exam time 80 minutes
Short content:	The subject "Modeling and Simulation of Networks" will give students the skills to learn the methods of network modeling and optimization, as well as software tools, to solve the problems of analysis and synthesis of data transmission networks based on the acquired knowledge.
Goal:	The course is designed for undergraduate students and teaches the methods of network modeling and optimization, how to use the modeling tools to solve the problems of analysis and synthesis of data transmission networks.
Objective:	In this course, students are taught modeling and simulation of telecommunication networks using modern software tools. Furthermore, it is also intended to provide insights into the importance of network modeling in solving network problems.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Have knowledge about the descriptions of network models and their evaluation methods LO 2. Have knowledge about the descriptions of communication channel models and their evaluation methods; LO 3. Have knowledge about the models of the main transmission methods of communication systems and their performance indicators; LO 4. Have the ability to know and use the main methods of analyzing the results of modeling; LO 5. Have knowledge about the types of models, analytical and simulation modeling, modeling issues, issues of analysis and synthesis of communication systems, will have the skills to optimize the characteristics of communication systems.
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities; - communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);

<table>
<tr><td></td><td>- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Laboratory work</td><td>20</td><td rowspan="3">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Written)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction. Basic concepts and terms of science. Application of modeling in the design of telecommunication systems and its role
- Random numbers, random processes and their models
- Communication channels and their models. Noise models.
- Models of noisy coding and modulation processes
- Models of data transmission protocols
- The role of mass service theory in telecommunications. Data flow models.
- Single channel queueing system models
- Multi-channel queueing system models
- Preferential Queueing System models
- Modeling network nodes
- Modeling of telecommunication networks
- Modeling of data routing processes
- Software configurable network modeling
- IoT network modeling
- 5G network modeling</td></tr>
<tr><td>Literature:</td><td>Literature 1. Mohsen Guizani, Ala Al-Fuqaha, Bilal Khan, Ammar Rayes, “Network Modeling and Simulation: A Practical Perspective”, 2010, -P 304. 2. Dimitri P. Bertsekas, “Network Optimization: Continuous and Discrete Models”, - p 600. 3. Leonard Kleinrock, “Queueing Systems, Vol. 2: Computer Applications 1st Edition”, -p. 340, 1976</td></tr>
</table>

6.16. Introduction to IMS	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Sadchikova Svetlana Aleksandrovna, Abdujapparova Mubarak Baltabaevna
Component:	Eective
Cycle:	Core
Credit point:	6
Pre-requisities	Multimedia communication networks
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Midterm control, Exam
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 3 questions, the first 2 of which are from 15 points, the third from 20 points, the questions consist of 2 Parts: 2 theoretical questions and 1 practical question. Total exam time 80 minutes
Short content:	The purpose of teaching the discipline “Introduction to IMS” is to provide bachelors with knowledge about the principles of building convergent telecommunication networks based on Softswitch, methods of migration to NGN technology of PSTN operators and mobile network operators, principles of building networks based on the IMS concept, the functions of their structural elements, the structure, types of requests and responses of the SIP protocol , protocol operation algorithms when establishing a multimedia session of a voice and video call, and supporting high-speed multimedia applications; methods of providing services to users in the IMS network.
Goal:	The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in IP Multimedia Subsystem and multimedia networks.
Objective:	-be able to build schemes for exchanging signaling messages for voice and video calls based on the SIP protocol, depending on various reasons for the end of the call; analyze SIP connection establishment diagrams to support high-speed multimedia applications; determine the required structure for building converged networks of the next generation according to the specified parameters and the necessary equipment configuration.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Know the ideology and principles of construction, architecture of convergent networks of the new generation; LO 2. Understand the architecture and functional elements of the Softswich switch; LO 3. IMS architecture – composition and purpose of levels, functions and elements of the transport control plane, application level; types of standard services in IMS multiservice networks; LO 4. Determine the required structure for building converged networks of the next generation according to the specified parameters and the necessary equipment configuration; LO 5. Formulate requirements for equipment functions using the example of a training network consisting of Softswitch ZTE ZXSS10 SS1b, IP switch ZTE ZXR105952E, NMS server (network management server), IP terminals and other devices;

<table>
<tr><td></td><td>LO 6. Gain skills in working with Cisco Packet Tracer, Elastix programs, programs for setting up SIP terminals, modems, IAD, DSLAM.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-10)</td><td>20</td><td rowspan="3">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Written)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- General concepts about IMS.
- Principles of construction, architecture of new generation converged networks.
- Architecture and functional elements of the Softswich switch.
- Migration methods for PSTN operators to NGN technology.
- Migration methods to NGN technology for mobile network operators.
- SIP protocol - purpose, addressing, SIP network architecture, functions of network elements.
- Basic SIP requests and responses for a multimedia session (voice and video call). Establishing a connection based on the SIP protocol.
- SIP protocol messages provide high-speed multimedia applications.
- Standardization in IMS. IMS architecture – composition and purpose of levels. IMS Control Plane.
- IMS Bearer plane, IMS application plane.
- Basic protocols in IMS networks.
- Standard services in IMS multiservice networks: Messaging, Presence.
- Standard services in IMS multiservice network: half-duplex fast communication (PoC), conferencing, group management.
- Main interfaces used in IMS networks.</td></tr>
<tr><td>Literature:</td><td>Literature 1. M.Wuthnow, M.Stafford, J.Shih. IMS: a new model for blending applications. – Auerbach Publications, CRC Press Taylor & Francis Group, LLC, Boca Raton, USA, 2010. 2. S.A. Sadchikova, M.B. Abdujapparova. Multiservice networks based on IMS. (Book). T.: “Aloqachi”, 2021. 3. A.A. Muradova. Next generation converged networks. Book. – T.: Aloqachi, 2018.</td></tr>
</table>

6.17. Next generation convergence networks	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Sadchikova Svetlana Aleksandrovna
Component:	Eective
Cycle:	Core
Credit point:	6
Pre-requisities	Subscriber access network
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Midterm control, Exam
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 3 questions, the first 2 of which are from 15 points, the third from 20 points, the questions consist of 2 Parts: 2 theoretical questions and 1 practical question. Total exam time 80 minutes
Short content:	The discipline "Next generation convergence networks" is focused at the theoretical and practical theoretical knowledge on architecture and design of modern high-speed multimedia converged networks, modern concepts of transport network design (ATM, SDH, Gigabit Ethernet) and access networks (xDSL, FTTx, PON), signaling protocols (H323, RAS, SIP, MGCP/H.248) and scenarios of equipment interaction during data exchange, as well as practical skills in designing an NGN network of various levels for the Triple-Play service.
Goal:	The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in Next generation convergence networks.
Objective:	-understanding the fundamentals of network technologies; -studying network protocols - developing practical skills in network configuration and management; -analyzing and optimizing the algorithms of the H.248, SIP, and CCS7 protocols for establishing a multimedia session of voice and video calls and support for high-speed multimedia applications; - particular attention is paid to the methods of NGN services providing, describing their functions and considering signaling diagrams.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Know the principles of telecommunication networks design, their equipment, basic parameters; LO 2. Understand the principles of building multiservice networks, the prospects for their development; LO 3. Distinguish the types of protocols used in NGN networks, their application; be able to determine the possibilities of building convergent networks of the next generation based on the specified equipment; LO 4. Build signal diagrams based on the protocols used when providing services for a specific example of a network; LO 5. Be able to choose the protocols used for a specific example of a network based on various technologies used in the construction of converged networks of the next generation; LO 6. Acquire skills in drawing up signal diagrams when providing various services of multiservice networks.

<table>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th>Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td>Practical works (1-10)</td><td>15</td><td></td><td></td></tr>
<tr><td>Laboratory works (1-15)</td><td>15</td><td rowspan="3">0-50</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Frontier control</td><td>10</td></tr>
<tr><td>Exam (Writing)</td><td colspan="2">0-50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction. Goals, objectives and relevance of the discipline. Convergent networks - basic concepts and definitions. Reasons for the transition to the next generation convergence networks.
- The transport layer of converged networks of the next generation. Multiprotocol architecture of transport networks. The importance of upgrading transport and access networks in the transition to NGN.
- Current state and prospects of NGN access network development. Evolution of the NGN access network. The current state and prospects of development. Classification of technologies used on access networks.
- Packet voice and video processing. Principles of packet voice transmission. RTP, RTCP protocols.
- Mediagateways – types, functions and characteristics.
- Next-generation converged network management layer. Softswitch. A call handling system in the NGN network. Multi-level Softswitch architecture.
- Control protocols in the NGN network. The place and role of control protocols in the NGN network, the functional purpose of call control protocols. Megaco/H.248 protocol.
- SIP, SIP-T protocols. Megaco/H.248 protocol.
- BICC, Sigtran protocols. CCS7 - PSTN interconnection protocol.
- Convergence of services in a modern communication network. Basic and additional services of the next generation network.
- Interaction of “NGN subscriber - PSTN subscriber” and “NGN subscriber - mobile operator”.
- NGN service level, NGN service platform and applications.
- Service Quality Management in NGN.
- Maintenance and operation of NGN networks. Requirements for the maintenance and operation system. Service Provider application Platforms for NGN networks.</td></tr>
<tr><td>Literature:</td><td>Literature 1. Toni Janevski. NGN Architectures, protocols and services. First Edition. John Wiley & Sons, Ltd. Published 2014 by John Wiley & Sons, Ltd. 2014. 2. B.S. Goldstein, N.A. Sokolov, G.G. Yanovsky. Communication networks. Textbook for universities. - St. Petersburg: BHV - St. Petersburg, 2009. 3. A.V. Roslyakov, S.V. Vanyashin, M.Yu. Samsonov. I.V. Shibaeva, I.A. Chechnyova. Next generation networks NGN /ed. A.V. Roslyakova. - M.: Eco-Trends, 2008. 4. I.G. Baklanov. NGN: principles of construction and organization / ed. Yu.N. Chernyshova. - M.: Eco-Trends, 2008.</td></tr>
</table>

6.24. Network Smart Devices Software	
Semestr:	8
Date of last modification:	31.08.2023
Teachers:	Elov Jamshid Bekmurodovich, Berdimuradov Mirzohid Samidulla ugli
Component:	Elective
Cycle:	Core
ECTS:	6
Pre-requisities	Programming structure in telecommunications
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	This course provides a comprehensive introduction to the Internet of Things (IoT), exploring data exchange across various devices like Arduino and Raspberry Pi. IoT connects everyday objects, embedding them with intelligence for networked intercommunication. It serves as a platform where electronic teams share specific data, merging physical and digital realms to innovate new products and business models. The course covers critical IoT aspects such as monitoring and control, big data, business analytics, and collaborative information sharing. It emphasizes the IoT as an integral system and infrastructure that supports personalized and city-wide applications and services.
Goal:	The purpose of teaching the subject is to train students in the basics of network smart devices software, the structure and characteristics of networks, their operation with devices, characteristics of data streams transmitted over the network and processes of exchange of these data through devices.
Objective:	-understanding the fundamentals of basics of telecommunications network network smart devices software; - studying network protocols with devices -developing practical skills in network configuration and devices; -analyzing and optimizing network smart devices software; -troubleshooting network smart devices issues; -exploring modern trends and technologies in network smart devices software.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understanding of the structure and main characteristics of network smart devices software. LO 2. Gain skills in the general concept of building a network smart devices software system LO 3. Learns and uses network protocols and services in smart devices software LO 4. Learns data exchange in smart devices and its software LO 5. Learns the methods of programming and controlling smart devices, the principles of organizing data transmission in the device LO 6. Acquires skills in working with new technologies used in smart devices software systems

<table>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-10)</td><td>30</td><td rowspan="2">40</td><td rowspan="3">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to the basics of network smart devices software.
- How the internet of things started. Areas of application of the internet of things.
- Architecture of the internet of things. Information, signals, digital communication system and criteria for communication quality.
- Arduino basics and internet connectivity. IoT protocols. Hardware requirements. Software requirements. Challenges in IoT.
- Internet connectivity. Arduino Uno wireless connectivity (WiFi). Arduino Yún wireless connectivity (WiFi). Wireless setup.
- Communication protocols. HTTP protocols. MQTT protocols.
- Prototypes. Complex flows: Node-RED. External libraries. Read sensor data.
- IoT Patterns: Realtime clients. Data publish. Standard functions.
- IoT Patterns: Remote control. Learning objectives. Screen logic. Code (Arduino).
- On-demand clients. Database table (MySQL). Database connection.
- Location aware. Get GPS coordinates. Coding exercises for location aware.
- Machine to human. Effective workflow. Process creation.
- Machine to machine. Light sensor device. Analog and digital sensors. Lighting control device.
- Cloud platforms for IoT. Cloud computing, benefits. Examples for cloud platforms.
- Microcontrollers, mini-PC, debug kits for IoT projects.</td></tr>
<tr><td>Literature:</td><td>Literature 1. “Introduction to the internet of things”. P.A. Kokunin., I.I. Latypov., L.S. Latypov. 2022. Kazan. 2.Dimitrios Serpanos, Marilyn Wolf “Internet-of-Things (IoT) Systems”, Architectures, Algorithms, Methodologies, Springer International Publishing AG 2018. 3.Adeel Javed, “Building Arduino Projects for the Internet of Things: Experiments with Real-World Applications”, Illinois/USA, 2016. 4. Donald Norris, “The Internet of Things: Do-It-Yourself Projects with Arduino, Raspberry Pi and BeagleBone Black” , United States, 2015.</td></tr>
</table>

6.19. Programming structure in telecommunications	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Elov Jamshid Bekmurodovich, Berdimuradov Mirzohid Samidulla ug‘li
Component:	Elective
Cycle:	Core
ECTS:	6
Pre-requisities	Fundamentals of network programming
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	The Programming structure in telecommunications course encourages you to understand the fundamentals of programming and maintaining processes that enable telecommunications systems and networks to interconnect and interoperate.
Goal:	The purpose of mastering the subject is to provide theoretical and practical knowledge of programming in telecommunication networks, programming technologies and network programming model skills.
Objective:	- network programming models; - service architecture of the network; - organization of a database in programming in telecommunications; - device and network security; -addressing in the network; -programming based on streams; - hardware and software design in telecommunications; - designing practical applications based on sockets; - design of communication system programs based on telecommunication client-server theory.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Gain an understanding of network programming models, network services architecture, database organization in telecommunications programming, and device and network security. LO 2. Understands network addressing, flow-based programming, hardware and software design in telecommunications, and socket-based application design. LO 3. Learns to design and create communication systems programs based on the client-server theory of telecommunications and acquires the skills to use them. LO 4. Master the skills of creating a client-server program for data exchange based on the TCP protocol. LO 5. To have the skills to create a client-server program for data exchange based on the UDP protocol LO 6. Practitioner acquires network application programming skills, learns to program and use network devices

Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities; - communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods); - case-study method (analysis of situations); - game technologies, in which students participate in business, role-playing, simulation games; - information and communication (including distance learning) technologies. In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.
Assessment of the student's knowledge:	

Type of task		Number of points (max)		Total
Current control	Practical works (1-10)	20	40	100
	Independent work	10		
	Oral presentation	10		
Mid-term control	Written work	10		
Final control	Exam (Written)	50		

Topics of lectures:	- Introduction to "Programming structure in telecommunications". The purpose and basic concepts of science. - Architecture of telecommunication networks. Communication model. Connections. Applications and network services. - Step model of the network. ISO/IP-RM model of communication processes and protocols. Definition of the OSI model. Tasks of the steps of the OSI model. - Network protocol model. TCP/IP model definition. A set of protocols in the TCP/IP model. Communication software and protocols. - Protocol engineering. Principles of programming based on protocols. Protocol specification. Definition of formal languages (FSM, SDL). - Network programming models. Programming at the practical level. Socket programming at the transport stage. Programming device drivers. - Principles of architectural design. Design models. Object-oriented design. - Network programming. Provision of services and organization of the network. "Client-server" programming model. Streams and their types. Stream programming through "client-server" technology. - Network programming. Host-to-host data transfer. Hardware and software organization of peer-to-peer and Internet applications. - Service architecture of the network. Provision and maintenance of resources. Service architecture of the network. Data transfer interface. Consolidation of interfaces. - Organization of the database. Methods of database organization in telecommunications programming. Properties of tables and fields. Organization of surveys. - Organization of the database. Database models in telecommunications. Rates of relational, network and hierarchical models. - Device and network security. General security issues of IP. Role model definition and duties. Concepts of Sandbox and Middleware. - Web-based architectures. Traditional architectures for services. Designing a Web DT. Distributed systems and their organization.
Literature:	1. Behrouz A. Forouzen. “Data communication and networking”, Mc Graw-Hill Springer, New York 2010. 2. Stephan Rupp, Gerd Siegmund, Telecommunication Software Engineering - Lecture Notes. Edition: V 0.2,20/ http://www.srupp.de 3. G.J. Holzmann, Design and validation of computer protocols, Chapter 8-11, Prentice- Hall, 1991, ISBN 0-13-539925-4, http://www.spinroot.com/spin/Doc/Book91.html 4. Stallings, William. Data and Computer Communications, 8th ed. Upper Saddle River, NJ: Prentice Hall, 2010.

6.20. Switching and routing	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Matkurbonov Dilshod Matkurbon ugli, Usmanova Nargiza Baxtiyarbekovna
Component:	Elective
Cycle:	Core
Credit point:	6
Pre-requisities	Modeling and Simulation of Networks
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Midterm control, Exam
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 3 questions, the first 2 of which are from 15 points, the third from 20 points, the questions consist of 2 Parts: 2 theoretical questions and 1 practical question. Total exam time 80 minutes
Short content:	The course is intended for undergraduate students who have knowledge and skills in the features of protocols and algorithms that describe the processes of switching and routing in data networks and their principles, IP/MPLS, information transmission, audio and video messages based on IP technology protocols.
Goal:	This course provides a foundation of knowledge and skills in the design, analysis and planning of studies related to networks and data communications systems.
Objective:	-understanding the fundamentals of network technologies; -studying network protocols -developing practical skills in network configuration and management; -analyzing and optimizing network performance; -troubleshooting network issues; -exploring modern trends and technologies in networking
Learning outcome:	After studying the discipline, students should be able to: LO 1. Must have knowledge of the structure of the OSI and TCP/IP network model, protocol concepts and interfaces. LO 2. Must have knowledge of the principles of building modern networks and data transmission systems. LO 3. Must know IP/MPLS technology and the protocols used in it. LO 4. Must know the principles of operation of the data link and network layers, as well as the configuration of the devices used in them. LO 5. Able to configure configurations of devices used at different network levels LO 6. Have skills in the characteristics, standards and implementation of IP/MPLS, IP telephony and IPTV technologies.
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities; - communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods); - case-study method (analysis of situations);

<table>
<tr><td></td><td>- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-6)</td><td>20</td><td rowspan="3">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Written)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Classification of data networks and requirements for them
- General principles for constructing data networks. TCP/IP model.
- Functions, Data link layer standards, frame format structure.
- Data link protocols (Frame Relay, ATM, Ethernet).
- Functional model of the switch, types and principles of operation of the MAC table.
- Network layer functions, IPv4 and IPv6 addressing systems.
- Classification of protocols and routing algorithms and requirements for them. The concept of routing metrics and the principles of their formation.
- Functional model of a router, types and principles of operation of the routing table.
- Criteria and standards for assessing the quality of service in IP networks.
- Methods for ensuring quality services in switching and routing processes.
- IP/MPLS technology and classification of protocols used.
- Characteristics, standards and technologies for transmitting audio messages based on the IP protocol.
- Characteristics, standards and technologies for transmitting video messages based on the IP protocol.
- Requirements for reliability indicators of data transmission networks and ways to improve them.
- Methods and protocols for monitoring data networks.</td></tr>
<tr><td>Literature:</td><td>Literature 1. W. Stallings. Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud. Copyright © 2016 by Pearson Education, Inc.. 2. Behrouz A. Forouzan. Data Communications and Networking with TCP/IP Protocol Suite. Sixth Edition. McGraw Hill LLC. 2022 3. “Computer networks. Principles, technologies, protocols: A textbook for university students, Fifth Edition” N.A. Olifer, V.G. Olifer, St. Petersburg, Peter, 2016.</td></tr>
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<table>
<tr><th colspan="2">6.21. Future Networks</th></tr>
<tr><td>Semestr:</td><td>7</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Usmanova Nargiza Baxtiyarbekovna, Dilshod Matkurbonov Matkurbon ugli</td></tr>
<tr><td>Component:</td><td>Elective</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>Credit point:</td><td>6</td></tr>
<tr><td>Pre-requisities</td><td>Virtual network technologies, Info-communication systems and networks</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Type sof classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Formoffinalcontrol</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Writing</td></tr>
</table>
</td></tr>
<tr><td>Controlforms:</td><td>Midterm control, Exam</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is written in the form of 3 questions, the first 2 of which are from 15 points, the third from 20 points, the questions consist of 2 Parts: 2 theoretical questions and 1 practical question. Total exam time 80 minutes</td></tr>
<tr><td>Shortcontent:</td><td>The discipline "Networks of the Future" is designed to provide bachelors with basic theoretical knowledge, practical skills and abilities in the field of the Internet and next-generation communication infrastructure, issues of practical use and analysis of new technologies, analytical knowledge in emerging approaches and technical solutions with a focus on the Networks of the Future, issues of resource use (aggregation, processing, storage and communication interfaces for various domains in order to ensure any end-to-end service at various levels of abstraction and connections), the use of new business models for new network technologies.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Goal:</td><td>The goal is to develop bachelor's degree students' competencies and knowledge in the field of theoretical and practical aspects of creating the future Internet infrastructure through the structure, components, applied technologies and solutions, the organization of various levels of the future network, principles of technological implementation and operation of modern networks, functional processes and protocols, virtualization technologies and cloud computing.</td></tr>
<tr><td>Objective:</td><td>- Next Generation Internet and Communications Infrastructure;
- Resource utilization (aggregation, processing, storage and communication interfaces for different domains in order to provide any end-to-end service at different levels of abstraction and connections);
- Apply the new business models for new network technologies;
- practical use and analysis of new network technologies.</td></tr>
<tr><td>Learning out come:</td><td>After studying the discipline, students should be able to:
In terms of knowledge:
LO 1. Future Internet infrastructure, structure, technologies and solutions;
LO 2. Organization of networks of the future from the point of view of different levels and planes;
LO 3. Principles of technological implementation and operation of modern networks; functional processes and protocols in the field of software-defined networks, cloud technologies.</td></tr>
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<table>
<tr><td></td><td>In terms of skills:
LO 4. Be able to solve problems of implementation of modern and future networks (quality of service, security, performance);
LO 5. Have skills in implementation of technologies in the Internet of Things (IoT), industrial networks, automotive networks and other areas;
LO 6. Be able to apply scientific and systematic concepts in various applications;
know the basics for development of standards and benchmarks in development of technologies, technological and economic requirements.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-10)</td><td>20</td><td rowspan="3">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Written)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>
- Introduction. Modern information and communication infrastructure. IP network architecture. Principles of organizing networks of the future (Future Internet).
- Factors and requirements for new technologies. Requirements for network technologies of the future (within the framework of Self-Routing, Self-Engineering Traffic, Self-Organizing Network).
- Principles of distributed and pervasive networks. Autonomous and self-organizing systems. Programmable networks and elastic infrastructure.
- Software-defined networks (SDN). SDN principles, architecture, functionality.
- Virtualization in the network. Network Functions Virtualization.
- Practical application of SDN. SDN and NFV principles. Examples (use-cases, scenarios).
- Functionality of a modern network. Cloud computing principles. Principles of computing and storage in a cloud environment.
- Implementation of functional capabilities in modern networks: ensuring QoS and QoE.
- Implementation of functional capabilities in modern networks: ensuring security.
- Principles of promising technologies. General description of IoT (Internet of Things).
- Principles of advanced technologies. Energy saving, "green" technologies (Energy Oriented Internet, Green technologies).
- Principles of advanced technologies. Artificial Intelligence. Communication means based on nanotechnology (Nanocommunications).
- Prospects of mobile technologies. Principles and problems of mobile networks and technologies. Sensor networks.
- Principles of using modern and advanced network technologies in economic sectors (production systems, transport).
</td></tr>
</table>

	- Development of ICT in Uzbekistan based on the principles of future networks: case study (by types, kinds of networks).
Literature:	William Stallings, Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud/Pearson Education, Inc., 2016. Гольдштейн, Б. С., Кучерявый А. Е. Сети связи пост-NGN/СПб.: БХВ, Петербург, 2014. Network Programmability and Automation/Matt Oswalt, Christian Adell, Scott S. Lowe, and Jason Edelman, O'Reilly Media, Inc. 2023 Nazim Agoulmine. Autonomic Network Management Principles: Form Concepts to Applications/2011 Elsevier Inc. Academic Press.

<table>
<tr><th colspan="2">6.22. Explotation and services of telecommunication networks</th></tr>
<tr><td>Semestr:</td><td>8</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Djurayev Rustam Xusanovich, Djabbarov Shuxrat Yuildashevich</td></tr>
<tr><td>Component:</td><td>Elective</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>Credit point:</td><td>6</td></tr>
<tr><td>Pre-requisities</td><td>Modeling and Simulation of Networks</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Type sof classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Formoffinalcontrol</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Writing</td></tr>
</table>
</td></tr>
<tr><td>Controlforms:</td><td>Midterm control, Exam</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is written in the form of 3 questions, the first 2 of which are from 15 points, the third from 20 points, the questions consist of 2 Parts: 2 theoretical questions and 1 practical question. Total exam time 80 minutes</td></tr>
<tr><td>Shortcontent:</td><td>This course provides basic concepts and definitions in production and performance. Methods and tools of technical diagnostics of telecommunication networks and devices, test and diagnostic indicators, technical diagnostic system, maintenance and repair, use of operational devices used in telecommunication networks, setting and analyzing issues related to technical operational research, experimental research of networks It provides the necessary foundation to study the design and development, feasibility evaluation and proposal formulation, and diagnostic features of digital devices and microprocessor packages.</td></tr>
<tr><td>Goal:</td><td>The goal of the subject is to enable students to be able to operate and maintain networks. It is to provide theoretical knowledge and practical skills on the principles of technical operation and maintenance of telecommunication networks, strategies and types of technical maintenance, control and technical diagnostic methods and tools.</td></tr>
<tr><td>Objective:</td><td>- technical operation and service of telecommunication networks;
- construction of technical operation systems;
- control of technical service systems before and after failure;
- ability to use single and multi-channel signature analyzer devices;
- to have knowledge and skills about fault detection algorithms;
- acquires knowledge and skills to assess the reliability of operational methods;
- able to monitor and diagnose a failed element, board, block or device and repair it.</td></tr>
<tr><td>Learning out come:</td><td>After studying the discipline, students should be able to:
LO 1. Gains an understanding of technical operation and service provision in telecommunication networks.
LO 2. Acquires knowledge about the problems of increasing the place, importance and reliability of technical operation and service provision in telecommunication networks;
LO 3. Gains knowledge of maintenance systems control before and after termination of employment;
LO 4. Can explain telecommunications network failure models, control and technical diagnostics methods, tools and types;
LO 5. Can use single and multi-channel signature analyzer devices used in troubleshooting;</td></tr>
</table>

<table>
<tr><td></td><td>LO 6. Acquires knowledge and skills to assess the reliability of technical diagnostics and operational methods;
LO 7. Able to monitor and diagnose a failed element, board, block or device.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-10)</td><td>20</td><td rowspan="3">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Written)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topicsoflectures:</td><td>- Place and importance of technical operation and maintenance in telecommunication networks. Basic terms and concepts
- Basic criteria of reliability of telecommunication networks and problems of increasing reliability
- Technical operation and maintenance of telecommunication networks, main tasks, life cycle
- Principles of construction of technical operation systems of telecommunication networks
- Technical service systems and their features
- Maintenance systems until retirement
- State-of-the-art maintenance systems
- Control and technical diagnostic tasks and their classification
- Controllability and technical diagnostic indicators. Failure models of digital systems
- Methods, tools and types of control and technical diagnostics
- Logic probes, current indicators and logic analyzers. Types and descriptions
- One-channel signature analyzers. Multi-channel signature analyzers.
- Signature calculation methods and fault detection algorithms
- Reliability assessment of technical diagnostic methods
- Network condition monitoring methods. Classification and analysis of monitoring tools</td></tr>
<tr><td>Literature:</td><td>R.H. Djuraev, Sh.Yu. Djabbarov, J.B. Baltayev. «Raqamli tizimlarning texnik diagnostikasi». (Darslik). -T.: «Aloqachi»,2020, - 232 b.
Джураев Р.Х., Джаббаров Ш.Ю. Контроль и диагностика цифровых устройств систем передачи данных. (Монография). -Т.: «Алоқачи».2020, - 168 с.
Джураев Р.Х., Джаббаров Ш.Ю., Балтаев Ж.Б. «Системы технического обслуживания и эксплуатации сетей телекоммуникации». Учебник.-Т.: «Алоқачи».2019, 234 с.
Гуменюк В.М. Основы теории надежности и технической диагностики: учеб. пособие [Электронний ресурс] / Инженерная школа ДВФУ. – Электрон. дан. – Владивосток: Дальневост. федерал. ун-т, 2013. – 183 с.</td></tr>
</table>

<table>
<tr><th colspan="2">6.23. Multimedia transmission in IP networks</th></tr>
<tr><td>Semestr:</td><td>8</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Djurayev Rustam Xusanovich, Djabbarov Shuxrat Yuildashevich</td></tr>
<tr><td>Component:</td><td>Elective</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>Credit point:</td><td>6</td></tr>
<tr><td>Pre-requisities</td><td>Multimedia communication networks</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Type sof classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Formoffinalcontrol</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Writing</td></tr>
</table>
</td></tr>
<tr><td>Controlforms:</td><td>Midterm control, Exam</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is written in the form of 3 questions, the first 2 of which are from 15 points, the third from 20 points, the questions consist of 2 Parts: 2 theoretical questions and 1 practical question. Total exam time 80 minutes</td></tr>
<tr><td>Shortcontent:</td><td>This course provides basic concepts and definitions in production and performance. Requirements for multiservice networks in multimedia transmission in IP networks, Triple play services, QoS and routing, tools and methods of providing multimedia services in wired and wireless broadband networks, management of multimedia services, provision of multimedia services in real time and IP network provides the necessary basis for studying the characteristics of international recommendations for testing.</td></tr>
<tr><td>Goal:</td><td>The purpose of the course is to teach students the necessary knowledge of multimedia transmission in the IP network.</td></tr>
<tr><td>Objective:</td><td>- IP network concept;
- Basic principles of multimedia transmission in IP networks;
- Coding and transmission of audio-video information;
- Implementation of IP - telephony and IPTV services.</td></tr>
<tr><td>Learning out come:</td><td>After studying the discipline, students should be able to:
LO 1. Acquires knowledge about the use of devices used in the network, setting and analyzing issues related to network research, experimental research and design of the network, evaluation of technical capabilities and formulation of proposals, the basics of multimedia descriptions;
LO 2. Can use multimedia services and their requirements, technologies and networks, methods and tools for providing multimedia services;
LO 3. Gain knowledge about network reliability indicators and ways to increase them, systems and tools for providing multimedia services, quality and safety indicators for providing multimedia services;
LO 4. Can control the principles of information coding in multimedia services, transmission of multimedia information in packet switching networks, provision of QoS in transmission of multimedia information, organization of multimedia services in wired and wireless broadband networks;
LO 5. knows how to transfer multimedia information in wired switching networks, organize multimedia services in wired and wireless broadband networks;</td></tr>
</table>

<table>
<tr><td></td><td>LO 6. Can implement IP - telephony and IPTV, audio-video information transmission and IPTV services;
LO 7. Can explain Softswitch, IMS, Triple play services and QoS evaluation methods.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-7)</td><td>20</td><td rowspan="3">40</td><td rowspan="5">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Written)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Concept, purpose and basic requirements of multimedia. Classification and classification of multimedia traffic
- Coding of text and audio information
- Coding of graphics and video information
- Packet switching methods. Switching principles in X.25, Frame Relay, ATM, IP and MPLS technologies
- Organization of voice information transmission. The concept of IP telephony. IP telephony standards
- Organization of video transmission. Organization of IPTV services. IPTV standards and quality assurance
- Multicast methods of transmission through IPTV. Principles of content compression in IPTV networks
- Wired broadband access technologies
- Wireless broadband access technologies
- Multimedia services through broadband access networks
- Triple Play services
- Quality of service for multimedia traffic in packet switching networks
- Protocols for providing quality services. Real-time protocols: RTP, RSVP, RTCP, RTSP
- Analysis of ways to ensure the quality of service in multiservice networks
- Testing and monitoring of IP networks
- Basic concepts and principles of multiservice network construction
- Softswitch-based multiservice network architecture
- IMS system (IP Multimedia Sybsystem)
- Network security tasks. Basic concepts and definitions</td></tr>
<tr><td>Literature:</td><td>Б.С. Гольдштейн, Н.А. Соколов, Г.Г. Яновский. Сети связи: учебник для вузов. Спб.: Бхв - Петербург, 2010, 400 С.
Катунин А.П. Аудиовизуальные средства мультимедиа. Новосибирск. 2009. - 272 с.
Khanvilkar S. ET AL. Multimedia networks and communication // ELECTRICAL ENGINEERING HANDBOOK / edited by w.k. chen. – [s. l.]: Academic Press, 2004. – p. 401–425.
Ершов В.А., Кузнецов Н.А. Мультисервисные телекоммуникационные сети. - М.: Изд.во МГТУ им. Н.Е. Баумана. 2003
Гургенидзе А.Т. Кореш В.И. Мультисервисные сети и услуги широкополосного доступа. -СПб.: Наука и техника, 2001
R.I. Isayev, D.X. Ibatova. Multimediyali aloqa tarmoqlari. (Darslik). – T. «Aloqachi», 2019 y. -304 b.</td></tr>
</table>

6.24. IoT in telecommunication networks	
Semestr:	8
Date of last modification:	31.08.2023
Teachers:	Muradova Alevtina Aleksandrovna
Component:	Elective
Cycle:	Core
Credit point:	4
Pre-requisities	Network Smart Devices Software, Future Networks
Workload:	**Types of classes** / **Hours** Total / 120 Lecture / 30 Practical works / 18 SAW (Student autonomous work) / 72 Form of final control / Exam Final assessment method / Writing
Control forms:	Midterm control, Exam
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 3 questions, the first 2 of which are from 15 points, the third from 20 points, the questions consist of 2 Parts: 2 theoretical questions and 1 practical question. Total exam time 80 minutes
Short content:	The aim of the discipline “IoT in Telecommunication Networks” is to develop leading scientific concepts, skills and abilities, principles of construction and technologies of telecommunication networks based on IoT, general concepts and architecture of wireless networks consisting of Internet of Things objects, protocols used in wireless sensor networks and principles of their operation, creation of infrastructure and data storage, platforms and tools of wireless networks, development of understanding of general concepts, architecture, applications of the Internet of Things, security issues and research problems in the Internet of Things.
Goal:	The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in IoT in Telecommunication Networks.
Objective:	-understanding the fundamentals of network technologies; - learn and be able to demonstrate the basic concepts and terms of the Internet of Things in telecommunication networks, trends in the development of the Internet of Things; -gain knowledge about the architecture of a wireless sensor network, basic devices and tools; - studying network protocols -developing practical skills in network configuration and management; - analyzing and optimizing the algorithms.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Know the principles of telecommunication networks design, their equipment, basic parameters; LO 2. Understand the principles of building Mobile Ad Hoc Networks (MANETs). LO 3. Study the protocol stack of wireless sensor networks, physical, data link and network layers and protocols, national and international standards, regulatory documents. Explain and apply the protocol stack, transport layers, application layers and protocols for wireless sensor networks. LO 4. Correctly use topology management, clustering and time synchronization devices. LO 5. Select a network protocol by studying the hardware and software of sensor nodes, wireless technologies used in Internet devices, GSM, CDMA, LTE standards, network structure and topology. LO 6. Become familiar with the structure and topology of the GPRS network, standards of Internet of Things objects, study and explain the need for connection processes. Study

	the structure, operating principles, types of NFC, RFID, ZigBee protocols and be able to organize the workflow. LO 7. Research and explain the structure, operating principles and operation of MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe protocols. LO 8. Learn the principles of using Internet of Things objects in various fields, explain the principle of operation. LO 9. Create "Smart Homes" built on the basis of IoT in telecommunication networks, explain the principle of operation of the sensor connection scheme, acquire skills and qualifications for working with the scheme.
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities; - communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods); - case-study method (analysis of situations); - game technologies, in which students participate in business, role-playing, simulation games; - information and communication (including distance learning) technologies. In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.
Assessment of the student's knowledge:	

Type of task		**Number of points (max)**		**Total**
Current control	Practical works (1-7)	20	40	100
	Independent work	10		
	Oral presentation	10		
Mid-term control	Written work	10		
Final control	Exam (Written)	50		

Topics of lectures:	- Introduction to the IoT discipline in telecommunication networks. Basic concepts and definitions of the Internet of Things, trends in the development of the Internet of Things. - Wireless sensor networks. Basic concepts. Architecture of wireless sensor networks. - Mobile Ad-hoc networks (MANET). - Protocol stack for wireless sensor networks. Physical, channel and network layers and protocols. - Protocol stack for wireless sensor networks. Transport layer and application layer, protocols. - Topology management, clustering and time synchronization. - Data storage, manipulation. Routing based on data and content. - Hardware and software of sensor nodes. - Wireless technologies used in the Internet of Things. GSM, CDMA, LTE standards. Structure, network topology. - Wireless technologies used in the Internet of Things. GPRS, small cell standards. Structure, network topology. - Internet of Things Standards. - Building NFC, RFID, ZigBee protocols, operating principles. - Building MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe protocols, operating principles. - Internet of Things and Computer Systems. - Cyberspatial systems in the Internet of Things, security in the Internet of Things (vulnerabilities, attacks and countermeasures), security engineering in the development of the Internet of Things. - Applications of wireless sensor networks: healthcare, housing, industry, agriculture, military structures.

	- Principles of using the Internet of Things in various fields. - “Smart homes” built on the basis of IoT in telecommunication networks.
Literature:	Literature: 1. Gastón C. Hillar. Internet of Things with Python. Book. Packt Publishing, 2016. 388 p. 2. Khan R., Ghoshdastidar K., Vasudevan A. Learning IoT with Particle Photon and Electron. Book. Packt Publishing Limited, 2016. 138 p. 3. Davronbekov D.A., Aliyev U.T., Khakimov Z.T. Wireless networks. Textbook. T: Mahalla va oila nashere, 2021. 460 p. 4. Likhtsinder B.Ya. Wireless sensor networks. Tutorial. M: Goryachaya Liniya-Telecom, 2021. 236 p. 5. Zayniddinov H.N. Internet of Things (IoT). Tutorial. T: Alokachi. 2019. 220 p. 6. Greengard S. Internet of Things. The future is already here. Textbook. Translated from English. M: IG Tochka, 2017. 224 p.

6.25. Theory of teletraffic in communication networks	
Semestr:	8
Date of last modification:	31.08.2023
Teachers:	Muradova Alevtina Aleksandrovna
Component:	Elective
Cycle:	Core
Credit point:	4
Pre-requisities	Data communications
Workload:	**Types of classes** / **Hours** Total / 120 Lecture / 30 Practical works / 18 SAW (Student autonomous work) / 72 Form of final control / Exam Final assessment method / Writing
Control forms:	Midterm control, Exam
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 3 questions, the first 2 of which are from 15 points, the third from 20 points, the questions consist of 2 Parts: 2 theoretical questions and 1 practical question. Total exam time 80 minutes
Short content:	The aim of the discipline "Theory of teletraffic in communication networks" is to provide students with knowledge of the theory of teletraffic in communication networks, call flows, flow parameters, mathematical models of the simplest call flows, non-stationary Poisson flow, primitive flow, mathematical models of Erlang flows, types of load, issues of inter-station traffic distribution and calculation of throughput, quality of service, duration of call service in telecommunication networks, time of receipt of requests in the queuing system, models of packet information flows in multimedia networks, as well as the formation of skills for their application in practice.
Goal:	The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in Theory of teletraffic in communication networks.
Objective:	-understanding the fundamentals of network technologies; - learn and be able to demonstrate the basic concepts and terms of the teletraffic theory, call flow, flow parameters, definition domains in communication networks; - calculations of the simplest call flow, mathematical models of the simplest call flows; - analysis of mathematical models of the flow of demands, non-stationary Poisson flow, primitive flow, flow of demands with limited aftereffect, Erlang flow.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Know the principles of telecommunication networks design, their equipment, basic parameters; LO 2. Understand the principles of calculating service quality parameters, call service duration, queue length, number of requests in the general service system, time of receipt of requests in the general service system, probability of call loss in telecommunication networks; LO 3. Analyze Markov processes; determination domains, its general properties, ergodic properties, basic descriptions of the Markov process; LO 4. Calculate the first Erlang model, equilibrium system equations; LO 5. Analyze and optimize switching systems, apply the obtained experimental results to calculate the quality indicators of the system and calculate the volume of network equipment;

<table>
<tr><td></td><td>LO 6. Calculate models of packet information flows in multimedia networks.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="3">Current control</td><td>Practical works (1-10)</td><td>20</td><td rowspan="3">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Oral presentation</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Written)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction. Objectives and tasks of the course "Theory of Teletraffic in Communication Networks". Used mathematical models and devices.
- Theory of Teletraffic in Communication Networks. The concept of call flows. Characteristics and properties of call flows. Types of call flows.
- The simplest call flow. Mathematical model of the simplest call flow.
- Non-stationary and non-ordinary Poisson flow, primitive flow, flow with limited aftereffect, Erlang flow, flow with repeated calls.
- The concept of telephone load. Types of telephone load. Load distribution by communication directions.
- Quality of call service. Indicators of call service quality.
- The concept of random processes. Markov processes of birth and death. The property of ergodicity. Features of the Markov process.
- Mathematical model of the first Erlang formula.
- The Engset model. Comparative characteristics of the Erlang and Engset models.
- Systems with waiting. The second Erlang model.
- Analysis and optimization of switching circuits.
- Jacobeus combinatorial method for calculating the blocking probability of two-link circuits.
- Comparison of quality of service characteristics in circuit-switched and packet-switched networks.
- Repeat call system.
- Packet information flow models in multimedia networks.</td></tr>
<tr><td>Literature:</td><td>Literature: 1. Akimaru H., Kawashima K. Teletraffic: Theory and Applications. Springer Science & Business Media. 2012. 225 p. 2. Evans J., Filsfils C. Deploying IP and MPLS QoS for Multiservice Networks: Theory and Practice. USA, 2007, 456 p. 3. ITU–D, Study Group 2, Question 16/2. Teletraffic engineering. Handbook. Geneva, January 2005. 4. Iversen V. B. Teletraffic Engineering handbook. Technical University of Denmark. 2001. 310 p. 5. Pshenichnikov A.P. Teletraffic theory. Textbook. M: Hotline-Telecom. 2017. 212 p. 6. Namestnikov S.M., Sluzhivyy M.N., Ukraintsev Yu.D. Basics of teletraffic theory. Tutorial. Ulyanovsk: Ulyanovsk State Technical University. 2016. 154 p. 7. Abdurakhmanova M.F., Khodzhaev N.S., Nasrullaeva B.N. Axborotni taqsimlash nazariyasi. Uquv qullanma. T: Aloqachi. 2009. 75 b. 8. Kozhanov Yu.F. Basics of automatic switching. Tutorial. St. Petersburg: Siemens. 1999. 147 p.</td></tr>
</table>

<table>
<tr><td colspan="2">6.26. Individual project</td></tr>
<tr><td>Semestr:</td><td>5</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Abdujapparova Mubarak Baltabayevna</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>Credit point:</td><td>4</td></tr>
<tr><td>Pre-requisites</td><td>–</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>120</td></tr>
<tr><td>Lecture</td><td>-</td></tr>
<tr><td>Practical works</td><td>48</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>72</td></tr>
<tr><td>Form of final control</td><td>Report</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Report</td></tr>
<tr><td>Final control:</td><td>The student defends the completed project by presenting it to the commission, and each member of the commission evaluates the work.</td></tr>
<tr><td>Short content:</td><td>This course is an independent scientific research work of the student, which is carried out independently on the basis of in-depth mastering of the scientific and theoretical foundations of specialized subjects, study, analysis and generalization of international and national economic problems.</td></tr>
<tr><td>Goal:</td><td>The goal of the individual project course is to deeply master the scientific and theoretical foundations of specialized subjects by students.</td></tr>
<tr><td>Objective:</td><td>Concept of individual project, project activity, project culture; Goals, design tasks, problems in the modern world.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Understand the problematic topic in the field of computer engineering.
LO 2. To develop students' ability to set a specific problem and solve it.
LO 3. Development of proposals and recommendations aimed at the implementation of a problematic topic.
LO 4. Increase the potential of students to effectively use scientific literature, practical analytical-statistical data and other materials in scientific-practical activities.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "INSERT", "Fishbone" method, "I know, I found out, I want to know" hands-on activities, gamification and others are actively used during practical classes.</td></tr>
</table>

<table>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th>Type of task</th><th>Number of points (max)</th><th>Total</th></tr>
<tr><td>Completeness of theoretical material</td><td>0-20</td><td rowspan="3">0-100</td></tr>
<tr><td>Implementation of the practical part of the project</td><td>0-30</td></tr>
<tr><td>To answer the given questions clearly and succinctly</td><td>0-50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to Computer Engineering
- Concept of "Individual project, project activity, project culture". Goals, design tasks, problems in the modern world. 2
- Methodology and technology of project activity. Design thinking methods.
- Designing the topic and problems of the project. Design concept. Relevance - evidence, validity.
- Methods of determining the goal and dividing it into tasks, originality, compliance with the topic. Review of key materials on the topic.
- Logic of actions and sequence of steps in personal project planning. Calculate the calendar schedule of your activity.
- Information search and systematization. Information culture. Types of information sources. Information processing tools - methods, techniques, technologies.
- Use of information technologies in research and project activities. Working on the Internet. Organization of work with scientific literature. Introduction to catalogs.
- Communication barriers in public defense of project results. Use of information technology in research and project. Methods and forms of data submission.
- Presentation of the results of the educational project. Analysis of information, implementation of the project, formation of conclusions. Prepare possible forms for presenting results. A basis for the design process. Explanation of the obtained results.
- Recommendations and analysis of reported errors. Correction of defects. Search, compare, identify strengths and weaknesses of similar projects.
- Initial public presentation: topic, working hypothesis, relevance, research plan, expected results, project plan.</td></tr>
<tr><td>Literature:</td><td>1. Andrew S. Tanenbaum. Computer Networks, Fourth Edition. Publisher; Prentice Hall, 2011. 2. James F. Kurose, Keith W. Ross "A Top-Down Approach: Computer Networking", 2017. Pearson Education Limited 3. Musaev M.M. "Computer systems and networks". Tashkent.: "Alokachi" publishing house, 2013. Chapter 8. 394 pages. - Guide for higher educational institutions. 4. Miryusupov Z. Z., Djumanov J. Kh. Computer networks: study guide, Muhammad Al-Khorazmi name. TATTOO. - T.: Alokachi, 2020. - 144 p.</td></tr>
</table>

6.27. Qualification Practice 1 (Practical Training)	
Semestr:	6
Date of last modification:	31.08.2023
Teachers:	Abdujapparova Mubarak Baltabayevna
Component:	Compulsory
Cycle:	Core
Credit point:	6
Pre-requisites	Individual project
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / - Practical works / - SAW (Student autonomous work) / 180 Form of final control / Practice Report
Control forms:	Practice Report
Final control:	The report is the practice work of the student in the form of a report on the subject of the graduation qualification work.
Short content:	Development and formation of general professional competences, as well as acquisition by students of the necessary skills and experience of practical work in their specialty in modern conditions, and preparation for graduation qualification work.
Goal:	The goal of production practice is comprehensive development of all types of professional activity of students in their fields.
Objective:	The direct management of practice in enterprises is carried out by the engineering and technical staff of these enterprises. The head of the enterprise assigns the responsibility for the organization of the operation to the chief specialist or his deputy.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understand the problematic topic in the field of computer engineering. LO 2. Search for information, critically analyze and synthesize, apply a systematic approach to solving given problems. LO 3. Development of proposals and recommendations aimed at the implementation of a problematic topic. LO 4. To be able to carry out social communication and fulfill one's role in the team, control technological process parameters, product quality and production control in the field of computer engineering.
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities; - communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods); - case-study method (analysis of situations); - game technologies, in which students participate in business, role-playing, simulation games; - information and communication (including distance learning) technologies. In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "INSERT", "Fishbone" method, "I know, I found out, I want to know" hands-on activities, gamification and others are actively used during practical classes.

<table>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th>Type of task</th><th>Number of points (max)</th><th>Total</th></tr>
<tr><td>Complete and accurate completion of the task</td><td>0-50</td><td rowspan="3">0-100</td></tr>
<tr><td>Being able to demonstrate the ability to think independently within the framework of pre-graduate work practice</td><td>0-20</td></tr>
<tr><td>To answer the given questions clearly and succinctly</td><td>0-30</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>
- The direct management of practice in enterprises is carried out by the engineering and technical staff of these enterprises. The head of the enterprise assigns the responsibility for the organization of the operation to the chief specialist or his deputy.
- Study of normative and technical literature on the topic of practice.
- Get technical safety instructions.
- Get the topics of the graduation thesis. Identifying problematic situations for graduate work. Forming a group.
- Determining the main goals and tasks of the graduate work.
- Standards for the development of a technical assignment for a graduate qualification work. Development of requirements for graduate work
- Projecting. Search and systematization of information on the topic of graduate work.
- Projecting. Creating a model on the subject of a graduate thesis.
- Analysis of information, implementation of graduation qualification work, formation of conclusions. Prepare possible forms for presenting results. Explanation of the obtained results.
- Recommendations and analysis of reported errors. Correction of defects. Search, compare, and identify strengths and weaknesses of similar graduate qualifications. Preparation of reports.
- Initial public presentation: topic, working hypothesis, relevance, research plan, expected results, thesis plan.
- Final presentation. Presentation of work carried out within the framework of pre-graduation qualification work
</td></tr>
<tr><td>Literature:</td><td>1. Project Solving Basic Technique Third edition, Fujitsu Learning Media Ltd. – 2011, 2013. –62 p. 2. Andrew S. Tanenbaum. Computer Networks, Fourth Edition. Publisher; Prentice Hall, 2011. 3. James F. Kurose, Keith W. Ross "A Top-Down Approach: Computer Networking", 2017. Pearson Education Limited 4. Musaev M.M. "Computer systems and networks". Tashkent.: "Alokachi" publishing house, 2013. Chapter 8. 394 pages. - Guide for higher educational institutions. 5. Miryusupov Z. Z., Djumanov J. Kh. Computer networks: a study guide, named after Muhammad Al-Khorazmi. TATTOO. - T.: Alokachi, 2020. - 144 p.</td></tr>
</table>

6.28. Qualification Practice 2 (Pre-Graduation Work Practice)	
Semestr:	8
Date of last modification:	31.08.2023
Teachers:	Abdujapparova Mubarak Baltabayevna
Component:	Compulsory
Cycle:	Core
Credit point:	6
Pre-requisites	Qualification Practice 1 (Practical Training)
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / - Practical works / - SAW (Student autonomous work) / 180 Final assessment method / Practice Report
Control forms:	Practice Report
Final control	The report is the individual work of the student in the form of a report on the subject of the graduation qualification work.
Short content:	In modern conditions, mastering the necessary skills and experience of practical work in one's specialty and preparing for graduation work.
Goal:	The goal of pre-graduation practice is comprehensive development of all types of professional activities of students in their fields.
Objective:	The direct management of practice in enterprises is carried out by the engineering and technical staff of these enterprises. The head of the enterprise assigns the responsibility for the organization of the operation to the chief specialist or his deputy.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understand the problematic topic in the field of computer engineering. LO 2. Search for information, critically analyze and synthesize, apply a systematic approach to solving given problems. LO 3. Development of proposals and recommendations aimed at the implementation of a problematic topic. LO 4. To be able to carry out social communication and fulfill one's role in the team, control technological process parameters, product quality and production control in the field of computer engineering.
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities; - communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods); - case-study method (analysis of situations); - game technologies, in which students participate in business, role-playing, simulation games; - information and communication (including distance learning) technologies. In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "INSERT", "Fishbone" method, "I know, I found out, I want to know" hands-on activities, gamification and others are actively used during practical classes.

<table>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th>Type of task</th><th>Number of points (max)</th><th>Total</th></tr>
<tr><td>Complete and accurate completion of the task</td><td>0-50</td><td rowspan="3">0-100</td></tr>
<tr><td>Being able to demonstrate the ability to think independently within the framework of pre-graduate work practice</td><td>0-20</td></tr>
<tr><td>To answer the given questions clearly and succinctly</td><td>0-30</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>
- The direct management of practice in enterprises is carried out by the engineering and technical staff of these enterprises. The head of the enterprise assigns the responsibility for the organization of the operation to the chief specialist or his deputy.
- Study of normative and technical literature on the topic of practice.
- Get technical safety instructions.
- Get the topics of the graduation thesis. Identifying problematic situations for graduate work. Forming a group.
- Determining the main goals and tasks of the graduate work.
- Standards for the development of a technical assignment for a graduate qualification work. Development of requirements for graduate work
- Projecting. Search and systematization of information on the topic of graduate work.
- Projecting. Creating a model on the subject of a graduate thesis.
- Analysis of information, implementation of graduation qualification work, formation of conclusions. Prepare possible forms for presenting results. Explanation of the obtained results.
- Recommendations and analysis of reported errors. Correction of defects. Search, compare, and identify strengths and weaknesses of similar graduate qualifications. Preparation of reports.
- Initial public presentation: topic, working hypothesis, relevance, research plan, expected results, thesis plan.
- Final presentation. Presentation of work carried out within the framework of pre-graduation qualification work
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<tr><td>Literature:</td><td>1. Project Solving Basic Technique Third edition, Fujitsu Learning Media Ltd. – 2011, 2013. –62 p. 2. Andrew S. Tanenbaum. Computer Networks, Fourth Edition. Publisher; Prentice Hall, 2011. 3. James F. Kurose, Keith W. Ross "A Top-Down Approach: Computer Networking", 2017. Pearson Education Limited 4. Musaev M.M. "Computer systems and networks". Tashkent.: "Alokachi" publishing house, 2013. Chapter 8. 394 pages. - Guide for higher educational institutions. 5. Miryusupov Z. Z., Djumanov J. Kh. Computer networks: a study guide, named after Muhammad Al-Khorazmi. TATTOO. - T.: Alokachi, 2020. - 144 p.</td></tr>
</table>

<table>
<tr><th colspan="2">6.29. Graduation qualification work</th></tr>
<tr><td>Semestr:</td><td>8</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Abdujapparova Mubarak Baltabayevna</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>Credit point:</td><td>14</td></tr>
<tr><td>Pre-requisites</td><td>–</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>420</td></tr>
<tr><td>Lecture</td><td>-</td></tr>
<tr><td>Practical works</td><td>-</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>420</td></tr>
<tr><td>Form of final control</td><td>State Attestation</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>State Attestation</td></tr>
<tr><td>Final control:</td><td>The defense is conducted through a presentation of the completed work. The presenter is given 10 minutes, followed by time for questions from the commission members.</td></tr>
<tr><td>Short content:</td><td>This work aims to show the student's competence in analyzing, researching, and addressing complex issues within their field of study, reflecting their readiness for professional practice. Additionally, it serves to assess the student's proficiency in conducting independent research, critical thinking, and effective communication of their findings.</td></tr>
<tr><td>Goal:</td><td>The goal of the graduation qualification work is to demonstrate the student's ability to independently apply the knowledge and skills acquired during their studies to solve specific professional tasks.</td></tr>
<tr><td>Objective:</td><td>Applying Theoretical Knowledge: To apply the theoretical concepts and methodologies learned during the course of study to real-world problems within the student’s field. Conducting Independent Research: To develop and implement a research plan, including data collection, analysis, and interpretation, demonstrating the student's ability to conduct independent research.</td></tr>
<tr><td>Learning outcome:</td><td>LO 1. Applying Theoretical Knowledge: To apply the theoretical concepts and methodologies learned during the course of study to real-world problems within the student's field.
LO 2. To develop and implement a research plan, including data collection, analysis, and interpretation, demonstrating the student's ability to conduct independent research.
LO 3. To identify and analyze a specific problem or question relevant to the field, proposing viable solutions or approaches.
LO 4. To enhance the student's ability to critically evaluate existing literature, theories, and practices related to the chosen topic.
LO 5. To encourage the exploration of new ideas, techniques, or approaches within the field, contributing to the advancement of knowledge or practice.
LO 6. To effectively communicate research findings and arguments in a clear, concise, and well-structured manner, both in written and oral forms.</td></tr>
<tr><td>Teaching methods:</td><td>–</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th>Type of task</th><th>Number of points (max)</th><th>Total</th></tr>
<tr><td>Completeness of theoretical material</td><td>0-20</td><td rowspan="3">0-100</td></tr>
<tr><td>Implementation of the practical part of the project</td><td>0-30</td></tr>
<tr><td>To answer the given questions clearly and succinctly</td><td>0-50</td></tr>
</table>
</td></tr>
</table>

Topics of lectures:	- Choosing a topic: Selecting and agreeing on a thesis topic that should be relevant, significant, and aligned with the field of study. - Creating a plan: Developing a detailed plan of the work, including the main sections and the order in which they will be completed. The plan is approved by the academic advisor. - Literature review and analysis: Searching for and studying scientific sources, literature, and data related to the research topic. This stage involves analyzing previous studies and forming the theoretical foundation of the work. - Conducting research: Developing and implementing the research methodology, collecting necessary data, conducting experiments, surveys, interviews, and other research procedures. - Data analysis and processing: Processing the collected data using appropriate methods, analyzing them, and interpreting the results. - Writing the thesis: Composing the theoretical and practical sections of the work, including the introduction, main sections, conclusion, and bibliography. The work must adhere to the formatting requirements set by the university. - Editing and revisions: Reviewing the text to ensure it meets the requirements, correcting errors, and refining details. Editing the work based on feedback from the academic advisor. - Preparation for defense: Preparing a presentation, thesis summary, and speech for the defense of the thesis before the committee. - Thesis defense: Presenting and defending the thesis before the examination committee and answering questions from the committee members. - Final submission: Making any necessary corrections based on the defense results, finalizing the thesis, and submitting it to the university archive.
Literature:	1. Karimov, I. (2020). Methods of scientific research. Tashkent: National Encyclopedia of Uzbekistan. 2. Rahimov, B. (2019). Methodology of conducting scientific research works. Tashkent: Science and Technology. 3. Mirzaev, M. (2018). A guide to writing and defending graduate theses. Tashkent: Ministry of Higher and Secondary Special Education. 4. Bell, J., & Waters, S. (2018). Doing Your Research Project: A Guide for First-time Researchers. McGraw-Hill Education. 5. Robson, C., & McCartan, K. (2016). Real World Research. Wiley. 6. Resnik, D. B. (2020). The Ethics of Research with Human Subjects. Springer. 7. Jones, L. (2011). Academic Integrity: A Guide for Students. University of Queensland Press.