MINISTRY OF HIGHER EDUCATION, SCIENCE AND INNOVATION

TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES NAMED AFTER MUHAMMAD AL–KHWARIZMI

MODULE HANDBOOK

Educational Program

BA 60610500 – Computer Engineering (Computer Engineering)

Tashkent 2024

Table A – Curriculum of BA 60610500 – Computer Engineering (Computer Engineering)

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	DBM201 Database 2/1 lectures 1 practical sessions 6 ECTS	NWK201 Computer networks 2/1 lectures 1 practical sessions 6 ECTS	SIP301 Signal and image processing 2/1 lectures 1 practical sessions 6 ECTS	MUS301 Multi-agent systems 1 lectures 0/1 practical sessions 4 ECTS	GIT401 Geoinformation technologies 2/1 lectures 1 practical sessions 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	PCA301 Parallel computer architecture and programming 2 lectures 1 practical sessions 8 ECTS	EBS301 Embedded systems 2/1 lectures 1 practical sessions 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	WAC201 Create web applications 2/1 lectures 1 practical sessions 6 ECTS	OPS301 Operating systems 2/1 lectures 1 practical sessions 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 2/1 lectures 1 practical sessions 6 ECTS	MTH204 Probability and statistics 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	CAO201 Computer organization 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 60610500 – Computer Engineering (Computer Engineering)

№	Code	1th subject	2nd subject
1.	ITS201/ITS202	Application Software Package	Computer architecture
2.	GEN301/GEN302	Pedagogy. Psychology	Ecology
3.	GEN303/GEN304	Power supply of information communication systems	Life safety
4.	ITS303/ITS304	Computer Modeling	3D Technology
5.	ITS305/ITS306	Data communication	Virtual Reality
6.	ITS407/ITS408	Analyzing geodata based on Python	Multi-core processor architecture
7.	ITS409/ITS410	Multimedia Database	Bioinformatics and Biomechanics
8.	ITS411/ITS412	Cloud Computing	Distributed systems
9.	ITS413/ITS414	Data Mining	HPC System
10.	ITS415/ITS416	Big data management	Computer Vision
11.	ITS417/ITS418	Big data processing technologies and methods	Programming Computer Vision with Raspberry Pi

Syllabuses

1. Humanities

<table>
<tr><td colspan="2">1.1. The newest 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>Babadjanov Khasan</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>Seminars</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>Seminars</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>Tashkenbaeva Diyora Abdurashidovna</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>Seminars</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.</td></tr>
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<tr><td></td><td>LO 8. The student will master the skills of perceiving and analyzing texts with philosophical and religious content, techniques for conducting discussion and polemics, 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.
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<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>Seminars</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>- 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. 5.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>Seminars</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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</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>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>Seminars</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>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>
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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>Djalilova Nilufar Dilshodovna, Radjabova Dilnoza Anvarovna</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</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">Current 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><td colspan="2">2.2. Foreign language II (English language)</td></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>Avezova Dildora Davlatovna, Saydaliyeva Gavharxon Avazovna</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</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">Current 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><td colspan="2">2.3. Academic writing</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>Abdullaeva Simela Khristoforovna, Gayubova Komila Anvarovna</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</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, 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 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">Current 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, Kalandarov Utkir Namozovich</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</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);</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 (1-3)</td><td>25</td><td rowspan="2">37</td><td rowspan="3">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:	Ochilova Ozoda Odilovna, Ganiev Abror Sattarovich
Component:	Compulsory
Cycle:	Core
ECTS:	6
Pre-requisities	-
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>Ochilova Ozoda Odilovna, Ganiev Abror Sattarovich</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>

<table>
<tr><th colspan="2">3.4. Differential Equations</th></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>Mamatov Abdugani Ermamatovich</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>Calculus</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>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.</td></tr>
<tr><td>Goal:</td><td>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.</td></tr>
<tr><td>Objective:</td><td>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.</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 “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.</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 works (1-3)</td><td>25</td><td rowspan="2">37</td><td rowspan="4">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>4</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Kalandarov 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">Midterm 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.
- The main tasks of mathematical statistics. The subject of mathematical statistics. Primary sampling analysis. The variation series. Graphs of the variation series. The</td></tr>
</table>

	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:	3
Date of last modification:	31.08.2023
Teachers:	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. Ecology</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 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 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.</td></tr>
<tr><td>Goal:</td><td>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.</td></tr>
<tr><td>Objective:</td><td>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.</td></tr>
<tr><td>Learning outcome:</td><td>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.</td></tr>
</table>

<table>
<tr><td></td><td>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.</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>12</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>- 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.</td></tr>
<tr><td>Literature:</td><td>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</td></tr>
</table>

<table>
<tr><td colspan="2">4.2. Life safety</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>Saidova Gulchexra Erkinovna</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>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 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>

4.3. Pedagogy. Psychology	
Semestr:	5
Date of last modification:	31.08.2023
Teachers:	Yusupova Zamira Zaripovna, Zakirova Madina Rinatovna
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:	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.
Goal:	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.
Objective:	- 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.
Learning outcome:	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.

<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. Power supply for infocommunication systems	
Semestr:	6
Date of last modification:	31.08.2023
Teachers:	Amurova Natalya Yurievna
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:	Midterm control, Exam
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 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.
Goal:	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.
Objective:	- 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.
Learning outcome:	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..

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.

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>Abdullayeva Zamira Shamshaddinovna, 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>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 (1-15)</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>Abdullayeva Zamira Shamshaddinovna, 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 (1-15)</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>

5.3. Database	
Semestr:	3
Date of last modification:	31.08.2023
Teachers:	Kuvnakov Avaz Ergashevich, Gaipnazarov Rustam Takhiritdinovich
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:	Database course will encourage you to understand topics related to the engineering and design of database systems, including: data models; database and schema design; schema normalization and integrity constraints; query processing; query optimization and cost estimation; transactions; recovery; distributed, parallel, NoSQL and heterogeneous databases; triggers, functions and procedures; integrate high-level programming languages and databases and creating interfaces; obtain knowledge and skills in database troubleshooting, transaction management, database administration and security.
Goal:	The goal of the Database course is to provide a thorough understanding of database systems' design and engineering.
Objective:	The objective of the Database course is to develop the ability to design, implement, and manage efficient and secure database systems. Participants will gain practical skills in data modeling, schema design, SQL querying, and database optimization. The course aims to provide hands-on experience with transaction management, recovery techniques, and the use of distributed and parallel databases. Additionally, learners will integrate high-level programming languages with databases, create user interfaces, and troubleshoot database issues effectively.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understand databases and have knowledge about creating and managing databases. LO 2. Identifying the purpose of the database, know concept of database and creation processes. LO 3. Development of relational databases and development of logical and physical data models for database management systems. LO 4. Demonstrate an understanding of the database model and the relational model. LO 5. Develop conceptual and logical data models and develop a database based on these models. LO 6. Apply knowledge of database normalization and evaluation. LO 7. Write all types of queries using SQL and use high level languages to create queries in database. LO 8. Creating functions, triggers and indexes in SQL. LO 9. Develop skills in database troubleshooting, transaction management, database administration and security.

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 (1-15)	30	40	100
	Independent work	10		
Mid-term control	Written work	10		
Final control	Exam (Testing)	50		

Topics of lectures:	- Introduction to Databases, purpose and basic concepts. Installing and configuring database systems (MySQL Server, Oracle Server, Microsoft SQL Server). - Architecture of databases and three-tier architecture. - Database models and entity-relationship model. Database design, creating entity-relationship diagrams. Designing relational databases. - Relational model and relationships in databases. Creating, updating, and deleting tables in SQL. - Relational algebra and relational calculus elements. Selecting data and performing operations on them using logical operators like AND, OR, NOR. - Designing, modeling, and administering databases. Sorting data using the WHERE clause in SQL. - Normalization of databases and 1NF, 2NF, 3NF, and Boyce-Codd normal forms. Creating queries using GROUP BY and ORDER BY clauses. Creating queries using HAVING clause. - Writing SQL queries and SQL operators. Using UNION, INTERSECT, and MINUS standard commands. - Creating simple and complex queries for data manipulation. Working with multiple tables using JOINS. - Describing data using SQL. Creating queries using standard functions. - Processes and standard functions in SQL. Using aggregate functions. - Transaction management. Creating complex queries. - Distributed databases and data processing. Creating INDEX in SQL. - Distributed databases and the Internet. Creating and using VIEWS. - Database administration and security. Creating functions in SQL. Creating triggers in SQL. - Using ODBC and various software for database access. Creating a simple interface using programming languages and database. - XML and databases.
Literature:	Literature 1. Fundamentals of Database Systems Elmasri, R., S. B. Navathe: (5th Ed.)// Addison Wesley, 2015. 2. A Guide to Modern Databases and the NoSQL Movement. Eric Redmond, Jim R. Wilson. USA, 2015. 3. Fundamentals of database systems sixth edition. Ramez Elmasri. Department of Computer Science and Engineering The University of Texas at Arlington. 2011. 4. Database. T.A. Khojakulov. Textbook. T.: TATU, 2022. 5. Database Practice, Methodical instruction. Kuvnakov A.E., Djurayev T.B. Malikova N.T. TATU. 2023.

<table>
<tr><th colspan="2">5.4. Fundamentals of Cyber Security</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>Kholimtaeva Ikbol Ubaydullaevna, Akhmedova Nozima Farkhod kizi</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>
</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>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:	Buriev Yusuf Absamat ugli, Mukhsinov Shamil Shavkatovich
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 (1-15)</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>

<table>
<tr><td colspan="2">5.6. Electronics and circuits</td></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>Sattarov Khurshid Abdishukurovich, Saidov Kamoladdin Nuraddinovich</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>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 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.</td></tr>
<tr><td>Goal:</td><td>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.</td></tr>
<tr><td>Objective:</td><td>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.</td></tr>
<tr><td>Learning outcome:</td><td>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.</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="3">Current control</td><td>Practical works (1-6)</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><th colspan="2">5.7. Computer organization</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>Sayfullaeva Nargiza Akromovna, Atadjanova Nozima Sultan-Muratovna</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>Discrete Structures, 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>An introductory course in computer engineering that teaches the fundamental concepts of digital logic design and computer organization. Lecture topics include binary numbers, Boolean algebra, logic gates and combinational logic, sequential logic, state machines, memories, instruction set architecture, processor organization, caches and virtual memory, input/output, and case studies.</td></tr>
<tr><td>Goal:</td><td>It is to give students knowledge about the specific features of the structure of modern computers, command formats and address modes, memory hierarchy and organization, connection and communication between the processor and external devices, and the organization of calculations in the computer system.</td></tr>
<tr><td>Objective:</td><td>-understanding the fundamentals of computer organization technologies; -studying principles and architectures of computer organization -developing practical skills in computer configuration and management; -analyzing and optimizing computer performance; -troubleshooting computer organization issues; -exploring modern trends and technologies in computer organization</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Understand Boolean logic and state machines as theoretical foundations of digital systems;
LO 2. Conceive, analyze, design, and build combinational and sequential digital logic solutions to everyday problems;
LO 3. Understand the basic structure and functionality of microprocessor, and build a simple one using FPGA hardware;
LO 4. Understand the structure and operation of memory hierarchies and I/O systems</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">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>- Digital Logic Design
- Boolean algebra and combinational logic
- Sequential logic
- HDL, Verilog design
- State machines
- Timing and clock
- Binary numbers and arithmetic
- Memories
- Computer Organization
- Single-cycle microprocessor
- Pipelined microprocessor
- Caches
- Performance measurement
- Virtual memory
- Input/output
- Advanced topics</td></tr>
<tr><td>Literature:</td><td>1. Computer organization and architecture: designing for performance / William Stallings. — Tenth edition.
pages cm 2016. 2. “Computer organization. Principles, technologies, protocols: A textbook for university students, Fifth Edition” N.A. Olifer, V.G. Olifer, St. Petersburg, Peter, 2016.4, Computer organization and design: the hardware/soft ware interface/David A. Patterson, John L. Hennessy. — 5th ed.p. cm. — (Th e Morgan Kaufmann series in computer architecture and design) 2014. 3 С.А.Орлов, Б.Я.Цилькер. Организация ЭВМ и систем: Учебник для вузов. 3-е изд. — СПб.: Питер, 2015. — 685. 4.F. F. Rajabov, N.S. Atadjanova, N.A.Irmuxamedova. “Raqamli axborotlarni qayta ishlash va yaratish texnologiyasi.” Uquv qullanma 3.52.01.01 – Raqamli axborotlarni qayta ishlash ustasi kasbi uchun davlat ta’lim standartiga muvofiq yaratilgan – Toshkent, UzR FA “Fan” nashriyoti, 2021. 272 b. 5. F.F.Rajabov, J.X.Djumanov, K.T.Abdurashidova, D.E.Eshmuradov. «VLSI tizimini loyihalashtirish» fanidan amaliy ishlarni bajarish buyicha uquv qullanma. /TATU. 149 bet. Toshkent, 2022</td></tr>
</table>

5.8. Fundamentals of artificial intelligence	
Semestr:	4
Date of last modification:	31.08.2023
Teachers:	Nurmurodov Javohir Nurmurod ugli
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>

<table>
<tr><th colspan="2">5.9. Create web applications</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>Sadikov Rustam Tahirovich</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</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>Science provides students with theoretical and practical knowledge of modern web programming and their creation technologies, HTML, CSS, Javascript, PHP, Bootstrap, JQuery, Bootstrap, AngularJs and PHP programs designed for web programming, basic concepts of web technologies through modern framework platforms, server side programming technologies, MySQL, AJAX technology and working with them, working with MVC framework technologies, building skills and competencies of designing websites in the YII2 framework.</td></tr>
<tr><td>Goal:</td><td>The study of this course is based on the knowledge gained in the study of "Programming", "Data base".</td></tr>
<tr><td>Objective:</td><td>-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</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO1. Understand the concept of static and dynamic sites
LO2. Knowing how to create a Frontend and Backend part of a website
LO3. To be able to create a structure of a website in HTML used in creating a website, to work with design in CSS
LO4. Able to write and search for functions in the programming language for the user interface in Java Script
LO5. should have the skills to work with requests and use frameworks in PHP</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>

	- 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:	- Introduction to WEB programming. Introduction to web technology. Basic concepts. Stages of development of the WWW. Client-server technologies, Internet protocols. Components of a web application. Frontend and backend technologies. - Introduction to HTML. The general structure and main tags and attributes of an HTML document. Tags for working with images, tables, links, lists, and forms. - HTML5 new standards new tags, attributes and their functions. In HTML5. Work with audio, video and graphics. Visual effects. - Introduction to CSS. How to link HTML document with CSS. CSS syntax. Types of selectors. Types of selectors (simple, combination, pseudo-element, pseudo-class, attribute selectors). Units of measurement. - CSS features. CSS pagination. CSS color properties. Border properties in CSS. Background properties in CSS. CSS font properties. Margin features. Padding features. Box model concept. Box model rules. - CSS3 basics. CSS text effects. Two-dimensional and three-dimensional transformation in CSS. CSS animations. CSS preprocessors (sass, less). - JavaScript Basics. Features of the JavaScript scripting language. Link to an HTML document. Variables. Data types. Arrays. - JavaScript functions and objects. Event processing using JavaScript functions. Constant expressions in JavaScript. - Working with JavaScript browser and web document object model. Understanding the Document Object Model (DOM). Working with HTML objects and CSS properties in the object model of the document. JavaScript browser object model (BOM). Date object methods and properties. - Introduction to JQUERY. Basic concepts. Introduction to jQuery. jQuery syntax. Ways to use jQuery. jQuery selectors. jQuery events. jQuery UI. - Bootstrap framework technologies. Link Bootstrap libraries, configure base templates. Working with existing classes in Bootstrap technology. - Introduction to PHP. PHP basics, syntax. PHP versions. Variables, constants, data types. Operators. - PHP functions and objects. Working with arrays, strings and files in PHP. Working with forms. Error handling in PHP - Global variables in PHP. POST, GET, COOKIE, SESSION, SERVER, REQUEST, ENV, FILES. Scopes of variables. Actions on files. - Object-oriented programming in PHP. MVC technology. Classes and objects in PHP. About MVC technology. Model. View. Controller. - Working with MySQL database management system in PHP. - Application of CMS technology in creating websites.
Literature:	1. Nazirova E.Sh., Sadullaeva Sh.A., Abidova Sh.B., Tajiev J.A. Creating web applications / T.: "Alokachi", 2018, 356 p. 2. Zaynidinov H.N., Nazirova E.Sh., Yahshibayev D.S., Makhmudjanov S.U. Creating web applications. textbook / T.: "Alokachi", 2020, 348 p. 3. Dronov V.A. PHP, MySQL, HTML5 and CSS 3. Razrabotka sovremennyx dinamicheskix Web-saytov (pdf+epub) – SPb.: BXB Petersburg 2016. 688p. 4. Martyshin S.A. Bazy dannyx. Prakticheskoe primenenie SUBD SQL –i NoSQL – tipa dlya proektirovaniya informatsionnyx sistem: ucheb. Posobie // - Moscow: ID "FORUM" - INFRA-M, 2019, – 368 p..

6. Core

<table>
<tr><td colspan="2">6.1. Computer networks</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>Botirov Sokhibjon Rustamovich</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>Computer organization</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 purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in building computer networks.</td></tr>
<tr><td>Objective:</td><td>-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</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Understand how a computer network works.
LO 2. Understand the process of data transfer in the computer network.
LO 3. Possess skills in network design and organizing interconnection.
LO 4. Use standards when building computer networks (ISO, IEEE).
LO 5. Perform network infrastructure design work with scalability in mind
LO 6. Perform configuration of network equipment in accordance with the tasks</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.</td></tr>
</table>

<table>
<tr><td></td><td>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 to Computer Networks. History of computer networks.
- Standards of computer networks.
- Network models and network architecture.
- Physical layer. Types of cables and connectors. Physical medium of data transmission.
- Wireless and mobile networks. Wireless sensor networks
- Data link level. MAC addressing. Switching and VLANs
- Network layer. Network protocols. Network layer protocols (IP, ICMP)
- IP addressing and subnets
- Routing (static and dynamic). Routing protocols (RIP, OSPF, BGP)
- Transport layer. Transport layer protocols (TCP, UDP). Congestion control and reliable data transmission
- Application layer protocols (HTTP, FTP, SMTP, DNS).
- Network services and applications. Basics of client-server architecture.
- Network Security. Firewalls and intrusion detection systems (IDS/IPS). Virtual Private Networks (VPN)
- Network Management and Monitoring. Tools and methods for network monitoring
- Modern Technologies and Trends. Cloud computing and virtualization
- 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>

6.2. Parallel processing architecture and programming	
Semestr:	5
Date of last modification:	31.08.2023
Teachers:	Rakhimov Mekhriddin Fazliddinovich
Component:	Compulsory
Cycle:	Core
Credit point:	8
Pre-requisities	Programming II, Computer Organization
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 / 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 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:	Students get acquainted with the capabilities of modern computers, the principles of building multi-core processors, parallelization technologies, software applications for parallel data processing, concepts of basic programs and parallelization packages, parallel processing technologies, types of shared and distributed memory, and parallel programming. models, parallel system architecture, ways to improve performance, MIMD architecture capabilities for parallel processing, GRID technology, heterogeneous computing systems, Intel and AMD processors, OpenMP technologies, CUDA, parallel signal and image processing methods.
Goal:	The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in parallel programming.
Objective:	-understanding the fundamentals of parallel computer architecture; -studying parallel computing technics -developing practical skills in parallel programming; -analyzing and optimizing computer performance; -troubleshooting computing efficiency issues; -exploring modern trends and technologies in parallel programming
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understand how a parallel computer works. LO 2. Understand the process of data parallelism and task parallelism. LO 3. Possess skills in parallel programming. LO 4. Use libraries when creating parallel program. LO 5. Perform parallel programming tasks with efficiency in mind
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;

<table>
<tr><td></td><td>- 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>- Problems of parallel computing. Parallelization is one way to increase processing speed.
- Hardware functions for parallel processing, data presentation and command execution.
- Basic features of memory organization and types of memory.
- Machine code, mnemonics, and programming languages.
- Pipelining, superscalar machining, VLIW architecture.
- Multiprocessors and multicomputers with shared and dedicated memory.
- NUMA and ccNUMA architecture, cache consistency.
- Programming models, performance evaluation. Amdahl's Law. Parallelization of data and instructions.
- Computer systems with shared memory, cluster systems.
- Parallelization algorithms and programs, stages of creating parallelization algorithms, multithreaded programs.
- Multi-core processors, memory and intercom organization, software threading, stream processing technology.
- Parallel computing capabilities of Intel and AMD processors.
- Standard Stream Processing Tools, OpenMP technology.
- Examples of practical applications of parallel processing technology. Digital signal and image processing.
- Data parallelization in Deep Learning Processes.</td></tr>
<tr><td>Literature:</td><td>Literature 1. David A. Patterson, John L. Hennessy. Computer Organization and Design. 4th Edition. 2012, 919 pp. 2. Parallel Computer Architecture: A Hardware/Software Approach" by David E. Culler and Jaswinder Pal Singh. 1988. 1056 pp. 3. Introduction to Parallel Computing" by Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar. Second Edition, 2003. 856pp. 4. “Programming Massively Parallel Processors: A Hands-on Approach” David B. Kirk and Wen-mei W. Hwu, 2016 (Third Edition), 576 pp.</td></tr>
</table>

6.3. Signal and image processing	
Semestr:	5
Date of last modification:	31.08.2023
Teachers:	Kholdorov Shohruhmirzo Imomali ugli
Component:	Compulsory
Cycle:	Core
ECTS:	6
Pre-requisities	Electronics and circuits
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 purpose and tasks of the science of signal and image processing, types of signals, their composition and structure, image types and main characteristics, one and two-dimensional signal filtering algorithms, morphological processing of images, spectral measurement of one and two-dimensional signals transformation, image compression, signal information extraction, and image object recognition information.
Goal:	In the course of lectures, it is necessary to train students in digital processing of one- and two-dimensional signals, filtering, spectral processing and their application in fields, as well as the ability to use special instrumental software tools.
Objective:	To have an idea about the main characteristics and parameters of one- and two-dimensional signals, the main procedures of their processing, the principles of image processing; to know and be able to use processes of digital processing of two-dimensional signals, design and diagnostic tools, methods and algorithms, digital processing of signals and their implementation by software; to acquire the skills of selecting one- and two-dimensional signals by time parameters, using algorithms of interpolation and decimation signals, spectral transformation algorithms in local and integral bases; to have an idea of the main characteristics and parameters of one- and two-dimensional signals, the main procedures of their processing, the principles of image processing.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Basic procedures of one- and two-dimensional signal processing, principles of image processing will be acquired. LO 2. Knows and can use methods and algorithms of digital processing of two-dimensional signals, digital processing of signals and their implementation through software. LO 3. One-and two-dimensional signal sampling by time parameters, interpolation and decimation signal algorithms, will have the skills to be able to apply spectral modification algorithms at local and integral bases.
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="3">Current control</td><td>Practical works (1-10)</td><td>30</td><td rowspan="3">40</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">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. Goals and tasks of the science "Signal and image processing".
- Types of signals, their composition and structure
- Image types and main features
- Algorithms of convolution and correlation in signals
- One-dimensional signal filtering algorithms
- Two-dimensional signal (image) filtering
- Morphological processing of images
- Spectral transformation of one- and two-dimensional signals
- Spectral transformation algorithms
- Study of Wavelet spectral transformation (Wavelet Transform).
- Implementation of discrete cosine transformation
- Image processing algorithms. Geometric changes
- Histograms. Change frequency.
- Compress images
- Extraction of signal informant symbols
- Image segmentation
-Recognition of objects in the image</td></tr>
<tr><td>Literature:</td><td>Literature 1. Musaev M.M., Raximov M.F., Berdanov U.A. Tizim va signallarni qayta ishlash. O’quv qo’llanma, Toshkent, 2022. 2. Айфичер Э., Джервис Б. Цифровая обработка сигналов. Практический подход. 2-е издание. Вильямс, 2004. — 992 с. 3. Vinay K. Ingle and John G. Proakis. “Digital signal processing using Matlab, Third edition”. Global Engineering. 2012. 4. Рафаэл С. Гонсалес, Ричард Е. Вудс, ; пер. с англ. Л. И. Рубанова, П. А. Чочиа. Цифровая обработка изображений. - Изд. 3-е, испр. и доп. - Москва : Техносфера, 2012 (М. : Типография "Наука" РАН). - 1103 с. : ил., табл.; 25 см. - (Мир цифровой обработки).; ISBN 978-5-94836-331-8</td></tr>
</table>

6.4. Multi-agent systems	
Semestr:	6
Date of last modification:	31.08.2023
Teachers:	Rakhimov Mekhriddin Fazliddinovich
Component:	Compulsory
Cycle:	Core
Credit point:	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 / Project
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:	A "Multi-agent systems" course typically covers the principles, architectures, and applications of systems composed of multiple interacting agents. The course begins with an introduction to the definition, characteristics, and historical development of agents and multi-agent systems. It explores different types of agents (reactive, deliberative, hybrid) and their architectures, as well as the nature of their environments (static vs. dynamic, deterministic vs. stochastic, discrete vs. continuous). The course typically concludes with a project or assignment involving the design and implementation of a multi-agent system, with students analyzing and presenting their project outcomes.
Goal:	The goal of the course is to provide students with a comprehensive understanding of the principles, architectures, and applications of systems composed of multiple interacting agents..
Objective:	-understanding agent concepts; - to learn the principles and protocols of communication; -to explore distributed problem-solving techniques, including distributed search algorithms; - to understand the various learning approaches in multi-agent systems; - To discuss the ethical and societal implications of deploying multi-agent systems in real-world applications; - To provide hands-on experience through projects or assignments
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understand and explain the fundamental concepts, definitions, and characteristics of agents and multi-agent systems. LO 2. Design and evaluate different types of agent architectures. LO 3. Develop and analyze coordination and cooperation mechanisms among agents. LO 4. Apply distributed problem-solving techniques. LO 5. Utilize reinforcement learning, cooperative learning strategies, and evolutionary approaches in multi-agent systems. LO 6. Design, implement, and evaluate multi-agent systems in practical domains such as robotics.

<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 (1-15)</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 Multi-Agent Systems.
- Agent Characteristics and Architectures.
- Agent Environments. Interaction between agents and their environments.
- Agent Communication. Message passing and inter-agent communication.
- Coordination and Cooperation in MAS.
- Negotiation and Conflict Resolution. Techniques for negotiation among agents.
- Distributed Problem Solving. Distributed search algorithms.
- Multi-Agent Learning. Reinforcement learning in multi-agent systems.
- Modeling and Simulation of MAS. Methods and tools for modeling multi-agent systems.
- MAS in Robotics and Autonomous Systems. Multi-agent coordination in robotics
- MAS in Distributed Control Systems. Use of MAS in control and automation
- MAS in E-commerce and Trading Agents.
- Applications of MAS in online marketplaces.
- Ethical and Societal Implications of MAS. Ethical considerations in MAS deployment
- Current Trends and Research in MAS. Emerging research areas and technologies in MAS.
- Case Studies and Practical Applications of MAS. Detailed analysis of real-world MAS applications.</td></tr>
<tr><td>Literature:</td><td>1. "Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations", Yoav Shoham and Kevin Leyton-Brown, 2009, First edition. 532 pp. 2. "Introduction to Multiagent Systems" Michael Wooldridge. 2nd Edition, 2009, 560 pp. 3. "Engineering Multi-Agent Systems" Olivier Boissier, Virginia Dignum, Frank Dignum, and Jacques Ferber. 1st Edition, 2004, 316 pp 4. "Distributed Artificial Intelligence: A Perspective" Vijay Kumar and M. Michael Littman, 1998, 288 pp.</td></tr>
</table>

<table>
<tr><td colspan="2">6.5. Geoinformation Technologies</td></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>Djumanov Jamoljon Xudaykulovich</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>This course will encourage students to understand an geodata, extends the existing base of GIS knowledge and skills by amplifying programmatic approaches to spatial data and analysis. Lectures, labs and projects emphasize GIS model development, spatial database architecture and design best practices, and extend knowledge of web GIS by authoring and consuming geographic web services. Students will become familiar with methods of leveraging programming languages (such as Python) to make GIS processing easier, faster and more accurate by scripting and automating data management, production, manipulation and analysis procedures. Activities develop GIS analysis skills with examples from government, social science, physical science and the techniques-technologies.</td></tr>
<tr><td>Goal:</td><td>The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in building geomodels. This class uses lecture, lab exercises and a workshop setting to help students develop an in-depth understanding of the planning, analysing as wel as modelig of telecommunikation sysytem, ecology safe and public management uses of geographic information systems.</td></tr>
<tr><td>Objective:</td><td>-understanding the fundamentals applying geospatial task-solving tactics through individual and collaborative research, design and analysis to real-world challenges; studying geodata through the geocoordinate and special works projects; define geometrics, ecology and evaluate it with regards to a real-world scenario; develop new learning, time management and data organization skills; skill development through tutorials, videos, research, collaborations, etc; time management through weekly reports and scheduled meetings; data organization through proper metadata and file geodatabase design; demonstrate professional communication skills for reaching broad audiences; through web presence, audio/video presentations, discussion board responses, and client meeting; develop programming skills for geospatial applications; through ModelBuilder, ArcGIS Notebooks and ArcGIS for Developers tutorials;</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Effective use GIS, evaluating the reproducibility of a real-world geospatial problem of geodata base, and there manage;
LO 2. To be masters in the field GIS building a public-facing website that includes a summary of the project, an evaluation of geometrics, and a building a structure and</td></tr>
</table>

<table>
<tr><td></td><td>geodata models / accomplishments providing at least the technologies for solving at least one special works problem;
LO 3. Creating and disseminating a novel dataset in at least planning file formats (e.g., file geodatabase and GeoJSON) Use standards when building process skills in GIS design and organizing interconnection, scheduling to review the progress of the reproducibility project;
LO 4. Usage of library Leaflet JS, maintain a report posted on the web-site that outlines everything you do for this class (including any research, development, analysis, and collaboration work) and approximately how long it took you to do it.</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 (1-15)</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>- The essence of the science of geoinformation technologies and areas of application.
- Selection of geoinformation systems technologies.
- Data structures and models of geoinformation technologies.
- Data entry technologies and data sources.
- Geodatabases. Postgresql, PostGIS
- Working with attributive data and spatial queries
- Vector data and operations on them.
- Topographic maps and their scale.
- Linking remote sensing data with geographic information systems.
- Raster data processing.
- Connections between projections, coordinate models
- Data quality and errors.
- Geospatial data analysis using Python
- 3D visualization and maps.
- Map visualization and export into formats.</td></tr>
<tr><td>Literature:</td><td>1. Jumanov Zh.Kh., Geoinformation technologies in hydrogeology. -T.GP “Institute HYDROINGO” 2016. 258 p. 2. E.G. Kapralov, A.V. Koshkarev, V.S. Tikunov, Geoinformatics: in 2 books. Book 1: textbook for students. higher education institutions / - 3rd ed., revised. And additional - M.: Publishing center "Academy", 2019. - 400 p. 3. E.G. Kapralov, A.V. Koshkarev, V.S. Tikunov and others; Fundamentals of geoinformatics: In 2 books. Book 1: Textbook aid for students universities - M.: Publishing center "Academy", 2016. - 352 e. 4. R.V. Kovin., N.G. Markov. Geographic information systems: educational Tomsk.2017,-175s.</td></tr>
</table>

6.6. Operating Systems	
Semester:	6
Date of last modification:	31.08.2023
Teacher:	Atoev Sukhrob Gafurovich
Component:	Compulsory
Cycle:	Core
ECTS:	6
Pre-requisities	Computer organization
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 Operating Systems (OS) course provides a comprehensive introduction to the fundamental concepts and principles of OS. It covers the essential components, structures, and functionalities of modern OS, as well as the core algorithms and mechanisms used to manage system resources, handle processes, and facilitate user interactions.
Goal:	The primary goal of this course is to provide students with a comprehensive understanding of the fundamental concepts, principles, and design of modern OS.
Objectives:	- Understand the role and importance of OS in computer systems; - Examine the architectural design and internal organization of OS; - Explore process management, including process scheduling, synchronization, and deadlock; - Learn about memory management techniques, such as virtual memory and paging; - Discuss file system management and I/O operations; - Investigate concurrency control, multi-threading, and parallel processing; - Analyze security and protection mechanisms in OS.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Install, update, and manage OS. LO 2. Understand the OS classes and architectures. LO 3. Understand the network OS services and resources. LO 4. Work in different OS environments and applications. LO 5. Ensure information security in OS.
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;

<table>
<tr><td></td><td>- 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 (1-15)</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 OS. Basic understanding of OS. History of OS. Classification of OS.
- Architecture of OS. Basic principles of construction of OS. Properties of OS.
- The role of OS in managing computer devices. The structure of computers, processors, memory devices, buses, etc.
- Types of OS. Multiprocessor OS, server OS, client-server model, virtual machine.
- Embedded systems. Embedded systems architecture. Embedded systems model. Embedded processors.
- Installed software. Device drivers. Embedded OS. Application software.
- Command line terminals in OS. Windows command line and PowerShell environment. Terminals of Unix family OS.
- Threads in OS. Multithreading in programming.
- Management of processes in OS. Management, planning, dispatching and synchronization of processes. Process planning algorithms and parameters.
- Memory management in OS. Memory abstraction: concepts of address space, swapping, free memory management. Virtual memory.
- File systems in OS. Files. Catalogs. Working with files and directories. Table of file placement in memory. Caching, transaction-based file systems.
- OS for cloud computing. Virtualization of devices. Services, data processing centers. Software tools for cloud computing.
- Security in OS. Control access to resources. Protection levels. Fundamentals of cryptography. Authentication. Attacks on software systems.
- OS in the Unix family. Linux OS and its distributions. Linux kernel.
- OS for mobile devices. Android OS. Android architecture. Android applications. Security.</td></tr>
<tr><td>Literature:</td><td>1. Modern Operating Systems (4th Edition) 4th Edition. Andrew S. Tanenbaum, Herbert Bos. Pearson, 2014, 1136 pages. 2. Operating Systems. U.R.Khamdamov, Dj.B.Sultonov, S.S.Parsiyev, U.M.Abdullaev. Tashkent, 2021, 436 pages. 3. Linux with Operating System Concepts. Richard Fox. CRC Press, 2015, 688 pages. 4. Operating System Concepts. Binder Ready Version 9th Edition. Abraham Silberschatz, Peter B. Galvin, Greg Gagne. Wiley January 2013, 919 pages.</td></tr>
</table>

6.7. Embedded systems	
Semestr:	6
Date of last modification:	31.08.2023
Teachers:	Kholdorov Shohruhmirzo Imomali ugli
Component:	Compulsory
Cycle:	Core
ECTS:	6
Pre-requisities	Programming I, Electronics and circuits I
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 science consists in imparting knowledge about the operating systems of modern embedded systems, the organization of microcontrollers, means of parallel processing of information, the hardware means of direct access to memory, and the design of software tools of the embedded system.
Goal:	In the course of lectures, the requirements for embedded systems, mutual integration of embedded systems with embedded system device management objects, system processors and tools are formed.
Objective:	To have an idea about the system requirements for installed systems and the means of connecting the installed system devices with the control object; to know how to organize a microcontroller and to be able to use them and to have skills about parallel processing of information; Implement interrupt routines in embedded systems and get an idea of the hardware of memory direct access and I/O interfaces of embedded systems
Learning outcome:	After studying the discipline, students should be able to: LO 1. Will have skills in operating systems and real-time OS for embedded systems. LO 2. Learns to design the hardware of embedded systems based on the Arduino system. LO 3. Knows and uses input-output systems construction, input-output control methods, input-output channels and processors, input-output modules, and ports.
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",

<table>
<tr><td></td><td>"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 (1-15)</td><td>30</td><td rowspan="3">40</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">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 systems. Basic concepts about embedded systems.
- Basic requirements for installed systems
- Tools for connecting embedded system devices with the control object
- Microcontroller organization
- Tools for parallel processing of information
- Implementation of the outage procedure in installed systems
- Signal processing systems
- Hardware means of direct access to memory.
- Input/output interfaces of embedded systems
- Operating systems for embedded systems.
- Real time OS usage tools.
- Hardware design of systems installed on the basis of the Arduino system
- Software design of installed systems
- Setting up microcontroller systems
- Diagnostic tools for installed systems
- Practical hardware and software implementation of systems installed on the basis of modern tools</td></tr>
<tr><td>Literature:</td><td>1. Klyuchev, A.O., Kovyazina D.R., Kustarev, P.V., Platunov, A.YE. Hardware and software of embedded systems. Tutorial. – SPb.: NRU ITMO, 2010. – 290 p. 2. Tammy Noergaard. Embedded Systems Architecture A Comprehensive Guide for Engineers and Programmers. Newnes 2013. – 653p. 3. Platunov A.YE, Postnikov N.P. High-level design of embedded systems. – SPb.: NRU ITMO, ch. 2, 2013. – 172p. 4. Goncharovskiy O.V. Design of embedded real-time control systems: textbook. allowance . Perm: Perm Publishing House. us. research Polytechnic university, 2013. – 165 p.</td></tr>
</table>

6.8. Application program package	
Semestr:	4
Date of last modification:	31.08.2023
Teachers:	Jabborov Khayitmurod Ishmumin ugli
Component:	Elective
Cycle:	Core
Credit point:	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: Written
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 subject "Application software packages" includes models of systems used in science, technology and production, computer application packages (MATLAB, MAPLE, etc.), which are tools for their mathematical classification and modeling, history and development trends, modeling, analysis and programming dynamic processes, as well as solving various practical problems related to different areas of human activity, using the MATLAB package.
Goal:	The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills of modeling, analysis and programming dynamic processes, as well as solving various practical problems related to different areas of human activity, using the MATLAB and Simulink.
Objective:	-understanding the fundamentals of modeling; -studying modeling methods and tools - developing practical skills in Simulink; -analyzing and optimizing modeling performance; - development of modern computer mathematics (Matlab, MAPLE, Mathcad, Statistica, Simulink, ScienceLab, etc.); - solving scientific, technical and production problems.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Have an idea about the scope, essence, direction of development of modern computer mathematics (Matlab, MAPLE, Mathcad, Statistica, Simulink, ScienceLab, etc.); content of basic rules for solving engineering and computing problems; LO 2. Have an understanding of basic software development methods and tools LO 3. Know and be able to use programming and user interface development skills, modeling technical systems and production processes in the environment of the above application packages; LO 4. Ability to use standard software packages, methods and tools to perform automatic calculations when solving scientific, technical and production problems; LO 5. Have the skills to create ready-made applications using standard application package tools, be able to identify scientific, technical and production problems that can be solved using existing standard application software packages; LO 6. Ability to optimize and model dynamic systems and devices; use of visualization tools in computing;

<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>- Introduction to the subject “Application Software Packages”, its purpose and objectives.
- Types, applications and functions of application packages
- Matlab functionality. Matlab program as a direct computing environment
- Matlab functionality. Matlab program as a direct computing environment
- Performing arithmetic operations with matrices in the Matlab environment. Matrix generation
- Study and solution of systems of linear algebraic equations (SLAE) in Matlab
- Graphic capabilities of applied mathematical programs, creation of two- and three-dimensional graphs
- Solving interpolation and approximation problems in Matlab
- Simulation and control of complex systems based on Simulink
- Simulation and control of complex systems based on Simulink
- Multivariate data analysis using the Statistic package. Solving classification and clustering problems using the Statistica package
- Mathcad system, functions and interface
- Performing calculations in the Matchad system
- Creating graphical functions and surfaces in Matchad
- Application of modern application packages in engineering practice</td></tr>
<tr><td>Literature:</td><td>Literature 1. Solovyova E. B. Machine modeling of REU. Mathematical modeling of linear analog circuits in the MatLAB software environment. Specialty 200700/ - St. Petersburg, 1998.
2. Gasparyan O.N. MATLAB. Tutorial. GUIA. 2005. – 143 p.
3. Gultyaev A. Visual modeling in the Matlab environment. Training course. – St. Petersburg: Peter, 2000.
4. Usmanov R.N., Khamidov V.S., Abdurashidova K.T., Khabirova D.N. Amaliy dasturii paketlar. –T.”Alokachi” 2018. 135 b.
5. Potemkin V. G. Tools Matlab 5_t. – M.: Dialogue-MEPhI, 2000.</td></tr>
</table>

<table>
<tr><td colspan="2">6.9. Computer Architecture</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>Rajabov Farkhat Farmanovich</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>Computer Organization</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>Written</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>This course aims to provide a strong foundation for students to understand the modern eras of computer architecture (i.e., the single-core era, multi-core era, and accelerator era) and to apply these insights and principles to future computer designs. The course is structured around the three primary building blocks of general-purpose computing systems: processors, memories, and networks.</td></tr>
<tr><td>Goal:</td><td>It is to give students knowledge about the specific features of the structure of modern computers. Students will learn how to evaluate design decisions in the context of past, current, and future application requirements and technology constraints.</td></tr>
<tr><td>Objective:</td><td>-understanding the fundamentals of Computer Architecture technologies; -studying principles and architectures of Computer Architecture -developing practical skills in computer configuration and management; -analyzing and optimizing computer performance; -troubleshooting Computer Architecture issues; -exploring modern trends and technologies in Computer Architecture</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Describe computer architecture concepts and mechanisms related to the design of modern processors, memories, and networks and explain how these concepts and mechanisms interact.
LO 2. Apply this understanding to new computer architecture design problems within the context of balancing application requirements against technology constraints; more specifically, quantitatively assess a design’s execution time in cycles and qualitatively assess a design’s cycle time, area, and energy.
LO 3. Evaluate various design alternatives and make a compelling quantitative and/or qualitative argument for why one design is superior to the other approaches.
LO 4. Demonstrate the ability to implement and verify designs of varying complexity at the register-transfer level.
LO 5. Create new designs at the register-transfer-level and the associated effective testing strategies.
LO 6. Write concise yet comprehensive technical reports that describe designs, explain the testing strategy used to verify functionality, and evaluate the designs to determine the superior approach.</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 (Written)	50		

Topics of lectures:	- Processors – instruction set architecture; single-cycle, FSM, and pipelined processor microarchitecture; resolving structural, data, control, and name hazards and analyzing processor performance. - Memories– memory technology; direct-mapped vs. associative caches write-through vs write-back caches, memory protection, translation, and virtualization. - FSM and pipelined cache microarchitecture and analyzing memory performance - Integrating Processors, Memories, and Networks – processor and L1 cache interface, banked memory systems, message-passing systems, shared-memory systems. - Advanced Processors – superscalar execution, out-of-order execution, register renaming, memory disambiguation, branch prediction, speculative execution multithreaded, VLIW, and SIMD processors. - Advanced Memories – memory synchronization, consistency, and coherence
Literature:	Literature 1. “Computer Architecture: A Quantitative Approach, 5th ed.,” by J. L. Hennessy and D. A. Patterson (Morgan Kaufmann, 2012) 2. “Digital Design and Computer Architecture, 2nd ed.,” by D. M. Harris and S. L. Harris (Morgan Kaufmann, 2012) 3. Computer Architecture, Fourth Edition. Andrew S. Tanenbaum. Publisher; Prentice Hall, 2011. 4. “Computer Architecture. Principles, technologies, protocols: A textbook for university students, Fifth Edition” N.A. Olifer, V.G. Olifer, St. Petersburg, Peter, 2016. 5 С.А.Орлов, Б.Я.Цилькер. Организация ЭВМ и систем: Учебник для вузов. 3-е изд. — СПб.: Питер, 2015. — 685 6.F. F. Rajabov, N.S. Atadjanova, N.A.Irmuxamedova. “Raqamli axborotlarni qayta ishlash va yaratish texnologiyasi.” O‘quv qo‘llanma 3.52.01.01 – Raqamli axborotlarni qayta ishlash ustasi kasbi uchun davlat ta’lim standartiga muvofiq yaratilgan – Toshkent, O‘zR FA “Fan” nashriyoti, 2021. 272 b. 7. F.F.Rajabov, J.X.Djumanov, K.T.Abdurashidova, D.E.Eshmuradov. «VLSI tizimini loyihalashtirish» fanidan amaliy ishlarni bajarish bo‘yicha o‘quv qo‘llanma. /TATU. 149 bet. Toshkent, 2022

<table>
<tr><td colspan="2">6.10. Computer modeling</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>Jabborov Khayitmurod Ishmumin 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>Application program package</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>Written</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>This subject allows students to study computer application software packages (MATLAB, Simulink package, etc.), which are tools for modeling systems, mathematical classification and modeling of them in scientific, technical and industrial fields, history and development trends, modeling of dynamic processes, analysis and programming, as well as solve various applied problems related to various areas of human activity using the SIMULINK package.</td></tr>
<tr><td>Goal:</td><td>The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills of modeling based on Matlab and Simulink.</td></tr>
<tr><td>Objective:</td><td>- knowing the stages of application program development, the classification of application programs; - prospects for application software development - studying the properties of the Simulink package, know types of component blocks, methods for designing simple systems using the Simulink package; - constructing several graphs of functions in one coordinate system, several graphs of functions in one window, and the formation of generated graphs</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Operation of computer equipment.
LO 2. Types of models: word processing, spreadsheets and graphs used in the office, database processing, expert systems with knowledge of general models of various industries and their areas of application.
LO 3. Have an understanding of the MATLAB system, one of the widely used packages in engineering, the type of data used in it, the functions, and the immediate computing environment of the MATLAB system.
LO 4. In the MATLAB system, they can perform actions such as analyzing a Simulink package and performing various actions on them.
LO 5. They will gain knowledge about the organization of polynomials and performing operations on them, approximation and interpolation, approximation and interpolation of functions, processing their models in the Matlab system.
LO 6. Using Simulink, you can gain insight into solving multivariate data analysis, classification, and classification problems.</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 (Written)	50		

Topics of lectures:	- Introduction to mathematical modeling. Modeling stages - Model, simulation and their stages - Types of models. Model classification - Classification of types of mathematical models - Systematic approach to the modeling problem - Cases of a systematic approach to the formation of models in modeling - Simulink is a visual mathematical modeling package. Start Simulink. - The Simulink package is a library of blocks. Block of signal sources (Source). - The Simulink package is a library of blocks. Block of signal sources (Source). - Simulink is the signal receiving block of the Sinks package. - Continuous and discrete blocks of the Simulink package. - Block of mathematical operations (Math) of the Simulink package. - Block of mathematical operations (Math) of the Simulink package. - Block of signal systems of the Simulink package. - Block of signal systems of the Simulink package. - Solving a system of linear algebraic equations in the Simulink package. - Simulation in Simulink - Unsustainable Manufacturing Simulation
Literature:	Literature 1. Dyakonov V.P. MATLAB. Training course SP.b. Peter 2001. 2. Ketkov Yu.L. , etc. MATLAB 7. Programming, numerical methods SP.b. BHV-Petersburg 2005. 3. Usmanov R.N., Khamidov V.S., Abdurashidova K.T., Khabirova D.N. Amaliy dasturii paketlar. –T.”Alokachi” 2018. 135 pp. 4. Андриевский Б., Фрадков А. Избранные главы теории автоматического управления с примерами на языке Matlab.– СПб.: Наука, 1999.

<table>
<tr><td colspan="2">6.11. 3D Technology</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>Karabayeva Khurshida Abdusamadovna</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>-</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>Written</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>Computer graphics have long been an integral part of our lives. Effective use of 3D graphics technologies in all aspects of society is also becoming a habit. This program describes the main and modern programming languages used in 3D technologies, their structure and methods of use, the advantages and disadvantages of each program, development trends and prospects of science, as well as the influence of works and results obtained in this regard on the prospects of programming languages used in the field of 3D technologies.</td></tr>
<tr><td>Goal:</td><td>The purpose of teaching the science of 3D technologies is to use information and communication technologies that every specialist should use in his field, to further develop his activities in students using 3D technologies and three-dimensional graphics, and technical tools based on these technologies. and is to create skills to work in practical programs.</td></tr>
<tr><td>Objective:</td><td>- principles of working with 3D graphics;
- creation of 3D products using multimedia technologies;
- development of skills and abilities for working with three-dimensional software.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the course, students should be able to:
LO 1. Use the appropriate 3D graphics editor.
LO 2. Customize the user interface and program content.
LO 3. About the concept of modeling and modeling technology.
LO 4. Create imaginary products using 3D technology software.</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, acquisition of experience in independent problem solving, the following should be highlighted:
- technologies of problem-based 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 (situation analysis);</td></tr>
</table>

<table>
<tr><td></td><td>- gaming technologies, within the framework of which students participate in business, role-playing, simulation games;
- information and communication (including distance) technologies.
To develop critical thinking of students, such methods as "Forecasting with open questions", "Cluster", "Cross discussion", "I know-I want to know-I learned", "INSERT", practical classes, gamification and others are actively used in 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>- The history of the development of computer graphics. Possibilities, advantages and disadvantages of three-dimensional graphics. 3D technology hardware.
- Types, advantages and disadvantages of 3D graphics editors.
- Concepts of modeling. Objects and their structure. Modeling technology. polygonal models.
- Advanced modeling. Rig technology. Rig animation and hierarchical structure.
- The concept of rendering. Global Illumination. Photorealistic rendering.
- Light and its main components. Lighting scenes.
- Color and surface properties. Image map. Shadow and surface texture. surface transparency.
- Camera. Camera types
- Technologies for creating 3D animation.
- Computer animation technologies. Camera animation. Light animation.
- Two-dimensional and three-dimensional integration. Advanced computer animation technology.
- Process animation. Face animation. Layered animation.
- Visual effects technology. Blue and green screens.
- 3D Morphing. Motion Capture Technology. Motion Capture
- Creation of materials. Supply of materials to facilities. Use of standard materials</td></tr>
<tr><td>Literature:</td><td>Literature 1 Derakhshani, D. 2012, 3ds Max 2017Essentials, Sybex, San Rafael, CA,USA. 2. Kelly Murdoch. Autodesk 3ds Max 2018 User Bible = Autodesk 3ds Max 2019Bible. — M.: "Dialectics", 2013. — 816 p. — ISBN 978-5-8459-1817-8. 3. Kelly Murdoch. 3ds Max 2018 User Bible = 3ds Max 2012 Bible. — M.: "Dialectics", 2012. — 1312 p. — ISBN 978-5-8459-1768-3 4. Папанек.В.Дизайн для реальной жизни.2019г.</td></tr>
</table>

<table>
<tr><td colspan="2">6.12. Data communication</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>Atadjanova Nozima Sultan-Muratovna</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>Computer networks</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>Written</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>The course "Data Communication" will help you understand the principles of data transmission, methods and means of data transmission, computer network communication protocols, detection and correction in data transmission, errors classification and types, signal encoding, transmission medium.</td></tr>
<tr><td>Goal:</td><td>The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills data transmission in computer networks.</td></tr>
<tr><td>Objective:</td><td>- understanding concept of bandwidth, the basics switching signals and the main characteristics of data transmission networks, the generalized task of switching, data movement; - studying network protocols; - developing practical skills in setting up and managing data transmission; - troubleshooting data transmission; - studying modern trends and technologies in the field of data transmission.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Understand the process of data transmission in a computer network
LO 2. Understand the process and characteristics of data transmission in analog and digital channels.
LO 3. Have the skills to transmit data of inter-network interaction.
LO 4. Use standards for data transmission in computer networks (ISO, IEEE).
LO 5. Perform network equipment configuration in accordance with the assigned tasks.</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 role-playing, simulation games;
- information and communication (including distance learning) technologies.</td></tr>
</table>

	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. Introduction to the subject - data switching. Physical medium and means of data transmission. - Standards of computer networks. IEEE 802 (IEEE 802.3, 802.5, 802.11, 802.16) - Data switching. Methods and means of data switching. - Wired data transmission. Ethernet technology. Hubs and switches. Input, output and filtering of data. - OS1 Reference Model. History of OSI development, stages, their functions, basic protocols. - Basics of inter-level interaction Principles of physical and channel data transmission. - MAC levels, LLC, protocols and their functions. - Network layer. Principles of network data transmission. IP protocol - Transport and session layer. How transport and session protocols work. Formation of a virtual communication session. - Presentation layer. How presentation layer protocols work. - Application level. Principles of operation of application-level protocols. - TCP / IP protocol stack. The history of the development of TCP / IP levels, their - functions, basic communication protocols - Addressing. Types of TCP / IP stack addresses IP address format - Interworking protocol. IP packet format. IP protoco - Network protocols. IPv4, IPv6 protocols, packet structure and comparison of the capabilities of the IPv4 and IPv6 protocols. - Comparison of TCP / IP and OSI layers Correspondence of TCP / IP communication protocol stacks and OSI model - Comparative analysis. Principles of operation of level 2,3,4 switches. - Routing. Data routing protocols used in LAN, MAN and WAN networks. - Comparative analysis. Principles of operation of routers in LAN, MAN and WAN networks. - Client-server applications. Client-server and peer-to-peer architectures and their structure. Client-server applications. Client-server and peer-to-peer services and their core applications. - Network control. Basic protocols used in network management. - Application protocols. DNS, ICMP, SNMP in distributed network management. - Generalized switching problem. Definition of information flows. Primary networks - PDH, SONET / SDH and DWDM. Data promotion. Multiplexing and demultiplexing. - Network security. Software and hardware security. Network security. Methods and means of protection of internetwork data transmission.
Literature:	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. Behrouz A. Forouzan, Sophia Chung Fegan, “Data Communications and Networking”, Fifth Edition, Science Engineering & Math Publications, 2012. 5.William Stallings, “Data and Computer Communications”, Eighth Edition, Pearson Education India, 2007.

<table>
<tr><td colspan="2">6.13. Virtual reality</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>Karabayeva Khurshida Abdusamatovna</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>Programming I,II, 3D Technology</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>Written</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>The Virtual Reality course deals with theoretical and practical stages of three-dimensional visualisation, when the image becomes part of the space and the user has the opportunity to immerse in it. During the course, students will get acquainted with types, classes, models of virtual reality; technical support, theoretical and practical bases for creating VR applications, principles of augmented reality.</td></tr>
<tr><td>Goal:</td><td>To provide students with theoretical and practical knowledge of virtual reality to develop their skills in creating and using software products based on VR technologies and to build and develop their skills in using them.</td></tr>
<tr><td>Objective:</td><td>-understanding of theoretical foundations of VR technology; -acquaintance with types, classes, models of VR; -development of skills and abilities to use VR tools and devices; -formation of knowledge and skills to create and process software products based on virtual and augmented reality technologies; -creation and management of products using Unity, 3D Max software and their application.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Have an understanding of the structure and characteristics of virtual reality systems.
LO 2. Know the types, classes, degrees and models, in particular, geometric and physical, of virtual reality systems, the basics of technology of their use.
LO 3. Have skills in the use of technical means and devices of VR and AR used in the virtual environment.
LO 4. Have skills in working with separate models of virtual reality systems, with browser virtual reality - Web VR.
LO 5. Apply knowledge engineering languages and tools in the form of the latest engines and frameworks to build such systems.</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>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>- Definitions of virtual reality. History of virtual reality. The three I's of virtual reality.
- Types, properties and degrees of virtual reality.
- Applications of virtual reality in various fields.
- Technical support for virtual reality. VR headsets: mobile and fixed helmets, manipulators and other peripherals.
- Tracking system in virtual reality. Tracking orientation in virtual space.
- Virtual Reality Modelling. Geometric modelling of virtual reality: polygonal and parametric 3D modelling. Kinematic modelling of virtual reality.
- BP software. Possibilities of the UNITY programme. Unreal Engine capabilities: Nanite and Lumen.
- Browser Virtual Reality. Web VR - browser virtual reality in HTML 5. Libraries and frameworks for browser VR development.
- Augmented reality in mobile applications. Types of AR and their application in mobile devices. Marker and spatial AR technologies.
- Audio in virtual reality. 3D spatial audio and its formats: Ambisonics B-format, Dolby Atmos technology.
- Light and optics in virtual reality. Design of VR optics.
- Virtual reality in cloud technology.
- The human factor: the security challenges of virtual reality.</td></tr>
<tr><td>Literature:</td><td>Literature 1. Steven M. LaValle. Virtual Reality. University of Illinois. DRAFT July 24, 2020, 214 p. 2. Tony Parisi. Learning Virtual Reality. O’Reilly Media, 2019, 128 p. 3. Jonathan Linowes. Unity Virtual Reality Projects. Packt Publishing, 2019, 236 p. 4. Artikova M.A. Virtual Reality. A textbook for university students, TUIT, 2023, 230 p.</td></tr>
</table>

6.14. Analyzing geodata based on Python	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Kuchkorov Temurbek
Component:	Elective
Cycle:	Core
Credit point:	6
Pre-requisities	Application Software Package, Programming I, Geoinformation technologies
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: Written
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
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 subject "Analyzing Geodata Based on Python" covers the use of Python for geospatial data analysis, beginning with an introduction to geospatial data types (raster and vector) and the Python tools and libraries used for such analysis, including GeoPandas, Shapely, and Rasterio. It includes understanding common geospatial data formats (e.g., Shapefiles, GeoJSON, GeoTIFF) and techniques for reading and writing this data. Students learn to manipulate and visualize geospatial data using libraries such as Matplotlib and Folium.
Goal:	The goal of the "Analyzing Geodata Based on Python" course is to equip students with the skills and knowledge necessary to effectively analyze and interpret geospatial data using Python.
Objective:	-understanding the fundamentals of geodata; - to gain knowledge of various geospatial data types (raster and vector) and formats -developing practical skills in visualize geospatial data using Python visualization libraries; - To apply advanced geospatial analysis methods; - to design and execute practical projects that demonstrate the application of geospatial analysis techniques to real-world problems.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Effectively use Python programming and its libraries to perform various geospatial data manipulation. LO 2. Understand and handle different types of geospatial data. LO 3. Execute spatial analysis operations. LO 4. Perform operations on raster data. LO 5. Apply geocoding and reverse geocoding techniques to convert addresses to geographic coordinates. LO 6. Create effective visualizations of geospatial data using Python libraries LO 7. Design and implement practical projects that apply geospatial analysis techniques to real-world problems

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 Geospatial Data and Python. - Geospatial Data Formats and I/O. - Data Manipulation with Pandas and GeoPandas - Visualization of Geospatial Data - Spatial Analysis Techniques - Raster Data Analysis - Geocoding and Reverse Geocoding - Advanced Spatial Analysis. Modeling spatial relationships and patterns - Data Integration and Cleaning - Case Studies in Geospatial Analysis - Performance Optimization in Geospatial Processing - Practical Project Work. Designing and implementing a geospatial analysis project - Ethical and Legal Considerations. Privacy and security issues in geospatial data - Emerging Trends in Geospatial Technology. Future directions and innovations in geospatial analysis - Review and Integration. Integration of skills and knowledge into comprehensive geospatial analysis
Literature:	Literature 1. "Python Geospatial Analysis" by Erik Westra, published by Packt Publishing in 2018, 1st Edition, 262 pages. 2. "Geoprocessing with Python" by Chris Garrard and J. L. Harter, published by Esri Press in 2010, 1st Edition, 270 pages. 3. "Geospatial Analysis: A Comprehensive Guide" by Michael DeMers, published by Wiley in 2014, 5th Edition, 572 pages. 4. "Python for Geospatial Data Analysis" by Joel Lawhead, published by Springer in 2021, 1st Edition, 299 pages.

6.15. Multi-core processor architecture	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Rajabov Farkhat Farmanovich
Component:	Elective
Cycle:	Core
Credit point:	6
Pre-requisities	Parallel computer architecture and 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: Written
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 "Multi-core Processor Architecture" course provides an in-depth understanding of modern multi-core processors, focusing on their design, functionality, and performance optimization. Students will explore key concepts such as parallelism, threading, memory hierarchies, and inter-core communication. The course covers techniques for efficient workload distribution and synchronization among cores, as well as strategies for maximizing performance while minimizing power consumption. Practical applications and case studies are used to illustrate how multi-core architectures are utilized in various computing environments.
Goal:	The goal of the "Multi-core Processor Architecture" course is to equip students with a comprehensive understanding of multi-core processor design and optimization, enabling them to effectively harness parallel processing power for high-performance computing.
Objective:	- understand the fundamental principles of multi-core processor design and architecture; - analyze and compare different multi-core architectures and their impact on performance; - develop skills in parallel programming and workload distribution across multiple cores; - explore memory hierarchy and its role in optimizing multi-core processor performance; - investigate inter-core communication mechanisms and their implications for system efficiency; - apply techniques to minimize power consumption while maintaining high processing efficiency in multi-core systems.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understand the core concepts and architecture of multi-core processors. LO 2. Analyze and optimize the performance of multi-core systems. LO 3. Develop and implement parallel algorithms for multi-core environments. LO 4. Manage and optimize memory hierarchy in multi-core processors. LO 5. Design and implement efficient inter-core communication strategies. LO 6. Apply techniques to balance power consumption and performance in multi-core 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); - 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. Overview of multi-core architecture and its evolution - Parallelism in Multi-core Systems. Types of parallelism: instruction-level, thread-level, and data-level - Processor Design and Architecture - Memory Hierarchy in Multi-core Processors. - Interconnects and Communication in Multi-core Systems - Synchronization and Concurrency. Mechanisms for synchronization (locks, semaphores, barriers). - Parallel Programming Models and Frameworks. Shared memory vs. distributed memory models. - Performance Optimization Techniques. - Power Management in Multi-core Processors. Dynamic voltage and frequency scaling - Real-time and Embedded Multi-core Systems - Virtualization in Multi-core Environments. - Security challenges in multi-core systems. - Analysis of popular multi-core processors. - Future Trends in Multi-core Architectures. Emerging trends in processor design. - Project Work and Research in Multi-core Systems
Literature:	Literature 1. "Computer Architecture: A Quantitative Approach" by John L. Hennessy and David A. Patterson, published by Morgan Kaufmann in 2017, 6th edition, 936 pages. 2 "Parallel Computer Architecture: A Hardware/Software Approach" by David E. Culler and Jaswinder Pal Singh, published by Morgan Kaufmann in 1999, 1st edition, 1056 pages. 3. "Principles and Practices of Interconnection Networks" by William J. Dally and Brian Towles, published by Morgan Kaufmann in 2004, 1st edition, 550 pages. 4. "Multicore Processors and Systems" edited by Stephen W. Keckler, Kunle Olukotun, and H. Peter Hofstee, published by Springer in 2009, 1st edition, 304 pages.

6.16. Multimedia Database	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Kuvnakov Avaz Ergashevich
Component:	Elective
Cycle:	Core
Credit point:	6
Pre-requisities	Database, Data structure 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: Written
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 Mobile Applications Development course will guide you through the principles of designing, developing, and deploying mobile apps. You'll explore mobile platforms, user interface design, application architecture, programming languages, and tools specific to mobile development. The course also covers app testing, performance optimization, and mobile security best practices.
Goal:	The purpose of mastering the discipline is to provide students with comprehensive theoretical knowledge and practical skills in designing, developing, and deploying mobile applications.
Objective:	- Understanding the fundamentals of mobile app development; -Learning mobile platforms and development frameworks; -Gaining practical skills in designing and building user interfaces; -Developing, testing, and deploying mobile applications; - Optimizing app performance and ensuring mobile security; - Exploring modern trends and emerging technologies in mobile development.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understand the key concepts of mobile application development. LO 2. Design intuitive and user-friendly mobile interfaces. LO 3. Develop and deploy mobile applications for various platforms. LO 4. Utilize development frameworks and tools effectively. LO 5. Optimize mobile app performance and ensure security. LO 6. Adapt to emerging trends and technologies in the mobile app industry.
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 (1-10)</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: History of mobile application development. Early mobile devices and mobile applications. Modern mobile OSes.
- Languages and technologies for creating mobile applications: programming for iOS and Android, emulators.
- Platforms for placing mobile applications: Play Market, Apple Store internet stores.
- Principles of mobile application development, requirements study and technical assignment formulation, platform selection.
- Mobile application design development, UI/UX design.
- Cross-platform programming technologies: DART => Flutter technology, installation and configuration of Android Studio.
- Flutter: Android Studio interface, writing the first program and using it in the emulator, familiarization with components.
- Flutter: working with basic components in Android Studio: Layout, Table, ListView, Grid, List, etc.
- Flutter: Create a simple calculator app in Android Studio, test it on an emulator and install it on a mobile phone.
- Flutter: working with database in Android Studio, connection with SQLite, MySQL MBBTs.
- Flutter: learning how to work with the API using the example of a mobile application working with a Telegram bot in Android Studio.
- Flutter: learning how to work with the API using the example of a mobile application working with a Telegram bot in Android Studio.
- Flutter: A full-fledged mobile application in Android Studio: building a simple messenger.
- Convert Android application written in Flutter to iOS, place the application in Play Market and Apple Store.
Security parameters, permissions, data encryption in the development and use of mobile applications.</td></tr>
<tr><td>Literature:</td><td>1. "The Mobile Frontier: A Guide for Designing Mobile Experiences" by Rachel Hinman. 2. "Programming iOS 14" by Matt Neuburg. 3. "User Interface Design and Evaluation" by Debbie Stone, Caroline Jarrett, Mark Woodroffe, and Shailey Minocha. 4. "Flutter for Beginners" by Alessandro Biessek. 5. "Flutter Recipes: Mobile Development Solutions for iOS and Android" by Fu Cheng. 6. "iOS and Android App Stores: The Pros and Cons of Selling in the Apple App Store and Google Play" by Chris A. Cohen.</td></tr>
</table>

<table>
<tr><td colspan="2">6.17. Bioinformatics and biomechanics</td></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>Atadjanova Nozima Sultan-Muratovna</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>Signal and image processing</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>Written</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>Bioinformatics and biomechanics course will encourage you to understand organizational parts of bioinformatics and biomechanics, the mechanical properties of biological tissues, the methods of organizing bioinformatics databases of human movement, and the stages of processing bio signals through software tools..</td></tr>
<tr><td>Goal:</td><td>The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in bioinformatics and biomechanics.</td></tr>
<tr><td>Objective:</td><td>-understanding the fundamentals of bioinformatics and biomechanics; -studying software and hardware for recording bio signals; -developing practical skills in Summary and interpretation of statistical data; - evaluation of the relationship between output and input parameters using a statistical software package.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Understand mechanical properties of biological tissues.
LO 2. Understand the stages of processing bio signals through software tools
LO 3. Possess skills statistical methods of generalization and interpretation of biomedical signals.
LO 4. Use description steps of bioinformatics and biomechanics models, development of models and algorithms for acquisition and processing of bioinformatic signals.
LO 5. Perform in order to solve practical problems in medicine, one should have the skills to select bioinformatics data structures and models
LO 6. Create digital processing programs for biomedical signals based on developed models and algorithms.</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">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>History of formation of bioinformatics as a science
Development challenges and achievements of bioinformatics
Mechanical properties of biological tissues
Software and hardware tools for recording biosignals
Appearance of biosignals
Stages of statistical research
Methods of determining the significance of biomedical data
Methods of statistical processing of biomedical data
Biomedical data processing software
Organization structure of bioinformatics and biomechanics database
Studying the important parameters of the Student criterion based on Excel tables.
Estimating the relationship between output and input parameters using the statistical software package Taminot.
Creating non-linear regression models using static software.
Use of an automated workstation for a doctor in medical practice.
Use of medical information systems in the management of medical-prophylactic institutions.</td></tr>
<tr><td>Literature:</td><td>Literature 1. Chen J.-W., Tanaka S., Howlett R.J., Jain, L.C. Innovation in Medicine and Sealth Sara 2016 - 315 p. 2. B.Bouchard. Smart Technologies in Healthcare. 2017. -235 p.3. Цифровая обработка биомедицинских сигналов и изображений :пособие / А. В. Фролов [и др.]. – Минск : БГУИР, 2016. – 64 с. : ил.</td></tr>
</table>

6.18. Cloud Computing	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Kuvnakov Avaz Ergashevich
Component:	Elective
Cycle:	Core
Credit point:	6
Pre-requisities	Database
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: Written
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 introduces students to Cloud computing system architecture, cloud systems, infrastructure creation, cloud parallel processing, distributed storage systems, virtualization, cloud security, and multi-core operating systems and real-world Google, Amazon, Microsoft, Yandex, VMWare, and etc. To teach modern solutions for cloud computing developed by, as well as practical use of their applications, capabilities of simulation programs and skills of infrastructure management.
Goal:	To teach modern solutions for cloud computing developed by, as well as practical use of their applications, capabilities of simulation programs and skills of infrastructure management.
Objective:	-Computer Organization CAO1316; - Computer Networks NWK1316; - Network Security NWS1416; - Must have the skills to effectively use cloud computing models;
Learning outcome:	After studying the discipline, students should be able to: LO 1. Must know terms related to cloud computing systems. LO 2. Must know the basic concepts of cloud computing theory. LO 3. Must know basic techniques used in cloud computing applications. LO 4. Must be able to apply knowledge of cloud computing in practice to analyze problem in calculation processes, formulate solution and find its solution. LO 5. Design and operation of cloud computing applications LO 6. Development and use of a new service based on cloud computing
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;

<table>
<tr><td></td><td>- 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 to cloud computing.
- Architecture, models and technologies of cloud computing.
- Organization of virtual machines and services.
- Ensuring security in cloud systems.
- Monitoring and management of cloud systems
- Moving various services to the cloud
- Cloud computing tools and technologies.
- IP addressing and subnets
- Cloud Computing Systems Research
- Mobile devices and cloud computing.
- Analysis of existing cloud infrastructures.
- Working in the Google Drive Cloud system.
- Open source private cloud creation and service virtualization (Windows, Linux, Mobile)
- Creation and use of IaaS infrastructure
- Creation and use of PaaS infrastructure
- Creation and use of SaaS infrastructure</td></tr>
<tr><td>Literature:</td><td>Literature 1. Fox, Armando. Engineering Software as a Service: An Agile Approach Using Cloud Computing [Text] : монография / A. Fox, D. Patterson. - San Francisco : Strawberry Canyon LLC, 2014. - 478 p.. 2. Baranwal G. [et al.]. Auction Based Resource Provisioning in Cloud Computing [Text] : монография - Singapore : Springer, 2018. - 113 p.. 3. T. E. Delov, Bulutli texnologiyalar [Text] : O'quv qo'llanma / O'z R Oliy va o'rta maxsus ta'lim vazirligi, Muhammad Al-Xorazmiy nom. TATU. - T. : "Nihol print" OK , 2021. - 196 b. 4. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski. Cloud Computing: Principles and Paradigms. John Wiley & Sons, Inc. 2011. 664 p. (Pdf)</td></tr>
</table>

6.19. Distributed systems	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Turayev Bobur
Component:	Elective
Cycle:	Core
Credit point:	6
Pre-requisities	Parallel computer architecture and 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: Written
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
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 "Distributed Systems" course provides an overview of the principles and challenges of designing and managing distributed computing environments. It covers key topics such as communication models and protocols, including message passing and remote procedure calls. The course delves into synchronization and coordination mechanisms, addressing issues like mutual exclusion and distributed consensus. Students learn about data consistency models and replication techniques, focusing on how to maintain consistency across distributed data stores. Additional topics include fault tolerance, scalability, and security considerations in distributed systems. The course combines theoretical concepts with practical applications to prepare students for real-world distributed system design and implementation.
Goal:	The goal of the "Distributed Systems" course is to equip students with the knowledge and skills to design, implement, and manage distributed computing systems, addressing challenges related to communication, synchronization, consistency, and scalability.
Objective:	- gain a thorough understanding of the fundamental concepts and characteristics of distributed systems; - learn and apply various communication models and protocols used in distributed systems; - develop skills in implementing synchronization and coordination mechanisms to manage concurrency; - understand different data consistency models and replication techniques; - learn methods to ensure fault tolerance and scalability in distributed systems.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Create effective architectures for distributed systems. LO 2. Utilize various communication models and protocols. LO 3. Implement and manage synchronization mechanisms to coordinate activities. LO 4. Analyze and apply data consistency models and replication techniques to maintain data integrity. LO 5. Develop strategies to enhance fault tolerance and handle failures in distributed systems.

	LO 6. Apply security principles and measures to protect distributed systems from vulnerabilities and threats
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)	24	40	100
	Independent work	6		
	Oral presentation	10		
Mid-term control	Written work	10		
Final control	Exam (Written)	50		

Topics of lectures:	- Introduction to Distributed Systems - Communication Models and Protocols - Synchronization and Coordination. Techniques for synchronization - Time and Ordering. Logical clocks, vector clocks, and their use in distributed systems - Consistency Models. Strong consistency, eventual consistency, and other consistency models - Replication Techniques. Data replication strategies and protocols - Fault Tolerance and Reliability. - Scalability and Load Balancing. Load balancing techniques and tools - Distributed Databases. Data distribution, partitioning, and query processing - Distributed File Systems. Data storage, retrieval, and consistency - Security in Distributed Systems. Authentication, authorization, encryption, and data integrity - Distributed Algorithms. Applications and performance considerations - Middleware and Distributed Services - Case Studies and Applications. Analysis of real-world distributed systems and their design - Emerging Trends and Future Directions. Recent advancements in distributed systems technology
Literature:	Literature 1. "Distributed Systems: Principles and Paradigms" by Andrew S. Tanenbaum and Maarten Van Steen, published by Prentice Hall in 2007, 1st Edition, 592 pages. 2."Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems" by Martin Kleppmann, published by O'Reilly Media in 2017, 1st Edition, 624 pages. 3. "Distributed Systems: An Algorithmic Approach" by Sukumar Ghosh, published by CRC Press in 2008, 1st Edition, 352 pages. 4. "Distributed Systems for Fun and Profit" by Mikito Takada, available online at distributed.systems since 2011, 1st Edition, 88 pages.

<table>
<tr><td colspan="2">6.20. Data Mining</td></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>Kuchkorov Temurbek</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>Probability and statistics, Programming I, Fundamentals of artificial intelligence</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>Written</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>The subject “Data Mining” is aimed at developing students’ theoretical knowledge, practical skills, the use of methods and tools of intellectual analysis when solving problems such as searching, collecting, sorting, classifying, and evaluating information on the subject area being studied on the basis of modern information technologies.</td></tr>
<tr><td>Goal:</td><td>To provide students with systematized theoretical knowledge and data analysis.</td></tr>
<tr><td>Objective:</td><td>The objectives of the course "Intelligent Data Analysis" may include:
– Introduction to the fundamentals of data mining (Data Mining)
– Study of data analysis methods and algorithms
– Application of data analysis tools
– Analysis and interpretation of results
– Ethical aspects of data analysis</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Have an idea of modern methods of data mining and their application, the history of their creation, as well as mathematical and software tools for data mining;
LO 2. Be able to make decisions based on intelligent analysis tools, know and use the features of the process,
LO 3. Be able to widely use methods and software of intellectual analysis in solving problems of the national economy;
LO 4. Be able to systematically analyze problems to be solved based on intellectual analysis, solve problems of identification and synthesis,
LO 5. Use modern information technologies and graphical capabilities of applied mathematical programs at different stages of data collection and processing.</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)	24	40	100
	Independent work	6		
	Oral presentation	10		
Mid-term control	Written work	10		
Final control	Exam (Written)	50		

Topics of lectures:	– Introduction to the Subject: The concept and fundamentals of intelligent data analysis. Applications of data analysis in fields such as statistics, machine learning, and databases. – Data Properties: Types of data objects and attributes. General statistical classification of data. – Syntax of Software Tools for Data Analysis: Overview of programming tools used in intelligent data analysis (Matlab / Python). – Software Tools and Libraries for Intelligent Data Analysis: Key libraries and tools (pandas, numpy, matplotlib, scikit-learn, scipy). – Graphical Data Representation: Data visualization methods (bar, pie, histogram, scatter). – Data Preprocessing: Data cleaning, sorting, and ensuring data integrity. – Data Processing, Modification, and Reduction: Data reduction techniques and regularization. – The Linear Regression Problem: Linear regression with one and multiple variables. Building a linear regression model and addressing correlation issues. – The Classification Problem: General concepts. Decision tree (Decision tree) and Bayesian classification. – Classification Algorithms Based on Machine Learning: Support Vector Machine (SVM) classification and K-Nearest Neighbors (KNN) method. – Concept of Artificial Neural Networks: Artificial neural networks, perceptron, weights, loss function, optimization function, activation functions, and the concept of backpropagation. – Classification Based on Artificial Neural Networks: Single-class and multi-class classification. – Model Evaluation and Selection: Methods to improve classification accuracy. – Clustering Problem Solving: Use of clustering methods (K-means, K-Medoids).
Literature:	Literature 1. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining Concepts and Techniques Third Edition. 2012, 703 pages. 2. Aurelian Geron, Hands on Machine Learning with Scikit-Learn Keras&Tensorflow // Second edition Concepts, Tools, and Techniques to Build Intelligent Systems, 2019, 510 pages. 3. Oliver Theobald, “Machine Learning for Absolute Beginners”, second edition, 2017, 128 pages

<table>
<tr><td colspan="2">6.21. High-Performance Computing Systems</td></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>Rajabov Farkhat Farmanovich</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>Parallel computer architecture and programming, Multi-core processor architecture</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>Written</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>The "High-Performance Computing Systems" course examines the design and optimization of systems for high-speed computations. It covers the fundamentals of parallel computing, including parallel programming models and techniques. The course explores various HPC architectures, such as clusters and supercomputers, and focuses on both distributed and shared memory systems. Students learn about storage and I/O solutions, performance tuning, and the application of HPC in different domains. The course also discusses emerging technologies and future trends in HPC, preparing students to address challenges and leverage opportunities in high-performance computing.</td></tr>
<tr><td>Goal:</td><td>The goal of the "High-Performance Computing Systems" course is to equip students with the knowledge and skills to design, implement, and optimize high-speed computing systems for advanced applications.</td></tr>
<tr><td>Objective:</td><td>- gain a comprehensive understanding of high-performance computing principles; - learn and apply parallel computing models and programming techniques; - explore various HPC architectures; - develop skills in performance tuning and benchmarking to enhance the efficiency; - understand and implement high-performance storage systems; - stay informed about emerging technologies and future trends in HPC.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Develop and design high-performance computing systems tailored to specific computational needs and applications.
LO 2. Write and optimize parallel programs using various programming models and languages.
LO 3. Assess and compare different HPC architectures.
LO 4. Apply performance tuning techniques and benchmarking tools to enhance the efficiency and scalability of HPC systems.
LO 5. Implement effective high-performance storage and I/O solutions to manage and access large-scale datasets efficiently.
LO 6. Evaluate and integrate emerging HPC technologies and trends</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)	24	40	100
	Independent work	6		
	Oral presentation	10		
Mid-term control	Written work	10		
Final control	Exam (Written)	50		

Topics of lectures:

- Introduction to High-Performance Computing
- Parallel Computing Basics. Concepts of parallelism and concurrency
- Parallel Programming Paradigms. ntroduction to parallel programming models
- GPU Programming and CUDA.
- HPC Architectures and Components. Key hardware components
- Distributed Memory Systems. Design and management of distributed memory systems
- Shared Memory Systems. Techniques for synchronization and coordination
- High-Performance Storage Systems
- I/O Performance and Optimization. Data access and retrieval strategies
- Scalability Challenges and Solutions. Addressing scalability issues in parallel applications
- Performance Tuning and Benchmarking. Tools and techniques for performance tuning
- Applications of HPC. Case studies of HPC applications in scientific computing
- Fault Tolerance and Reliability. Error detection and recovery mechanisms
- Security in HPC Systems. echniques for protecting data and ensuring secure access
- Emerging Trends and Future Directions. Exploration of emerging technologies and trends in HPC

Literature:

Literature 1. "High-Performance Computing: Modern Systems and Practices" by Thomas Sterling, Matthew Anderson, and Maciej Brodowicz, published by Morgan & Claypool Publishers in 2016, 1st Edition, 236 pages. 2."Introduction to High Performance Computing for Scientists and Engineers" by Georg Hager and Gerhard Wellein, published by CRC Press in 2011, 1st Edition, 286 pages. 3. "Parallel Programming in C with MPI and OpenMP" by Michael J. Quinn, published by McGraw-Hill Education in 2004, 1st Edition, 720 pages. 4."GPU Computing Gems: Jade Edition" edited by Wen-mei Hwu, published by Morgan Kaufmann in 2011, 1st Edition, 684 pages..

<table>
<tr><td colspan="2">6.22. Big Data Management</td></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>Kuvnakov Avaz Ergashevich</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>Database, Data Mining</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>Written</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>The main goal of studying the discipline "Big Data Management" is to give students theoretical knowledge and practical skills in the field of analysis, processing and storage of big data. It also introduces the main concepts, technologies and tools for working with big data, such as data warehouses, analysis methods, machine learning and neural networks.</td></tr>
<tr><td>Goal:</td><td>Students get an idea of how big data technologies are used to solve practical problems in various fields. Studying the discipline allows students to master modern tools for big data analytics and prepares them to work with big data in their professional activities.</td></tr>
<tr><td>Objective:</td><td>-Computer Organization (CAO1316); -Computer Networks (NWK1316); - Network Security (NWS1416); - Database (DTBS16MBK); - Database Management (DBMG16MBK);</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Must know terms related to big data.
LO 2. It is necessary to master the basic concepts of the theory of big data management.
LO 3. It is also important to study the main methods used in big data management.
LO 4. To successfully apply knowledge in the field of big data in practice, it is important to be able to analyze problems in computing processes, formulate solutions to these problems and find optimal ways to solve them.
LO 5. Have a basic understanding of big data analysis concepts, such as big data characteristics, storage and processing technologies, and analysis methods.
LO 6. Be able to apply decision support systems and data warehouse models to solve big data analysis problems</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>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>- Course Description. Objectives and Tasks. Introduction to Big Data Analysis.
- Understanding Big Data. Characteristics of Big Data.
- Transition to Big Data and Planning Issues.
- Decision support systems. OLTP and OLAP technologies. Multidimensional data model.
- Concept of Big Data Storage. Logical Models of Data Warehouses
- Concept of Big Data Storage. Physical Models of Data Warehouses
- Big Data Processing Concept
- Big data storage technology
- Basic methods of big data analysis. Modern software tools for analyzing large volumes of information
- NoSQL Database.Introduction to NoSQL
- MongoDB. CRUD Operations and Nesting.
- Indexing, grouping, mapreduce.
- Replica sets, sharding, spatial queries, GridFS
- Linear models for classification and regression. Support vector machines. Algorithmic compositions
- Application of Big Data in Artificial Intelligence
- Setting up a single-node Hadoop cluster. Install Hadoop locally and run MapReduce demos</td></tr>
<tr><td>Literature:</td><td>Literature 1. Alimova F.M., Kushmanova M.A., Naim N.A. BIG DATA. Study guide, Tashkent, 2021, TATU, 161 pages, ISBN 978-9943-7800-0-2. 2. Thomas Earle, Wadjik Khattak, Paul Buller. The basis of BIG DATA. Concept, algorithm and technology. Balance Business Books, 2018, 325 p. 3. Nutin Kumar. BigData. Using Hadoop and Hive, Mercury Learning and Information, Boston, 2021, 205. 4. Borko Furht, Armando Escalante. Handbook of Cloud Computing. Springer Science+Business Media, LLC 2010, 686 p.</td></tr>
</table>

<table>
<tr><td colspan="2">6.23. Computer vision</td></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>Sadikov Rustamjon Tokhirovich</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>Fundamentals of artificial intelligence, 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>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>Written</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>Computer vision course will encourage you to understand fundamentals of computer vision, working with color images, color basics, color models, stereotype, image processing methods, linear models and optimization, object detection (RCNN, Fast RCNN), image segmentation and neural networks.</td></tr>
<tr><td>Goal:</td><td>The purpose of mastering the discipline is to give students systematized theoretical knowledge and practical skills in building computer vision.</td></tr>
<tr><td>Objective:</td><td>-understanding the fundamentals of color basics; -studying color models, stereotype -developing practical skills in image segmentation; -analyzing and optimizing neural networks; -exploring modern trends and technologies in computer vision.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Understand how a computer vision works.
LO 2. Understand the process of object detection in the computer vision.
LO 3. Possess skills in image segmentation and image processing.
LO 4. Use method of determining the shape of an object.
LO 5. Perform frequency processing of images
LO 6. Perform work with Kalman filter and recursive median filter.</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",</td></tr>
</table>

<table>
<tr><td></td><td>"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 to the course, the history of the development of computer vision, the basics of computer vision.
- Basics of working with color images. Color models. Pseudo color image processing.
- Stereo image. Epipolar geometry. Epipolar boundary concept. Stereotypical systems.
- Image processing methods. Denoise the image. Linear filtering.
- Linear models and optimization.
- Methods of processing images. Methods of object detection MeanShift/CAMShisft
- Methods of processing images. Methods of object detection ViolaJones.
- Methods of processing images. Frequency processing of images.
- The active form of the object. Adaptation. Method of determining the shape of an object.
- Motion recognition.
- Kalman filter. Recursive median filter. Recursive moving average filter. Low pass filter.
- Medical image diagnostics.
- Object detection (RCNN, Fast-RCNN, Faster RCNN, Mask RCNN),
- Image segmentation. Architecture FCN.
- Neural networks.</td></tr>
<tr><td>Literature:</td><td>Literature 1 L. Shapiro, Dj. Stokman Computer Vision-M.Binom. Knowladges of Laboratories, 2021. -752 s. 2. Devid Forsayt, Yan Pons Computer Vision. : - Computer Vision: modern approach. M.: «Vilyams», 2004. 928 si Snavely's CS5670 - Comell Tech- access to computer vision class (Spring Nuh 2021). 3. Bill Freeman, Antonio Torralba va Phillip Isola's 6.819/6.869: Advances inm Computer Vision class MIT (Spring 2021) . 4. Yann LeCun va Alfredo Canziani's DS-GA 1008: NYU da Deep Learning classes.</td></tr>
</table>

6.24. Big Data Technologies and Techniques	
Semestr:	8
Date of last modification:	31.08.2023
Teachers:	Kim Elena Valerevna
Component:	Elective
Cycle:	Core
Credit point:	4
Pre-requisities	Big data management
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: Written
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:	Big data processing technology represents the principles, methods of processing and analysis of big data, technologies, software applications, architecture and model of computer systems, as well as design issues for data processing in computer programs, the concept of big data storage.
Goal:	The purpose of the big data course is a research approach, core technologies, using quantitative and mixed methods in practice.
Objective:	- Understanding the basics of big data processing technologies, the concept of big data storage. Knowledge of big data concepts, IoT, cloud and cloud technologies, big data application analysis, correlation analysis
Learning outcome:	After studying the discipline, students should be able to: LO 1. The student should have a general understanding of big data migration and planning issues, technologies, big data concepts, applications and standard technologies. LO 2. Must have an understanding of enterprise technology, cloud system architecture, and big data storage concepts. LO 3. Students should have the skills to identify and prepare for data analysis, use basic big data analytics and qualitative methods as appropriate to their objectives. LO 4. The subject area of big data processing is a research approach, basic technologies that use quantitative and mixed methods in practice.
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: - enterprise technology and business intelligence for big data; - data processing methods in big data technologies; - big data technologies and their prospects; - enterprise technology and business intelligence for big data; - architecture of cloud systems used in big data.

<table>
<tr><td>Assessment of the student's knowledge:</td><td colspan="4"><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 colspan="4">- Introduction. Concepts, terms and definitions for big data
- Big Data Migration and Planning Challenges
- Big data methods and technologies
- Data processing methods in big data technologies
- Big data technologies and their prospects
- Enterprise technology and business intelligence for big data
- Architecture of cloud systems used in big data
- Big data storage concept
- Big Data Concepts
- Big Data Storage Technologies
- Identifying and preparing data for analysis
- Basic Big Data Analysis Techniques
- Qualitative methods for big data analysis
- Quantitative and mixed methods analysis of big data
- The subject area of big data processing is a research approach</td></tr>
<tr><td>Literature:</td><td colspan="4">Literature 1. Basic Big Data: Concept, Algorithm and Technology: Thomas Earle Publisher: Balance Business Books, 2018. 2. Methods and technologies for processing big data: educational manual / M.M. Zheleznov; Ministry of Science and Higher Education Russian Federation. Moscow: Publishing house MISS - MGSU, 2020. 3. Forman, J. Many numbers: Big data analysis using Excel / Dj. Master. – M.: Alpina Publishing House, 2019. – 461 p.</td></tr>
</table>

<table>
<tr><td colspan="2">6.25. Computer vision programming with a Raspberry PI</td></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>Rajabov Farkhat Farmanovich</td></tr>
<tr><td>Component:</td><td>Elective</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>Credit point:</td><td>4</td></tr>
<tr><td>Pre-requisities</td><td>Computer Vision, Embedded systems, Operating systems</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>Written</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>Computer vision programming with a Raspberry PI course will encourage you to understand an computer vision programming with a Raspberry PI, technologies and Raspberry PI device, tools and libraries for computer vision programming, computer vision methods and architectures, using Raspberry PI.</td></tr>
<tr><td>Goal:</td><td>The goal of teaching science is to introduce students to the algorithms, methods and concepts of computer vision, to provide them with the technical basis of computer vision technology, image processing methods and software tools, modern concepts and software systems in computer vision. includes learning to implement knowledge on the Raspberry Pi platform.</td></tr>
<tr><td>Objective:</td><td>-understanding the fundamentals of computer vision;
-studying Raspberry Pi platform
-developing practical skills in computer vision programing with a Raspberry PI;
-analyzing and optimizing computer vision programmes;</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Should have a general understanding of Raspberry Pi development history, software applications, and standard technologies.
LO 2. Computer architectures, elements, data representation, multiprocessor elements, Rasberry Pi architecture should have an idea.
LO 3. Must have the ability to distribute data and tasks between cores on a Raspberry Pi.
LO 4. Should have the skills to evaluate the performance level of serial and parallel computing processes on Raspberry Pi, to create a signal and image data processing program using OpenCV libraries.</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 (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>- The purpose, task and content of science. Object and subject of science. Content and main directions. Modern problems and development trends
- Principles of object visualization using Raspberry Pi
- OpenCV API capabilities. Uploading and printing an image using a Raspberry Pi. Image processing. Point operators.
- Change image and video parameters using Raspberry Pi. Change brightness and contrast with Raspberry Pi. Histogram synchronization.
- Filter images. Smoothing images with Raspberry Pi. Use of smoothing types.
- Digital Image Processing on Raspberry Pi. Using the P-Qt5 platform in digital image processing.
- Image discretization and quantization on Raspberry Pi. Geometric shape transformation operations on images. Sequence of operations.
- Morphological operations on images. Image expansion, image rotation operations. Use of software tools in performing morphological operations.
- Identifying and customizing properties. Detecting image edges using Python. Filtering processes in image recognition in Python. Problems of determining the boundaries of objects located in the image.
- Object segmentation. Refinement of active contours. Processes of segmentation in the recognition of objects in the composition of the image.
- Object segmentation. Separation and integration. Normalization of cross sections.
- Computational photography. Photometric calibration. High dynamic range viewing.
- Recognize objects. Familiar categories. Facial recognition features. Algorithms for extracting the human face contained in the image. Using the OpenCV library.
- Object tracking in video scenes on Raspberry Pi. Use of computer vision technologies in dynamic images. Trace through contours.
- Recognition database and testing. Formation of a database for the recognition of objects in the image. Testing and debugging familiarization processes by testing them in practice.</td></tr>
<tr><td>Literature:</td><td>1. R.N. Usmanov, T.A. Kuchkorov, A.B. Abdusalomov. “Kompyuter ko’rishi” o’quv qo’llanma, T:. – 2018. 173 bet.
2. Tinku Acharya and Ajoy K. Ray. Image Processing Principles and Applications, John Wiley and Sons, Inc., Publication, 2005. 451 p..
3. Richard Szeliski. Computer Vision: Algorithms and Applications. – 2011 Springer – 979pp..
4. Simon Monk. Raspberry Pi Cookbook: Software and Hardware Problems and Solutions 2nd Edition, ISBN-10-9781491939109, July 12, 2016, 522 b</td></tr>
</table>

6.26. Individual project

Semestr:	5
Date of last modification:	31.08.2023
Teachers:	Botirov Sokhibjon
Component:	Compulsory
Cycle:	Core
Credit point:	4
Pre-requisites	–

Workload:

Types of classes	Hours
Total	120
Lecture	-
Practical works	48
SAW (Student autonomous work)	72
Form of final control	Report

Control forms:	Report
Final control:	The student defends the completed project by presenting it to the commission, and each member of the commission evaluates the work.
Short content:	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.
Goal:	The goal of the individual project course is to deeply master the scientific and theoretical foundations of specialized subjects by students.
Objective:	Concept of individual project, project activity, project culture; Goals, design tasks, problems in the modern world.
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. 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.
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.

Assessment of the student's knowledge:

Type of task	Number of points (max)	Total
Completeness of theoretical material	**0-20**	**0-100**

	Implementation of the practical part of the project	**0-30**	
	To answer the given questions clearly and succinctly	**0-50**	
Topics of lectures:	- 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.		
Literature:	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.		

6.27. Qualification Practice 1 (Practical Training)	
Semestr:	6
Date of last modification:	31.08.2023
Teachers:	Rakhimov Mekhriddin Fazliddinovich
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>

<table>
<tr><th colspan="2">6.28. Qualification Practice 2 (Pre-Graduation Work Practice)</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>Rakhimov Mekhriddin Fazliddinovich</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>Pre-requisites</td><td>Qualification Practice 1 (Practical Training)</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>-</td></tr>
<tr><td>Practical works</td><td>-</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>180</td></tr>
<tr><td>Final assessment method</td><td>Practice Report</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Practice Report</td></tr>
<tr><td>Final control</td><td>The report is the individual work of the student in the form of a report on the subject of the graduation qualification work.</td></tr>
<tr><td>Short content:</td><td>In modern conditions, mastering the necessary skills and experience of practical work in one's specialty and preparing for graduation work.</td></tr>
<tr><td>Goal:</td><td>The goal of pre-graduation practice is comprehensive development of all types of professional activities of students in their fields.</td></tr>
<tr><td>Objective:</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.</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. 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.</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>

Assessment of the student's knowledge:	**Type of task**	**Number of points (max)**	**Total**
	Complete and accurate completion of the task	**0-50**	**0-100**
	Being able to demonstrate the ability to think independently within the framework of pre-graduate work practice	**0-20**	
	To answer the given questions clearly and succinctly	**0-30**	
Topics of lectures:	- 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		
Literature:	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.		

<table>
<tr><td colspan="2">6.29. Graduation qualification work</td></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>Rakhimov Mekhriddin Fazliddinovich</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.