MINISTRY OF HIGHER EDUCATION, SCIENCE AND INNOVATION

TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES NAMED AFTER MUHAMMAD AL–KHWARIZMI

MODULE HANDBOOK

Educational Program

BA 60610700 – Artificial Intelligence

Tashkent 2024

Table A – Curriculum of BA 60610700 – Artificial Intelligence

1st semester	2nd semester	3rd semester	4th semester	5th semester	6th semester	7th semester	8th semester
HUM101 The newest history of Uzbekistan. 1 lectures 1 seminars 4 ECTS	HUM102 Religious studies 1 lectures 1 seminars 4 ECTS	DBM201 Database 2/1 lectures 1 practical session 6 ECTS	NWK201 Computer networks 2/1 lectures 1 practical session. 6 ECTS	DKB301 Design of Knowledge Base 2/1 lectures 1 practical session. 6 ECTS	MLR301 Machine Learning 1 lectures 0/1 practical sessions 4 ECTS	MLR402 Neural networks and deep learning 2/1 lectures 1 practical session. 6 ECTS	QPR402 Qualification Practice 2 6 ECTS
AWR101 Academic writing 2/1 practical sessions 4 ECTS	HUM103 Philosophy 1 lectures 1 seminars 4 ECTS	CSF201 Fundamentals of Cyber Security 2/1 lectures 1 practical session 6 ECTS	IAI201 Introduction to Artificial Intelligence 2/1 lectures 1 practical session 6 ECTS	CCP301 Cloud computing 2 lectures 1 practical session 8 ECTS	EBS301 Embedded systems 2/1 lectures 1 practical session 6 ECTS	*Elective Subject* ITS407/ITS408 2/1 lectures 1 practical sessions 6 ECTS	GQW403 Graduation Qualification Work 14 ECTS
FRL101 Foreign language I 2/1 practical sessions 4 ECTS	FRL102 Foreign language I 2/1 practical sessions 4 ECTS	DSA201 Data structure and algorithms 2/1 lectures 1 practical session. 6 ECTS	WAC201 Create web applications 2/1 lectures 1 practical session. 6 ECTS	OPS301 Operating systems 2/1 lectures 1 practical session 6 ECTS	QPR402 Qualification Practice 1 6 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
MTH101 Calculus 2/1 lectures 1 practical session 6 ECTS	MTH102 Differential equations 1 lectures 0/1 practical seminars 4 ECTS	EAC201 Electronics and circuits1 2/1 lectures 1 practical session. 6 ECTS	MTH204 Probability and statistics 2/1 lectures 1 practical session. 6 ECTS	*Elective Subject* ITS303/ITS304 2/1 lectures 1 practical sessions 6 ECTS	*Elective Subject* ITS305/ITS306 2/1 lectures 1 practical sessions 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
PHY101 Physics I 1 lectures 1 practical sessions and laboratory 6 ECTS	DSST16MBK Discrete structures 1 lectures 0/1 practical session 4 ECTS	CAO201 Computer organization 2/1 lectures 1 practical session. 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	
PRG101 Programming I 1 lectures 2/1 practical sessions 6 ECTS	PHY102 Physics II 1 lectures 0/1 practical sessions and laboratory 4 ECTS				IDP301 Individual project 2/1 practical sessions 4 ECTS	-	
	PRG102 Programming II 1 lectures 2/1 practical sessions 6 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 60610700 – Artificial Intelligence

№	Code	1th subject	2nd subject
1.	ITS201/ITS202	Expert systems	Applied intelligent systems
2.	GEN301/GEN302	Pedagogy. Psychology	Life safety
3.	GEN303/GEN304	Fundamentals of entrepreneurship and business planning	Green economy
4.	ITS303/ITS304	Speech Information Processing	Time Series Analysis
5.	ITS305/ITS306	Natural Language Processing (NLP)	Speech recognition systems
6.	ITS407/ITS408	The Internet of Things	Human and computer interaction
7.	ITS409/ITS410	Cloud technologies	Parallel programming
8.	ITS411/ITS412	Computer vision	Pattern recognition systems
9.	ITS413/ITS414	Deep Learning	Reinforcement Learning
10.	ITS415/ITS416	Design of intelligent systems	Intelligent data analysis (Data Mining)
11.	ITS417/ITS418	Natural language recognition algorithms	Algorithms for intelligent data analysis

Syllabusses

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>
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<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="4">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>1/2</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Kasimova Zumrad Sabirzhanovna</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Secondary</td></tr>
<tr><td>ECTS:</td><td>4</td></tr>
<tr><td>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>
</table>

	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.
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**
Current control	Seminars	30	40	100
	Independent work	10		
Mid-term control	Written work	10		
Final control	Oral presentation	50		

Topics of lectures:	- 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
Literature:	1. Muratov D., Alimova M., Karimov J. Religious studies, textbook. - Tashkent, "Navroz" publishing house, 2019. - 264 p. 2. Rakhimdzhanov D., Ernazarov O. Introduction to religious studies. Study guide. - T.: Publishing House "National Society of Philosophers of Uzbekistan", 2018. - 304 p. 3. Isoqjanov R. Comparative religious studies. Study guide. - T.: OOO "Complex print", 2020. - 198 p. 4. Kamilov D. Religious studies. Study guide. - T.: Lesson Press, 2021. -128 p. Methodological manual of "Religious Studies"./Sh. Alimova. - T. 2018. -140 p.

<table>
<tr><td colspan="2">1.3. Philosophy</td></tr>
<tr><td>Semestr:</td><td>1/2</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>
</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>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>
</table>

<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="4">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>
</table>

2. Languages

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

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

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

<table>
<tr><td></td><td>- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">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>Islamova Odila Abduraimovna, Chay Zoya Sergeevna</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>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, Ganiyev 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);

<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>- 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, Ganiyev 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, Sadaddinova Sanobar Sabirovna</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">Current control</td><td>Practical works (1-3)</td><td>25</td><td rowspan="2">37</td><td rowspan="3">100</td></tr>
<tr><td>Independent work (1-2)</td><td>12</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">13</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to the subject. Differential equations with separable variables.
- Homogeneous and reducible to homogeneous differential equations. Application to applied tasks.
- Linear differential equations. Solution of linear differential equations by Lagrange and Bernoulli methods. Application to applied tasks.
- Bernoulli's equations.Equations in full differentials. Integrating multipliers.
- The differential equation is unresolved with respect to the derivative. The Lagrange and Clerault equations.
- Higher-order differential equations admitting a decrease in order.
- Linear differential equations of higher orders. Vronskian. Fundamental solutions. Basic theorems.
- Linear homogeneous differential equations with constant coefficients. The characteristic equation.
- Linear inhomogeneous differential equations with constant coefficients with a special right-hand side.
- Differential equations of the second order and their solution using the method of variation of arbitrary constants. The Ostrogradsky-Liouville formula.
- Approximate methods for solving differential equations (using mathematical packages).
- A system of differential equations. Methods of solutions.
- Original and image. Laplace transformations.
- Basic properties of the Laplace transform.
- Solving differential equations and systems of differential equations by the method of operational calculus.</td></tr>
<tr><td>Literature:</td><td>Literature 1. Khasanov Compiled A.B., An introduction to the theory of ordinary differential equations, Turan-Press 2019. 2.Yuzhov A.Q., Mirzakarimov E.M., Ordinary differential equations in the Maple system, Tashkent 2013. 3. Norbert Euler. A First Course in Ordinary Differential Equations.bookboon.com G. Black Mike, Mike Dunn, Programming Android with Kotlin, O'reilly Media, 2021.</td></tr>
</table>

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

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

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

3.6. Discrete Structures	
Semestr:	3
Date of last modification:	31.08.2023
Teachers:	Mamadaliev Khusniddin Abdijalilovich, Ismailova Lemara Rafatovna
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>6</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>5</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Saidova Gulchexra Alisherovna</td></tr>
<tr><td>Component:</td><td>Elective</td></tr>
<tr><td>Cycle:</td><td>Secondary</td></tr>
<tr><td>ECTS:</td><td>4</td></tr>
<tr><td>Pre-requisities</td><td>-</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of lessons</th><th>Hour</th></tr>
<tr><td>Total</td><td>120</td></tr>
<tr><td>Lecture</td><td>30</td></tr>
<tr><td>Practical work</td><td>18</td></tr>
<tr><td>SAW (Student Autonomous Work)</td><td>72</td></tr>
<tr><td>Final control form</td><td>Exam</td></tr>
<tr><td>Final evaluation method</td><td>Test</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes</td></tr>
<tr><td>Short content:</td><td>This course consists of lectures, practical classes and independent work of students aimed at in-depth study of theoretical knowledge with the help of practical skills. Life safety is the creation of normal human life conditions, protection of him and the environment (production, environment, everyday life) from dangerous and harmful factors of a natural and man-made nature.</td></tr>
<tr><td>Goal:</td><td>The course "Life Safety" provides basic concepts and definitions in the production and performance of work in private life. Defines visual concepts in the field of electrical safety, fire safety, electromagnetic safety, and also provides the necessary basis for the application of various types of lighting and noise effects on the human body and the environment.</td></tr>
<tr><td>Objective:</td><td>Distinguish ergonomic features of workplaces (light, noise, vibration, microclimate).</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Have an idea of the harmful effects of radiation on the human body and the environment
LO 2. Distinguish types, means of fire safety systems, as well as classify buildings by fire hazard
LO 3. Distinguish between methods and means of human protection in emergency situations
LO 4. He will get an idea of the main directions of the labor legislation of the Republic of Uzbekistan, protection of employees, current benefits
LO 5. Learns about modern electrical safety systems and the mechanisms of the effect of electricity on the human body</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, lessons are mainly conducted in active and creative forms. Among the effective pedagogical methods and technologies that help students actively participate in the search and management of knowledge, it is worth noting the acquisition of independent problem-solving experience:
- problem-based and project-based educational technology;
- educational and scientific activity technologies;
- communication technologies (discussion, press conference, brainstorming, educational debates and other active forms and methods);</td></tr>
</table>

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

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

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

4.4. Power supply for infocommunication systems	
Semestr:	5
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:	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 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, Saidov Samandar Muzaffarovich</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>Testing</td></tr>
<tr><td>Final assessment method</td><td>Exam</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. Mo‘minov B.B. Programming 1. Textbook. – T.: “Nihol print”, 2021. – 280 b. 2. Mo‘minov 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, Saidov Samandar Muzaffarovich</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>Testing</td></tr>
<tr><td>Final assessment method</td><td>Exam</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. Mo‘minov B.B. Programming 1. Textbook. – T.: “Nihol print”, 2021. – 280 b. 2. Mo‘minov 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
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.

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

<table>
<tr><td colspan="2">5.4. Fundamentals of Cybersecurity</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>Akhmedova Nozima Farkhod kizi, Kholimtaeva Ikbol Ubaydullaevna</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:	Mukhsinov Shamil Shavkatovich, Buriev Yusuf Absamat ugli
Component:	Compulsory
Cycle:	Core
ECTS:	6
Pre-requisities	Programming II
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Testing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is taken in the form of a test, which contains 25 questions, worth 2 points each, tests are divided into 3 levels of difficulty. Total exam time 60 minutes
Short content:	Data Structures and Algorithms course is a fundamental subject in computer science that focuses on the study of organizing and manipulating data efficiently. Data structures are the way data is organized and stored in a computer's memory, while algorithms are the step-by-step instructions for solving a specific problem.
Goal:	The purpose of "Data Structures and Algorithms" course is to provide a solid foundation in organizing, storing, and manipulating data efficiently in computer programs.
Objective:	-Understanding the fundamental data structures and their properties to effectively store and organize data;-learning various algorithms for searching, sorting, and manipulating data to solve real-world problems;-analyzing the performance of algorithms and data structures to make informed choices for optimizing code efficiency;-developing problem-solving skills by applying data structures and algorithms to solve complex computational problems;-enhancing software development capabilities by writing efficient and scalable code that can handle large datasets and perform tasks quickly.
Learning outcome:	After studying the discipline, students should be able to: LO 1. To be able to use data types correctly, to acquire the skills of using the technology of their creation. LO 2. Understand and apply properties of linear data structures. LO 3. Understand and apply the properties of static data structures. LO 4. Get an idea of List" type data structures. Ability to implement lists statically and dynamically. LO 5. To have an idea about the characteristics of dynamic data structures, to be able to use them LO 6. Be able to explain and apply the properties of non-linear data structure.
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities;

<table>
<tr><td></td><td>- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-15)</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>- 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><th colspan="2">5.6. Electronics and circuits, I</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>Saidov Kamoladdin Nuraddinovich, Sattarov Khurshid Abdishukurovich</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 (1-10)</td><td>25</td><td rowspan="3">40</td><td rowspan="5">100</td></tr>
<tr><td>Independent work</td><td>7</td></tr>
<tr><td>Oral presentation</td><td>8</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to Electronics and Circuits 1. The purpose and tasks of science;
- Electronic circuit simulators.
- An analysis of direct current and electric circuits;
- Calculating electric circuits and direct current;
- The main quantities of sinusoidal current and characterizing it;
- Characteristics of electrical circuits under the influence of a sinusoidal signal;
- Mutual induction circuits;
- Quadrupoles and filters;
- Transient processes in the electric circuit;
- The device operation of semiconductor and physical foundations;
- Contact phenomena in semiconductors;
- Semiconductor diodes;
- Bipolar transistors;
- Multilayer semiconductor devices;
- Field transistors (FT);</td></tr>
<tr><td>Literatures:</td><td>1. A.A. Tulyaganov, S.S. Parsiev, V.A. Tulyaganova, U.M. Abdullayev. Theory of electrical circuits. (tutorial), Communicator, 2018, 144 p. 2. X.K.Aripov, A.M. Abdullayev, N.B. Alimova, Electronics and circuit engineering (textbook) Tashkent.: « Communicator», 2017, 376 p. 3. Aripov X.K., Abdullaev A.M., Alimova N.B., “Schematic” (textbook), Tashkent. « The boston of thought», 2013, 447 p. 4. Ron Mancini, Amps For Everyone, 2002, Texas Instruments. 5. X.K. Aripov, A.M. Abdullayev, N.B. Alimova, Electronics (textbook) Tashkent, « Science and technology», 2011, 428 p. 6. Thomas F. Schubert, Jr., Ernest M. Kim. Fundamentals of Electronics Book 1: Electronic Devices and Circuit Applications, 2014,</td></tr>
</table>

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

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

<table>
<tr><th colspan="2">5.8. 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>Atadjanova Nozima Sultan-Muratovna, Sayfullaeva Nargiza Akromovna</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 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>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>25</td><td rowspan="3">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>7</td></tr>
<tr><td>Oral presentation</td><td>8</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- 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.” 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. 5. 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</td></tr>
</table>

5.9. 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="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 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] : o‘quv qo‘llanma Q. A. Bekmuratov.-T. : Aloqachi, 2019. - 312 b. - Adabiyotlar: 300 b.- 48 (adadi 100) экз.- ISBN 978-9943-5804-8-0 : 65150 so‘m 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 o‘qitish. 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: O‘Reilly Media 2020-390c. ISBN 13: 9781492078197.</td></tr>
</table>

5.10. Create web applications	
Semestr:	3
Date of last modification:	31.08.2023
Teachers:	Sadikov Rustam Tahirovich
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:	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.
Goal:	The study of this course is based on the knowledge gained in the study of "Programming", "Data base".
Objective:	-understanding the fundamentals of network technologies; -studying network protocols -developing practical skills in network configuration and management; -analyzing and optimizing network performance; -troubleshooting network issues; -exploring modern trends and technologies in networking
Learning outcome:	After studying the discipline, students should be able to: 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
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:	- 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>Sayfullayeva Nargiza Akromovna, 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>25</td><td rowspan="3">40</td><td rowspan="4">100</td></tr>
<tr><td>Independent work</td><td>7</td></tr>
<tr><td>Oral presentation</td><td>8</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Testing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction 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. Machine Learning	
Semestr:	6
Date of last modification:	31.08.2023
Teachers:	Nurmurodov Javohir Nurmurod ugli
Component:	Compulsory
Cycle:	Core
Credit point:	4
Pre-requisites	Database, Designing algorithms, Probability and Statistics
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 course teaches what every student needs to know about machine learning. Machine learning is one of the fastest growing technologies impacting our personal lives and society. This subject covers basic concepts of building blocks and components of artificial intelligence, algorithms, activation functions, machine learning and neural networks. It provides students with a balanced overview of the applications of machine learning algorithms in networks, their impact on existing jobs, and the potential to create new and exciting future industry trends, as well as the application areas and technologies of the field. A complete understanding of artificial neural network algorithms.
Goal:	The main goal of teaching science is to teach students how to use machine learning algorithms, how to create a learning sample and train a model based on a sample, and how to build simple neural networks and use special instrumental software tools. Analyzing incoming data from sensors based on machine learning algorithms and teaching robots to make decisions based on it.
Objective:	- to have basic concepts of machine learning; - 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. Basic concepts of machine learning. Statistical methods and their role in machine learning. Gain a general understanding of the application of machine learning in artificial intelligence. LO 2. Familiarity with types of machine learning. Teaching algorithms with and without a teacher. Get acquainted with the analysis and capabilities of the necessary instrumental tools (Octave/Matlab/Python/) for machine learning. LO 3 The concept of linear regression. Building a model for linear regression. Determining regression model coefficients. Acquires skills in model accuracy testing. LO 4. A multivariate form of regression analysis. Building a multivariate linear regression model. Multivariate regression model. Gradient descent method. Understands the concepts of stochastic gradient descent.

<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 (1-15)</td><td>30</td><td rowspan="3">40</td><td rowspan="5">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 machine learning
- Basics of linear algebra
- Types of machine learning
- Use of instrumental tools in machine learning
- Graphic representation of data
- Training sample (Dataset)
- The problem of linear regression in machine learning
- Classification issues in machine learning
- Classic classification algorithms
- The concept of regularization
- Unsupervised learning algorithms
- Solving the clustering problem
- Artificial neural networks
- Multi-level neural networks
- Solving the problem of classification based on neural network</td></tr>
<tr><td>Literature:</td><td>Literature 1. Keras&Tensorflow // Second edition Concepts, Tools, and Techniques to Build Intelligent Systems, 2019, 510 pages 2.Monica Bianchini, Milan Simic, Ankush Ghosh, Rabindra Nath Shaw // Machine Learning for Robotics Applications, Springer, 2020, 175 pages. 3.Oliver Theobald, “Machine Learning for Absolute Beginners”, second edition, 2017, 128 pages 4. Жуков Л.А., Решетникова Н.В. Приложения нейронных сетей: Учебное пособие для студентов, учащихся лицея и ЗПШНИ / Л. А. Жуков, Н. В. Решетникова. Красноярск: ИПЦ КГТУ, 2007. 154 с. 5. Галушкин А. И. Нейронные сети: основы теории. – М.: Горячая линия–. Телеком, 2012. – 496 с.: ил. ISBN 978-5-9912-0082-0</td></tr>
<tr><td></td><td>–</td></tr>
</table>

6.3. The Knowledge Base Design	
Semestr:	6
Date of last modification:	31.08.2023
Teachers:	Dadajonova Zilola Botirjon qizi, Kobilov Sirojiddin Sherkulovich
Component:	Compulsory
Cycle:	Core
Credit point:	6
Pre-requisites	Database, Data Structures and Algorithms
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	The Knowledge Base Design course encourages you to understand knowledge understanding, knowledge extraction technologies and devices, knowledge base design issues and models, knowledge management and representation methods, knowledge base structure and operational processes, in addition to software and hardware security of knowledge bases.
Goal:	The purpose of mastering the subject is to provide students with theoretical and experimental research in the field of software and software development, data analysis and knowledge base design, as well as the application of knowledge-based models in automated systems.
Objective:	- understanding the basics of the knowledge base; - basing on the project decisions made by thoroughly mastering the fundamentals of designing the knowledge base; - use of appropriate algorithms to check their correctness and effectiveness; - conducting experiments in creating a knowledge base and using artificial intelligence; - acquiring new knowledge in the fields; - reflect the created information technologies as a new element in the system.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understands the knowledge base design process. LO 2. To acquire skills in knowledge modeling and information interconnection. LO 3. Use knowledge representation models, apply them in fields, acquire skills to use knowledge in system automation. LO 4. Mining knowledge from data using artificial intelligence techniques and applying knowledge in developing expert systems
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities; - communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);

<table>
<tr><td></td><td>- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="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 (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to Knowledge Base Design. Concepts of database and knowledge base.
- Concept of data model. Applications of information in fields. Information and knowledge.
- Data design models. Display (expression) of knowledge.
- Knowledge representation models (frame, logical, semantic and product models)
- Concept of ethnology and its application in knowledge base design.
- Methods of knowledge design.
- The concept of an intelligent system.
- Development of knowledge-based systems.
- Expert systems development technologies.
- Application of expert systems in the design of the knowledge base.
- Application of fuzzy logic, reliability and evidence in expert systems.
- The concept of genetic algorithm in optimization problems.
- Knowledge management.
- Intellectual analysis of data. Intelligent internet technologies.
- Artificial neural networks. Application of artificial neural networks in knowledge extraction</td></tr>
<tr><td>Literature:</td><td>Literature 1. Дж. Джаратано, Г. Райли. Экспертные системы: принципы разработки и программирование. – М.: ООО “И.Д. Вильямс”, 2017. – 1152 с. 2. Д.Ф. Люгер. Искусственный интеллект: стратегии и методы решения сложных проблем. – М.: Издательский дом “Вильямс”, 2013. – 864 с. 3. Т.А. Гаврилова, В.Ф. Хорошевский, Базы знаний интеллектуальных систем. Санкт- Петербург: Питер, 2000. - 382 с. 4. “С. Осовский. Нейронные сети для обработки информации – М.: Финансы и статистика” 2017. – 345 с.</td></tr>
</table>

6.4. Cloud Computing

Semestr:	5
Date of last modification:	31.08.2023
Teachers:	Abduganiev Mukhriddin Mukhiddin ugli
Component:	Compulsory
Cycle:	Core
Credit point:	8
Pre-requisites	Database, Create web applications, Probability and Statistics
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 written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	This course provides an in-depth understanding of cloud computing, a vital component of modern IT infrastructure. It covers cloud service models (IaaS, PaaS, SaaS), deployment models, and virtualization technologies. Students will explore cloud architecture, data management, and security concerns, including identity and access management. The subject also looks at emerging trends like serverless computing and edge computing, equipping students with the skills to develop, manage, and optimize cloud-based solutions in various industries.
Goal:	The main goal of this course is to provide students with a thorough understanding of cloud computing technologies and architectures. It aims to cover essential concepts like service models, virtualization, and cloud security, while also exploring the management and optimization of cloud resources. The course prepares students to develop and implement cloud-based solutions for diverse applications.
Objective:	- Understanding the fundamental concepts of cloud computing. - Learning about cloud service models and deployment strategies. - Exploring security issues and solutions in the cloud.
Learning outcome:	After studying the discipline, students should be able to: LO 1: Understanding cloud computing architecture and models. LO 2: Implementing and managing cloud-based services. LO 3: Identifying and mitigating security risks in cloud environments.
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;

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<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>
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<table>
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<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 (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to Cloud Computing
- Cloud Service Models: IaaS, PaaS, SaaS
- Cloud Deployment Models: Public, Private, Hybrid, Community
- Virtualization Technology and Virtual Machines
- Cloud Storage and Data Management
- Cloud Networking and CDN (Content Delivery Networks)
- Cloud Security and Privacy Issues
- Cloud Application Development and Deployment
- Microservices Architecture and Containerization
- Cloud Cost Management and Optimization
- Cloud Monitoring and Management
- Serverless Computing and Function-as-a-Service (FaaS)
- Disaster Recovery and Business Continuity in the Cloud
- Emerging Trends: Edge Computing, IoT, AI in Cloud
- Major Cloud Providers: AWS, Azure, Google Cloud, and IBM Cloud</td></tr>
<tr><td>Literature:</td><td>Literature 1. A. Mahmood, E. Panaousis, "Cloud Security and Privacy: A Multi-Disciplinary Approach," Springer, 2021. 2. M. R. Simpson, "Cloud Computing: Principles and Paradigms," 2nd Edition, Wiley, 2021. 3. S. Erl, "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)," Wiley, 2021. 4. T. Erl, R. Cope, A. Naserpour, "Cloud Computing Design Patterns," Prentice Hall, 2022. 5. G. Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud," 2nd Edition, O'Reilly Media, 2021.</td></tr>
<tr><td></td><td></td></tr>
</table>

6.5. Neural networks and deep learning	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Ochilov Mannon Musinovich
Component:	Compulsory
Cycle:	Core
Credit point:	6
Pre-requisites	Data structure and algorithms, 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 / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	This course covers neural networks and deep learning, essential areas in artificial intelligence. Students will learn about the structure and functioning of artificial neural networks, including architectures like CNNs and RNNs. The course addresses key concepts such as activation functions, backpropagation, and optimization techniques. It also explores advanced topics like transfer learning, GANs, and deep reinforcement learning, providing a comprehensive understanding of how these technologies are applied to solve complex problems in vision, speech, and beyond.
Goal:	The goal of this course is to provide a deep understanding of neural networks and deep learning algorithms. It aims to teach students how to design, train, and optimize neural networks for various applications, including image recognition and natural language processing. The course also explores the latest advancements and ethical considerations in deep learning, preparing students for cutting-edge research and development in AI.
Objective:	- Learning the structure and functioning of neural networks. - Understanding the principles of deep learning. - Developing and applying deep learning models to solve complex problems.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Basic concepts of machine learning. Statistical methods and their role in machine learning. Gain a general understanding of the application of machine learning in artificial intelligence. LO 2. Familiarity with types of machine learning. Teaching algorithms with and without a teacher. Get acquainted with the analysis and capabilities of the necessary instrumental tools (Octave/Matlab/Python/) for machine learning. LO 3 The concept of linear regression. Building a model for linear regression. Determining regression model coefficients. Acquires skills in model accuracy testing. LO 4. A multivariate form of regression analysis. Building a multivariate linear regression model. Multivariate regression model. Gradient descent method. Understands the concepts of stochastic gradient descent.

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<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>
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<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 (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to Neural Networks and Deep Learning
- Biological Neurons and Artificial Neurons
- Activation Functions and Their Properties
- Neural Network Architectures: Single-Layer, Multi-Layer Perceptrons
- Backpropagation and Gradient Descent
- Optimization Techniques: SGD, Adam, RMSprop
- Regularization Techniques: Dropout, L2 Regularization
- Convolutional Neural Networks (CNNs): Architecture and Applications
- Pooling Layers and CNN Hyperparameters
- Recurrent Neural Networks (RNNs) and LSTM/GRU Networks
-Sequence-to-Sequence Models and Attention Mechanisms
- Deep Learning Frameworks: TensorFlow, Keras, PyTorch
- Generative Adversarial Networks (GANs). Deep Reinforcement Learning
- Ethical Considerations and Challenges in Deep Learning
- Applications of Deep Learning in Vision, NLP, and Beyond</td></tr>
<tr><td>Literature:</td><td>Literature 1. I. Goodfellow, Y. Bengio, A. Courville, "Deep Learning," MIT Press, 2021 Edition. 2. F. Chollet, "Deep Learning with Python," 2nd Edition, Manning Publications, 2021. 3. S. Raschka, "Machine Learning with PyTorch and Scikit-Learn," Packt Publishing, 2022. 4. T. Brownlee, "Deep Learning for Natural Language Processing," Apress, 2021. 5. D. Foster, "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play," 2nd Edition, O'Reilly Media, 2022.</td></tr>
<tr><td></td><td>–</td></tr>
</table>

6.6. Operating Systems	
Semester:	5
Date of last modification:	31.08.2023
Teacher:	Mirzayeva Nilufar Sirojidinovna, 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; - 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): 30; Independent work: 10 — 40 Mid-term control — Written work: 10 Final control — Exam (Testing): 50 Total: 100
Topics of lectures:	- 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.
Literature:	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.

<table>
<tr><th colspan="2">6.7. Embedded systems</th></tr>
<tr><td>Semestr:</td><td>6</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Kholdorov Shohruhmirzo Imomali ugli</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>ECTS:</td><td>6</td></tr>
<tr><td>Pre-requisities</td><td>Programming I, Electronics and circuits II</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>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 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.</td></tr>
<tr><td>Goal:</td><td>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.</td></tr>
<tr><td>Objective:</td><td>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</td></tr>
<tr><td>Learning outcome:</td><td>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.</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>30</td><td rowspan="3">40</td><td rowspan="5">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. Applied intelligent systems	
Semestr:	4
Date of last modification:	31.08.2023
Teachers:	Mamirov Xudoyberdi Xomidjonovich
Component:	Elective
Cycle:	Core
Credit point:	6
Pre-requisites	Calculus, Probability and statistics, Database
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical wdorks / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	This course introduces students to applied intelligent systems, focusing on the practical implementation of AI technologies in real-world scenarios. It covers key concepts such as intelligent agents, decision-making algorithms, and automation. The subject explores the integration of AI with existing systems across various industries, highlighting its impact on efficiency and innovation. Students will gain hands-on experience in designing and deploying intelligent systems, preparing them to tackle complex challenges and drive technological advancements.
Goal:	The goal of this course is to equip students with the knowledge and skills needed to design, implement, and evaluate intelligent systems in practical applications. It aims to provide an understanding of how AI technologies can be integrated into existing infrastructures to enhance performance and innovation. The course also explores the ethical and societal implications of deploying intelligent systems across various industries, preparing students to contribute meaningfully to the field.
Objective:	The objective of this course is to provide students with a thorough understanding of the principles and practices involved in designing, developing, and deploying intelligent systems. The course aims to bridge the gap between theoretical AI concepts and their practical applications in various industries. By the end of the course, students will be equipped with the skills to create innovative AI-driven solutions that enhance decision-making, automate complex processes, and address real-world challenges, while also considering the ethical and societal impacts of these technologies.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understand the foundational concepts and architectures of intelligent systems. LO 2. Design and implement intelligent systems for real-world applications in various industries. LO. 3. Integrate AI technologies with existing systems to enhance automation and decision-making. LO 4. Evaluate the ethical, societal, and practical implications of applied intelligent systems.

<table>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- Information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-15)</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 (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to Applied Intelligent Systems
- Intelligent Agents and Multi-Agent Systems
- Decision-Making Algorithms in Intelligent Systems
- Automated Reasoning and Inference Techniques
- Machine Learning in Intelligent Systems
- Natural Language Processing for Intelligent Systems
- Computer Vision and Image Processing in Applied AI
- Integration of AI with IoT (Internet of Things)
- Real-Time Data Processing and Intelligent Systems
- Optimization Techniques in AI Systems
- Human-AI Interaction and User Experience Design
- Ethics and Bias in Applied Intelligent Systems
- Case Studies: Intelligent Systems in Healthcare, Finance and Banking
- Emerging Trends and Future Directions in Intelligent Systems
- Security and Privacy Concerns in Intelligent Systems</td></tr>
<tr><td>Literature:</td><td>Literature 1. B. Smith, "Artificial Intelligence: A Guide for Thinking Humans," Princeton University Press, 2020. 2. P. Domingos, "The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World," Basic Books, 2021 Edition. 3. C. D. Manning, H. Schütze, "Foundations of Statistical Natural Language Processing," MIT Press, 2022 Edition. 4. M. D. L. Hunt, "Artificial Intelligence and Machine Learning in Industry," Wiley, 2021. 5. S. Russell, P. Norvig, "Artificial Intelligence: A Modern Approach," 4th Edition, Pearson, 2021.</td></tr>
</table>

6.9. Expert Systems	
Semestr:	4
Date of last modification:	31.08.2023
Teachers:	Azimov Bunyod Rakhimjonovich, Gofurjonov Muhammadali Rasuljon ogli
Component:	Elective
Cycle:	Core
Credit point:	6
Pre-requisites	Database, Data Structures and Algorithms
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	This course introduces students to expert systems, a branch of artificial intelligence focused on mimicking human decision-making. It covers knowledge representation, inference mechanisms, and uncertainty management. Students will learn to design and implement expert systems using rule-based and case-based reasoning. The course highlights the applications of expert systems in various domains, such as healthcare and finance, while addressing ethical considerations and the future of intelligent systems in automated decision-making.
Goal:	The purpose of this course is to introduce students to the design and implementation of expert systems, focusing on knowledge representation and inference mechanisms. It aims to equip students with the skills to build intelligent systems that can replicate human decision-making processes and address real-world problems across various industries.
Objective:	- Understanding the components and architecture of expert systems. - Learning to develop knowledge bases and inference engines. - Applying expert systems to solve complex problems.
Learning outcome:	After studying the discipline, students should be able to: LO 1: Understanding the theory and applications of expert systems. LO 2: Designing and implementing a simple expert system. LO 3: Applying expert systems in various domains like medicine, finance, etc.
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 (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to Expert Systems
- Components of Expert Systems: Knowledge Base, Inference Engine
- Knowledge Representation: Rules, Frames, and Logic
- Inference Mechanisms: Forward and Backward Chaining
- Knowledge Acquisition and Elicitation Techniques
- Uncertainty Management in Expert Systems
- Case-Based Reasoning
- Fuzzy Logic in Expert Systems
- Rule-Based Systems and Decision Trees
- Expert System Shells and Development Tools
- Building an Expert System: Design and Implementation
- Validation and Verification of Expert Systems
- Applications of Expert Systems in Medicine, Finance and Engineering
- Ethical Issues and Future Trends in Expert Systems
- Natural Language Processing in Expert Systems</td></tr>
<tr><td>Literature:</td><td>Literature 1. L. A. Zadeh, "Fuzzy Sets, Fuzzy Logic, and Fuzzy Systems: Selected Papers by Lotfi A Zadeh," World Scientific Publishing Company, 2021. 2. E. Turban, J. E. Aronson, and T. Liang, "Decision Support and Business Intelligence Systems," 11th Edition, Pearson, 2021. 3. M. Gelfond, "Knowledge Representation, Reasoning, and the Design of Intelligent Agents," Cambridge University Press, 2022. 4. G. Jacucci, M. A. Tabbone, "Expert Systems in Finance: Concepts, Implementation, and Applications," Springer, 2021. 5. S. J. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach," 4th Edition, Pearson, 2021.</td></tr>
</table>

<table>
<tr><td colspan="2">6.10. Time Series Analysis</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>Kobilov Sirojiddin Sherqulovich</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-requisites</td><td>Probability and Statistics</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Writing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes</td></tr>
<tr><td>Short content:</td><td>This course delves into time series analysis, focusing on the statistical and computational methods used to analyze time-dependent data. It covers essential concepts such as trend analysis, seasonality, stationarity, and forecasting. Students will explore various models like ARIMA, SARIMA, and advanced techniques for multivariate and non-linear time series. The subject also emphasizes practical applications in finance, economics, and other fields, providing a comprehensive understanding of data-driven decision-making processes.</td></tr>
<tr><td>Goal:</td><td>To equip students with the skills needed to analyze time-dependent data using statistical and computational methods.</td></tr>
<tr><td>Objective:</td><td>- Introduction to fundamental concepts and tools in time series analysis.
- Application of time series models to real-world data.
- Forecasting future values based on past observations.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1: Understanding the structure and characteristics of time series data.
LO 2: Applying time series models like ARIMA, SARIMA, and others.
LO 3: Conducting forecasting and analyzing the accuracy of predictions.</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="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 (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to Time Series Data
- Time Series Components: Trend, Seasonality, and Noise
- Stationarity and Differencing
- Autocorrelation and Partial Autocorrelation Functions
- Moving Average (MA) Models
- Autoregressive (AR) Models
- ARMA and ARIMA Models
- Seasonal ARIMA (SARIMA) Models
- Exponential Smoothing Methods
- Time Series Decomposition Techniques
- Forecasting Accuracy Metrics
- Multivariate Time Series Analysis
- Advanced Time Series Models: GARCH, VAR. Non-linear Time Series Models
- Time Series Clustering and Classification
- Applications of Time Series in Finance and Economics. Software Tools for Time Series Analysis</td></tr>
<tr><td>Literature:</td><td>Literature 1. R. J. Hyndman, G. Athanasopoulos, "Forecasting: Principles and Practice," 3rd Edition, OTexts, 2021. 2. W. Wei, "Multivariate Time Series Analysis and Applications," Wiley, 2020. 3. P. J. Brockwell and R. A. Davis, "Introduction to Time Series and Forecasting," 3rd Edition, Springer, 2021. 4. H. Lutkepohl, "Applied Time Series Econometrics," Cambridge University Press, 2022. 5. D. W. K. Andrews, "Nonlinear Time Series Models and Applications," Oxford University Press, 2021.</td></tr>
<tr><td></td><td>–</td></tr>
</table>

<table>
<tr><th colspan="2">6.11. Speech Information Processing</th></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>Gofurjonov Muhammadali Rasuljon ogli</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-requisites</td><td>Database, Data structure and algorithms, Probability and Statistics</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Writing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes</td></tr>
<tr><td>Short content:</td><td>This course explores the fundamental aspects of speech information processing, a critical area in artificial intelligence. Students will learn about the mechanisms of speech production and perception, digital signal processing techniques, and the development of algorithms for speech recognition and synthesis. The subject covers various methods like speech coding, feature extraction, and the implementation of speech systems in real-world applications. It provides a balanced overview of the field's impact on technology and its potential to innovate communication systems and interfaces.</td></tr>
<tr><td>Goal:</td><td>To provide students with an understanding of speech processing techniques, including the analysis, synthesis, and recognition of speech.</td></tr>
<tr><td>Objective:</td><td>- Understanding the fundamentals of digital speech signals.
- Learning about various speech coding and compression techniques.
- Analyzing speech signals for speech recognition and synthesis.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1: Comprehend the fundamentals of speech production and perception.
LO 2: Understand and implement basic algorithms for speech signal processing.
LO 3: Develop applications for speech recognition and synthesis.</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>
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<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="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 (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to Speech Signal Processing
- The Human Speech Production Mechanism
- Acoustic Phonetics and Digital Speech Signals
- Fundamentals of Digital Signal Processing
- Speech Analysis and Feature Extraction
- Time-Domain Methods for Speech Processing
- Frequency-Domain Methods: Fourier Analysis and Applications
- Linear Predictive Coding (LPC) and Applications
- Mel-Frequency Cepstral Coefficients (MFCC)
- Speech Coding Techniques and Standards
- Hidden Markov Models for Speech Recognition
- Deep Learning for Speech Recognition
- Speaker Identification and Verification
- Speech Synthesis and Text-to-Speech Conversion
- Noise Reduction and Speech Enhancement
- Speech Signal Applications in Human-Computer Interaction
- Emerging Trends in Speech Technology</td></tr>
<tr><td>Literature:</td><td>Literature 1. D. Yu, L. Deng, and F. Seide, "Deep Learning for ASR: Principles, Advances, and Future Trends," IEEE Transactions on Audio, Speech, and Language Processing, 2021. 2. J. Benesty, M. M. Sondhi, and Y. Huang, "Handbook of Speech Processing and Speech Communication," 2nd Edition, Springer, 2022. 3. T. Tan and T. Lee, "Automatic Speech Recognition: A Deep Learning Approach," Springer, 2021. 4. A. Graves, N. Jaitly, and A. Mohamed, "Recent Advances in End-to-End Automatic Speech Recognition," IEEE Signal Processing Magazine, 2022. 5. B. Ramabhadran and D. Wang, "Advances in Speech and Music Technologies," Springer, 2021.</td></tr>
<tr><td></td><td>-</td></tr>
</table>

6.12. Natural language processing (NLP)	
Semestr:	6
Date of last modification:	31.08.2023
Teachers:	Abjalova Manzura Abdurashetovna
Component:	Elective
Cycle:	Core
Credit point:	6
Pre-requisites	Database, Cloud 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 / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	NLP to provide students with knowledge about the theory and practice of natural language processing (NLP), to teach them to apply their theoretical knowledge in practice, to know the relationship of natural language processing (NLP) with the fields of Uzbek linguistics, to learn the models of phenomena specific to them encourage to construct, examine and explain.
Goal:	The purpose of mastering the subject is to introduce students to the theoretical issues of natural language processing (NLP) (acquaintance with concepts, methods of solving practical problems of the field, etc.) and to create a foundation for studying natural language processing (NLP), natural is to build language processing (NLP) skills.
Objective:	One of the major goals of research in natural language processing (NLP) is to enable computers to understand, interpret, and generate human language in a way that is both accurate and meaningful. This involves developing algorithms and models that can process and analyze natural language data, such as text and speech, in order to perform tasks like language translation, sentiment analysis, text summarization, question answering, and more.
Learning outcome:	After studying the discipline, students should be able to: LO 1. A translator based on the statistical method can perform a comparative analysis of the translation of software and systems based on hybrid technology. LO 2. They can apply knowledge of linguistics and databases to find solutions to linguistic and extralinguistic problems in the processes of machine translation, speech synthesizer, speech recognition, automatic text analysis. LO 3. Able to find solutions to problems arising in the formation of linguistic support, coordinate linguistic models of language structure for translator programs. LO 4. He will have the skills to create and use databases for computer translation products based on the methods of creating machine translation. LO 5. Can use knowledge of linguistics to create software related to speech. LO 6. Natural language processing (NLP): acquires skills for automatic processing of units at the levels of phonetics, lexis, morphemics, morphology, semantics, and syntax.

<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 (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to Natural Language Processing (NLP). The goals and tasks of science
- Text editing systems (Spellchecker).
- Automatic word processing system steps. Linguistic processor.
- Tokenization of text.
- Computer morphology and morphological analyzer
- Pos-tagging methods (phrase tagging methods)
- Formalization of grammatical categories for morpho analyzer
- Computer syntax. Syntax analyzer and parsing process
- The technology of creating parsing
- Linguistic issues in NLP
- Lexical ammonism and its management.
- Language models based on statistics. N-gram and Markov language models.
- Linguistic corpus: formation, development and possibilities
- Technology of language corpus creation
- Speech synthesizers are speech synthesis systems. Phonological issues in the creation of a speech synthesizer
- Automatic speech understanding systems.
- Information search and its tasks</td></tr>
<tr><td>Literature:</td><td>Literature 1. Rahimov A. Kompyuter lingvistikasi asoslari. – Toshkent: Akademnashr. 2011. – 160 b 2. Abjalova M. Tahrir va tahlil dasturining lingvistik modullari: [Matn] / Monografiya. – Toshkent, 2020. – 176 b. 3. Abjalova M. Korpus lingvistikasi: uslubiy qo‘llanma. – Toshkent: BookPrint, 2022. – 102 b. 4. Jurafsky D., Martin J. Speech and Language Processing An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition. – New Jersey: Prentice Hall, 2000. – 927 p. 5. Clark A., Fox C., Lappin Sh. The Handbook of Computational Linguistics and Natural Language Processing. 2010. – 801 p. 6. Большакова Е.И., Клышинский Э.С. и др. Автоматическая обработка текстов на естественном языке и компьютерная лингвистика: учеб. пособие. – Москва: МИЭМ. 2011. – 272 с.</td></tr>
</table>

6.13. Speech recognition systems	
Semestr:	6
Date of last modification:	31.08.2023
Teachers:	Jurayev Dilshod Boymuradovich, Abdullaeva Malika Ilkhamovna
Component:	Elective
Cycle:	Core
Credit point:	6
Pre-requisites	Database, Cloud 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 / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	The science is based on modern information technologies and the use of modern speech recognition methods, including digital processing technology, technical implementation approaches, the use of machine learning classification algorithms in speech recognition, acoustic modeling based on neural networks, language methods of creating models and forming the skills of developing an automatic speech recognition system based on them.
Goal:	In the course of lectures, students will be taught the structure of Uzbek speech, pre-processing of speech signals, parameterization algorithms, design of automatic speech recognition systems and analysis of principles of working with frameworks of existing speech recognition systems, theoretical foundations of speech recognition algorithms, methods for speech recognition systems It teaches the capabilities of these frameworks and includes developing the skills to apply them to the design of speech recognition systems.
Objective:	Analysis of the areas of application of modern speech recognition methods; to have an idea of their digital processing technologies and technical implementation approaches; mastering the methods of using classification algorithms of machine learning in speech recognition; studying the possibilities of acoustic modeling based on neural networks; to acquire the skills of creating language models and developing an automatic speech recognition system based on them; to be able to use the structure of Uzbek speech, the methods of preliminary processing of speech signals; be able to use frameworks of existing speech recognition systems in the design of automatic speech recognition systems for parameterization algorithms;
Learning outcome:	After studying the discipline, students should be able to: LO 1. Speech recognition systems have an understanding of the field of knowledge and expertise, and general skills about speech signals and systems that process them. LO 2. Coordinating skills and ability to use automatic speech recognition frameworks. LO 3. Basic processing of speech signals will acquire knowledge of their parameterization algorithms, methods of acoustic modeling of speech, algorithms of speech corpus formation, and technologies of language model creation, as well as skills of developing automatic speech recognition systems based on these.

<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 (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction. Basic concepts of science. Classification of speech recognition issues.
- Formation of speech signals, auditory system and processes of speech reception.
- Fundamentals of digital processing of speech signals.
- Algorithms for preliminary processing of speech signals.
- The concept of filtering speech signals, analog and digital filters
- Fundamentals of parameterization of speech signals.
- Methods of evaluation of speech recognition systems. Speech recognition speed and quality evaluation indicators.
- Dynamic programming method for speech recognition.
- Recognize speech using hidden markov models.
- Speech analysis software.
- Speech corpora. Methods of creating a speech corpus.
- Normalization and adjustment methods.
- Speech signal processing libraries. Librosa, python-audioprocessing modules.
- Classification algorithms of machine learning in speech recognition.
- Acoustic modeling based on neural networks.
- Frameworks of speech recognition systems.
- Methods of creating language models.</td></tr>
<tr><td>Literature:</td><td>Literature 1. Тампель И.Б., Карпов А.А. Автоматическое распознавание речи. Учебное пособие. - СПб: Университет ИТМО, 2017. – 152 с. 2. Борискевич А.А. Сифровая обработка речи и изображений.: Минск - 2007. – 295 к. 3. Матвеев Ю.Н., Симончик К.К., Тропченко А.Ю., Хитров М.В. Цифровая обработка сигналов Учебное пособие по дисциплине "Цифровая обработка сигналов". СПб: СПбНИУ ИТМО, 2013.- 166 с. 4. Soumya Sen, Anjan Dutta, Nilanjan Dey. Audio Processing and Speech Recognition. Concepts, Techniques and Research Overviews. SpringerBriefs in Computational Intelligence. ISBN 978-981-13-6097-8. 107pages. 5. Борискевич А.А. Сифровая обработка речи и изображений.: Минск - 2007. – 295 к.</td></tr>
</table>

6.14. The Internet of Things	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Ibrohimbek Yusupov, Mamirov Xudoyberdi Xomidjonovich
Component:	Compulsory
Cycle:	Core
Credit point:	6
Pre-requisites	Database, Cloud technology, Create web applications
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	The science is based on the formation of knowledge about the provision of mutual communication of objects, devices and objects via the Internet, their remote control, and the "Internet of Things".
Goal:	The main goal of the science of IoT technology is to teach its use in the modern world, by reviewing computer techniques, modern techniques for making decisions (in some cases the most optimal) in several different information systems: industrial, mechatronics, robotics, social, financial, etc. The science of IoT technology is to form the practical and theoretical implementation skills of society and various fields, in particular search engine, intelligent systems and service-oriented systems.
Objective:	- to have basic skills of using programming languages; - they can understand the basic concepts of the theory of IoT technology; - Must have knowledge of web programming.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Students will acquire basic database skills, knowledge of database structures, constructs and communication processes. LO 2. Students will gain practical skills in designing "smart systems" based on IoT technologies, solving problems in them, finding optimal solutions. LO 3. Students will gain knowledge about web programming, programming skills, and programming technologies. LO 4. They will be able to apply knowledge of IoT technology to analyze a problem, formulate a solution and find its solution in computational processes. LO 5. Gains knowledge and skills in how concepts emerge in IoT technology theory and applications.

<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 (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to IoT technology. History of IoT technology.
- Basic principles of the Internet of Things. Standardization of IoT.
- Structure and architecture of IoT.
- Application examples and main directions of sensors and actuators.
- Methods of connecting sensors and actuators to microcontrollers.
- Difference between microprocessors, microcontrollers and microcomputers.
- Description of the Arduino microcontroller.
- IoT technology. Embedded system architecture based on IoT.
- The role of network connections in the Internet of Things.
- Wired and wireless communication channels.
- Principles of connecting devices to the network and methods of information transmission.
- Wireless networks Wi-Fi technology and its features.
- LPWAN technology and its features.
- Examples of data collected and processed in IoT systems
- Data security in IoT technology. Disadvantages of IoT.
- Practical application of IoT. Smart transportation.
- Designing custom applications and services based on IoT systems.</td></tr>
<tr><td>Literature:</td><td>Literature 1. IoT texnologiyasi - Kris Jamsa - Jones & Bartlett Publishers - 2015 - 322p. IoT texnologiyasi: Principles and Paradigms - Raj Kumar Buyya, James Bromberg, Andrzej M. Goscinski - John Wiley & Sons - 2017 - 664p. IoT texnologiyasi – Velte – McGraw-Hill Education (India) Pvt Limited – 2019. Зайнидинов Х.Н.,Махмуджанов С.У., Аллабергенов Р.Д., Яхшибаев Д.С. ИНТЕРНЕТ ВЕЩЕЙ (IoT) Учебное пособие. УДК: 004.738.5(075.8) ISBN 978-9943-5897-0-4. Т.: «Aloqachi», 2019, 220 с.</td></tr>
</table>

<table>
<tr><th colspan="2">6.15. Human-computer interaction</th></tr>
<tr><td>Semestr:</td><td>7</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Azomova Umida Asrolovna</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>Programming, Create web applications</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Writing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes</td></tr>
<tr><td>Short content:</td><td>The science is aimed at forming the knowledge of students on the creation of interfaces between a modern computer and a person, in which concepts are given about the ways, methods and algorithms of developing an interactive software design based on the leading scientific concepts: interface, interface, cognitive models.</td></tr>
<tr><td>Goal:</td><td>The science is aimed at forming the knowledge of students on the creation of interfaces between a modern computer and a person, in which concepts are given about the ways, methods and algorithms of developing an interactive software design based on the leading scientific concepts: interface, interface, cognitive models. The course teaches modern ways of developing human-computer interaction. In particular, criteria for human-computer interaction are formed.</td></tr>
<tr><td>Objective:</td><td>- Learns the principles of organizing human-computer interaction, systems interface evaluation, graphical user interface design, and methods for considering user requirements.
This course focuses on the following concepts:
- development of human-computer interaction methods; - to create personal opportunities; - perform prototyping operations on the interface; - to develop methods of design evaluation; - Great importance is attached to the design interface and its programming.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Must know how to consider user requirements in interaction design.
LO 2. Must be able to describe basic theories, models, and methodologies in the field of human-computer interaction.
LO 3. Must be able to explain and apply methods for evaluating the usability and effectiveness of various application interfaces.
LO 4. Should be able to select the main requirements of the users when designing the user interface.
LO 5. Must be able to tell the difference between good and bad design.
LO 6. Students should know what is involved in designing an interaction process.</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>
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<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 (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to the science of "Human-Computer Interaction". Creating a human-computer interface.
- Fundamentals of developing human-computer interaction. Creating a human-computer interface
- Drawing the design structure of the program based on the analysis of the interfaces in the fields.
- Human-computer interaction models. Creating intelligent procedures in the design structure of the program based on the analysis of human psychology in the fields.
- Designing an interactive interface. Development of an algorithm of software tools and processes for the organization of the interface.
- Interface evaluation technique based on programming tools. Development of hardware tools and creation of software tools for organizing the interface.
- Support users with interactive services. Development of interface errors and their processing algorithms and creation of a software tool.
- Interface and its programming. Design interface virtual event programming. Development of a visual design window for audio data.
- Interaction modeling. Installation of ready-made software tools that convert Uzbek words into written form based on speech recognition algorithms.
- Interface - design errors and their handling. Types of technical platform and interface.
- Methods of representing the visual components of the design. Creation of procedures for identifying and eliminating errors in the written form of Uzbek words based on speech recognition algorithms.
- Problematic models and dialogs. Development of a visual design window for silent movements.</td></tr>
<tr><td>Literature:</td><td>Literature 1. Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Rules – Jeff Johnson – Elsevier – 2010 – 186p.2.Human-Computer Interaction.An Empirical Research Perspective: I. Scott MacKenzie - Elsevier – 2013 – 370p.Купер А., Рейман Р., Кронин Д. Алан Купер об интерфейсе. Основы проектирования взаимодействия. – Пер.с англ. – СПб.: Символ-Плюс, 2009. – 688 с. 3.Человеко-машинное взаимодействие 3 издание. – Алан Дикс, Жанет Финлей, Грегори Д Абодд, Рассел Биал – изд. Pearson Prentice Hall – 2009 – 834 стр 4. Проектирование пользовательского интерфейса: Стратегии для эффективного человеко-машинного взаимодействия 5 издание – Бэн Шнайдерман, Кэтрин Плайсант – изд. Addison Wesley – 2005 – 652стр.Interaction Design: Beyond Human-Computer Interaction 3rd Edition – Jenny Preece, Yvonne Rogers, and Helen Sharp – Wiley – 2011 Дизайн привычных вещей – Дональд Норман – изд. Вильямс 2006. 384 стр.</td></tr>
</table>

6.16. Cloud technologies	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Abduganiev Mukhriddin Mukhiddin ugli
Component:	Compulsory
Cycle:	Core
Credit point:	6
Pre-requisites	Database, Operation systems
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Testing Final assessment method / Exam
Control forms:	Current control, Midterm control, Exam
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is 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:	Science mechatronics and robotics is one of the main subjects for undergraduate students, and it is based on gaining in-depth knowledge and skills in cloud computing and serving to improve service delivery capabilities.
Goal:	The main goal of the science of cloud technologies is to form students' knowledge about services based on cloud computing. In the near future, services based on cloud computing will be the most suitable alternative to installing hardware and software. At the end of the course, students study current cloud computing services and their differences from previous services, draw a comparative conclusion and develop a new cloud computing service themselves.
Objective:	- to have basic skills of using programming languages; - able to understand the basic concepts of cloud computing theory; - They should have knowledge about machine learning.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Formation of students' knowledge about cloud computing. LO 2. Formation of students' knowledge about the organization of cloud computing information models. LO 3. Development of first-order logic skills in students. LO 4. Formation of students' skills in using probabilistic models. To be able to understand the basic concepts of cloud computing theory. LO 5. Formation of students' knowledge about the organization of cloud computing information models.
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 Current control — Independent work: 10 Current control: 40 Mid-term control — Written work: 10 Final control — Exam (Writing): 50 Total: 100
Topics of lectures:	- Introduction cloud computing. Opportunities of cloud technologies. - Classification of Clouds. Cloud services for different classes of users. - Cloud computing services - Virtualization in cloud computing - Cloud security. Cloud security models. - Amazon recommendations: EC2, SimpleDB, S3, Simple Queries, Simple Relational Database, Elastic MapReduce, Virtual Amazon Cloud. S3 Command Line tool. - Amazon Virtual Private Cloud (VPC) and Directory Service. - Amazon Messaging in the Cloud - Microsoft Cloud capabilities and their use. - Service Oriented Architecture and Cloud (SOA) - Mobile services in cloud computing - Cloud architecture for e-government requirements - Working with applications in cloud computing - Future prospects of cloud computing
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

6.17. Parallel programming	
Semestr:	7
Teachers:	Azimov Bunyod Rakhimjonovich
Component:	Compulsory
Cycle:	Core
Credit point:	6
Pre-requisites	Programming, Machine Learning
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	Parallel programming course will encourage you explores the theory, techniques, and practices involved in designing and implementing programs that can execute tasks concurrently. It delves into optimizing performance by distributing work across multiple processors or cores, managing shared resources, ensuring synchronization between parallel tasks, and addressing potential issues like race conditions and deadlocks.
Goal:	To provide knowledge and practical skills in the design, development and optimization of software that can effectively use parallel computing resources.
Objective:	- understanding the basics of parallel programming; - study of parallel processing technologies; - development of practical skills on memory organization in parallel systems; - analysis and optimization of parallel computing algorithms; - increase productivity of serial and parallel computing processes; - study of modern trends and technologies related to parallel programming
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understanding parallel processing technologies. LO 2. Knowledge of computer architectures, elements, methods of memory organization in parallel systems. LO 3. Parallel processing of signals for multi-core processors, design of software applications. LO 4. Evaluation of the level of productivity of serial and parallel computing processes.
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:	<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 (Writing)</td><td colspan="2">50</td></tr></table>
Topics of lectures:	- Introduction to parallel computing. Problems for parallel computing. - Tasks of hardware in parallel processing, data presentation and execution of commands. - Main features of memory organization and memory types. - Software presentation layer, machine code, mnemonic and programming languages. - Performance improvement: pipeline and superscalar processing, VLIW-architecture. - Parallel computers: multiprocessors and multicomputers with shared and dedicated memory. - Software of parallel computers, parallel programming - Architecture of parallelization systems, Flynn's classification, MIMD architecture. - Computer systems with separated memory, cluster systems, TOP500 supercomputers, communication systems of clusters. - Parallelization algorithms and programs, stages of creating parallelization algorithms, multi-threaded programs. - Multi-core processors, organization of memory and internal communication, program streams, stream processing technology. - Heterogeneous architectures of parallel data processing. - Capabilities of Intel and AMD processors in parallel computing - Examples of practical application of parallel processing technology. - Data-level parallelization in deep learning processes.
Literature:	Literature 1. David A. Patterson, John L. Hennessy. Computer Organization and Design. 4th Edition. 2012, 919 pp. 2. B.B. Воеводин, Вл.В.Воеводин. Параллельные вычисления. – БХВ, С-Петербур, 2002, 599с. 3. 3. Головкин Б. А. Параллельные вычислительные системы. — М.: Наука, 1980. - 520 с. 4. 4. Гергель В.П., Стронгин Р.Г. Основы параллельных вычислений для многопроцессорных вычислительных систем – Н.Новгород, ННГУ, 2003.

6.18. Computer vision	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Mominov Elyor Normurodovich, Dadajonova Zilola Botirjon qizi
Component:	Elective
Cycle:	Core
Credit point:	6
Pre-requisites	Probability and statistics, Calculus, 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 / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	This course builds on knowledge of graphics concepts, computer vision systems and networks, and programming.
Goal:	An overview of the goals and objectives of computer vision science, computer vision problems, common approaches, and current techniques is provided.
Objective:	While concrete examples and applications can be used for illustration, the focus is on basic techniques and algorithms. In this course, students learn the basic principles of image formation, image processing algorithms, and recognition from one or more images (video). This course emphasizes the basic vision tasks of scene understanding and recognition. Applications in object detection, image analysis, image acquisition, and object tracking are discussed.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Gain a thorough understanding of computer vision architecture and systems. LO 2. Learns image recognition and processing using OpenCv and other libraries. LO 3. They learn to create a system using modern programming languages. LO 4. They will be able to design and implement a computer vision program.
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:	<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 (Writing)</td><td colspan="2">50</td></tr></table>
Topics of lectures:	- Introduction to computer vision. Perform various basic image processing operations in Python/matlab/open-CV: Read image, write image, rotate images and fill image - Architecture of computer vision systems - Computer vision problems in image processing. Adjust the contrast of the image. Perform histogram processing and equalization - Object detection: traditional methods - Face recognition, Image justification, Answering visual questions. Implementation of various low-pass and high-pass filtering mechanisms. - Working with OpenCV. Cropping and expanding the image. Using the Fourier transform to filter an image. - Formation and processing of images. Using SIFT and HOG functions for image analysis. - Image segmentation and feature extraction. Perform/implement image segmentation. - Image quality improvement and filtering. Development of optical flow calculation algorithm. - Neural networks in computer vision. Using optical flow in any image processing software. - Deep learning methods for object recognition. - Advanced Image Processing and Computational Photography - Multiple object tracking using OpenCV. Object detection and recognition in available online image datasets. - Motion analysis and activity detection. Character or number or face classification project. - Computer Vision: Algorithms and Applications.)
Literature:	Literature: Computer Vision: Algorithms and Applications (Texts in Computer Science), by Richard Szeliski, Springer; 1st Edition. ISBN-10: 1848829345, ISBN-13: 978-1848829343, http://szeliski.org/Book/. Deep Learning, Goodfellow and Yoshua Bengio, Aaron Courville, 2016, MIT press. http://www.deeplearningbook.org/ Mastering OpenCV with Practical Computer Vision Projects, by Daniel Lélis Baggio, Shervin Emami, David Millán Escrivá, Khvedchenia Ievgen, Naureen Mahmood, Jasonl Saragih, Roy Shilkrot, Packt Publishing, ISBN-10: 1849517827, ISBN-13: 978-1849517829 Vision: A Computational Investigation into the Human Representation and Processing of Visual Information, by David Marr, The MIT Press, ISBN-10: 0262514621, ISBN-13: 978-0262514620.g.

6.19. Recognition of symbols	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Tillaboyev A'zamjon Anvarovich
Component:	Compulsory
Cycle:	Core
Credit point:	6
Pre-requisites	Computer vision, AIF201Fundamentals of artificial intelligence
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	The theoretical concepts of the course are learned by listening to lectures and completing labs, making it increasingly difficult to achieve all the learning concepts. Pattern Recognition Systems course covers the basics that a software engineer should know.
Goal:	The course focuses on increasing students' knowledge by assessing the performance of tasks, assignments and independent work related to pattern recognition systems.
Objective:	- Course activities are based on lectures by teachers, conducting laboratory work among students in order to consolidate theoretical knowledge and gain practical experience in pattern recognition systems.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Modern systems of character recognition LO 2. Issues of symbol recognition LO 3. Description of the objects of the subject area LO 4. Symbol recognition methods and algorithms. LO 5. Steps to solve recognition issues LO 6. Solving recognition issues Using libraries of modern programming languages
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:	<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 (Writing)</td><td colspan="2">50</td></tr></table>
Topics of lectures:	- An introduction to the science of pattern recognition systems. Technical and algorithmic support of symbol recognition systems. - Modern systems of symbol recognition and their fields of application. - Concepts of object, symbol and class. Description of objects. Formation of educational and control selections. - Character space formation. Character space and characters with quantitative and qualitative values in it. - Analysis of information about objects in various subject areas and formation in the form of selection tables. - Modern recognition technologies: TensorFlow, FaceNet, Apache Makout, PyTorch frameworks and their libraries. - Image recognition technologies. Vision systems. Object detection approaches in video data. - Sound and speech recognition technologies. - Statistical methods for identifying symbols. Bayes classifiers. Criteria. - Deterministic methods for identifying symbols. k-nearest neighbors, separating planes, potential functions, etc. - Application of the neural network method in symbol recognition. - Symbol recognition methods and algorithms based on the principles of precedent and partial precedent. Test algorithm. - Algorithms for calculating grades. Parametric models of estimation algorithms. - The problem of clustering and methods and algorithms for solving it. "Maxmin" algorithm, "k-means" algorithm, "Izodata" algorithm, "Forel" algorithm. - Evaluation and control of recognition quality. Application of symbol recognition systems in solving various practical problems
Literature:	Literature 1.Duda R., Hart P. Pattern recognition and scene analysis. – Moscow: Mir, 1976. – 509 p. 2. Verhagen K., Duin R. et al. Pattern recognition state and prospects. Per. from English N.G. Gurevich. - M.: Radio and communication, 1985. -117 p. 3. Vasiliev V.I. Recognition systems. – Kyiv: Naukova Dumka, 1983.–422 p. 4. Bobkov A.V. Pattern recognition systems. M.: MSTU im. N.E. Bauman, 2018. - 190 p. 5. Suzdaltsev V.A. Pattern recognition systems: textbook / V.A. Suzdaltsev, M.P. Shleimovich, V.V. Mokshin. – Kazan: Editorial and Publishing Center “School”, 2019. – 156 p.

<table>
<tr><td colspan="2">6.20. Deep Learning</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>Ochilov Mannon Musinovich</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-requisites</td><td>Probability and statistic, Database</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>180</td></tr>
<tr><td>Lecture</td><td>42</td></tr>
<tr><td>Practical works</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Writing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes</td></tr>
<tr><td>Short content:</td><td>This course covers the fundamental concepts and techniques of deep learning, including neural networks, convolutional networks, sequence modeling, and generative models. Students will learn both the theoretical foundations and practical implementations of deep learning models.</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>The objective of this Deep Learning course is to equip students with the skills to design, implement, and optimize neural networks using frameworks like TensorFlow and PyTorch, and to apply these models to solve real-world problems in areas such as image recognition and natural language processing.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Understand and explain the fundamental concepts of deep learning.
LO 2. Design and implement various neural network architectures, including CNNs and RNNs.
LO 3. Utilize popular frameworks like TensorFlow and PyTorch to build and train deep learning models.
LO 4. Apply deep learning techniques to solve practical problems in areas like image recognition and natural language processing.
LO 5. Explore and understand advanced topics and emerging trends in deep learning.</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;</td></tr>
</table>

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<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>
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<tr><td>Independent work</td><td>10</td></tr>
<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to Deep Learning
- Neural Networks Basics
- Activation Functions
- Loss Functions and Optimization
- Gradient Descent and Backpropagation
- Regularization Techniques
- Convolutional Neural Networks (CNNs)
- Advanced CNN Architectures
- Recurrent Neural Networks (RNNs)
- Long Short-Term Memory (LSTM) Networks
- Sequence Models
- Attention Mechanisms
- Autoencoders
- Generative Adversarial Networks (GANs)
- Reinforcement Learning Basics
- Transfer Learning and Fine-Tuning</td></tr>
<tr><td>Literature:</td><td>1. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville (2016). 2. "Neural Networks and Deep Learning" by Michael Nielsen (available online). "Deep Learning with Python: A Hands-on Introduction" by François Chollet (2017). 3. "Pattern Recognition and Machine Learning" by Christopher M. Bishop (2006). 4. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems" by Aurélien Géron (2019). 5. "Machine Learning Yearning: Technical Strategy for AI Engineers, In the Era of Deep Learning" by Andrew Ng (available online).</td></tr>
</table>

6.21. Reinforcement Learning	
Semestr:	7
Date of last modification:	31.08.2023
Teachers:	Ochilov Mannon Musinovich, Abdullaeva Malika Ilkhamovna
Component:	Elective
Cycle:	Core
Credit point:	6
Pre-requisites	Machine Learning, Deep Learning, AIF201Fundamentals of artificial intelligence
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	This course introduces students to the principles and algorithms of reinforcement learning (RL), focusing on how agents can learn to make sequential decisions in dynamic environments. Topics covered include Markov Decision Processes (MDPs), key RL algorithms, applications in various domains, and ethical considerations.
Goal:	The goal of this Reinforcement Learning course is to enable students to effectively understand, implement, and apply reinforcement learning algorithms to solve real-world sequential decision-making problems.
Objective:	Gain proficiency in fundamental concepts, algorithmic implementations (e.g., Q-Learning, DQN), real-world application, model evaluation, ethical considerations, and advanced topics in Reinforcement Learning.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understand core concepts like MDPs and dynamic programming. LO 2. Implement algorithms such as Q-Learning and DQN. LO 3. Apply RL to solve real-world problems. LO 4. Evaluate and optimize RL models effectively. LO 5. Consider ethical implications in RL applications. LO 6. Stay updated with recent advancements in RL research.
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.

<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>
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<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction to Reinforcement Learning
- History and Evolution of Reinforcement Learning
- Markov Decision Processes (MDPs)
- Dynamic Programming: Policy Evaluation and Iteration
- Value Iteration and Bellman Equations
- Monte Carlo Methods for Reinforcement Learning
- Temporal Difference (TD) Learning
- Q-Learning
- Deep Q-Networks (DQN)
- Policy Gradient Methods
- Actor-Critic Methods
- Advantage Actor-Critic (A2C)
- Proximal Policy Optimization (PPO)
- Deep Deterministic Policy Gradient (DDPG)
- Multi-Agent Reinforcement Learning
- Hierarchical Reinforcement Learning
- Applications of Reinforcement Learning (e.g., Autonomous Vehicles, Finance)</td></tr>
<tr><td>Literature:</td><td>1. "Reinforcement Learning: An Introduction" by Richard S. Sutton and Andrew G. Barto (2nd Edition, 2018). 2. "Deep Reinforcement Learning Hands-On" by Maxim Lapan (2018). 3. "Algorithms for Reinforcement Learning" by Csaba Szepesvári (2010). 4. "Reinforcement Learning and Optimal Control" by Dimitri P. Bertsekas (2019). 5. "Foundations of Machine Learning" by Mehryar Mohri, Afshin Rostamizadeh, and Ameet Talwalkar (2018).</td></tr>
</table>

<table>
<tr><th colspan="2">6.22. Design of intelligent systems</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>Khasanov Umidjon Komiljon 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-requisites</td><td>Probability and statistics, Database, Data structure and algorithms</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 wdorks</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>108</td></tr>
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<tr><td>Final assessment method</td><td>Writing</td></tr>
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<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is 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>“Intelligent systems design” refers to the process of creating or developing systems that demonstrate intelligence using principles of artificial intelligence or machine learning.</td></tr>
<tr><td>Goal:</td><td>The purpose of teaching science is to teach students modern intellectual techniques used in program development and design, and to generate the skills to apply and practice intellectual systems in program design, testing and maintenance.</td></tr>
<tr><td>Objective:</td><td>The task of the subject is to form the theoretical foundations of intellectual methods and tools used in software design, to develop skills to demonstrate the differences between agile approaches and traditional software development methods, and to develop widely used in the industry such as rational unified process (RUP) and Open Process Framework (OPF). is to highlight the practical significance of non-traditional approaches used.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Students develop knowledge about intellectual systems.
LO 2. Building students' knowledge about the organization of ISO models for software design technology in intelligent systems, and processes such as the CMM model and the Personal Software Process (PSP) are studied.
LO 3. Agile approaches based on methods and tools used in software design in intelligent systems such as Extreme Programming (XP), Agile Modeling (AMo), Scrum, ASD, DSDM, Crystal, Feature Driven Development (FDD), Incremental Funding Method (IFM) intelligent software development is carried out.
LO 4. A practical new project will be implemented by considering industry-wide and non-traditional approaches such as Rational Unified Process (RUP) and Open Process Framework (OPF).
LO 5. Designing systems based on modern intelligent systems, solving problems arising in them, methods of finding optimal solutions and practical skills.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;</td></tr>
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<tr><td></td><td>- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- Information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
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<tr><td>Mid-term control</td><td>Written work</td><td colspan="2">10</td></tr>
<tr><td>Final control</td><td>Exam (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Content, subject of the science of designing programs in intellectual systems. An understanding of intelligent systems. Basic terms of intellectual systems. Requirements for intelligent systems.
- Describe and compare software development and design methods. Concept and types of context in which different approaches can be applied. Designing traditional programs, identifying the main differences with intelligent systems.
- Basic languages used in object modeling and analysis (UML). Information in computer systems for intelligent processing of information.
- Specification of models in intellectual objects. Object planning in intelligent systems.
- Traditional life cycle models and intelligent systems. Life cycle models of traditional systems.
- Alternative solutions in the Applied intelligent systems. Systems development methodology.
- Agile models in intelligent systems. Iterative and incremental models.
- Methods and tools for implementing DevOps in the system. System development and formation of operational teams based on the DevOps model.
- Software tool methodology and process models in intelligent systems. The problem of classification in intelligent systems. Methods of application to solving practical problems.
- IEEE Standards for Software Engineering Processes. IEEE Program Features.
- Application of intelligent systems. Application of intellectual systems in fields.
- Intelligent system technology reliability (SRE) model. Methods of system reliability assessment.
- Testing Tools and Frameworks. Types of automated test systems.
- Creating an object model using UML
- Organization of intelligent systems for managing business processes
- Selection and implementation of KITS and Frameworks.</td></tr>
<tr><td>Literature:</td><td>Literature 1. Software Engineering: A Practitioner's Approach By Roger S. Pressman and Bruce Maxim McGraw-Hill Higher International; ISBN-10: 1259872971; ISBN-13: 978-1259872976, 9th Edition (09/19) 2. Software Engineering (10th Edition) by Ian Sommerville Pearson; ISBN-10: 0133943038; ISBN-13: 978-0133943030 (04/15) 3. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations by Gene Kin, Patrick Debois, John Willis, Jez Humble, and John Allspaw IT Revolution Press; ISBN-10: 1942788002; ISBN-13: 978-1942788003 (10/16) 4. Site Reliability Engineering by Niall Murphy, Betsy Beyer, Chris Jones, and Jennifer Petoff O'Reilly Media; ISBN-10: 149192912X, ISBN-13: 978-1491929124 (04/16)</td></tr>
</table>

6.23. Intelligent data analysis (Data mining)	
Semestr:	8
Date of last modification:	31.08.2023
Teachers:	Kuchkarov Muslimjon Adhamjon ugli, Kobilov Sirojiddin Sherkulovich
Component:	Elective
Cycle:	Core
Credit point:	6
Pre-requisites	Database, Fundamentals of artificial intelligence
Workload:	**Types of classes** / **Hours** Total / 180 Lecture / 42 Practical works / 30 SAW (Student autonomous work) / 108 Form of final control / Exam Final assessment method / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	This course provides each student with the methods and tools of intellectual analysis of data, based on theoretical knowledge, practical skills, and modern information technologies, to solve problems such as searching for, collecting, sorting, classifying, and providing information about the subject area being studied and to provide basic knowledge about the tasks of forming the use of tools and their application in practice.
Goal:	They learn how to use the methods and tools of intellectual data analysis and critically evaluate its problem areas. The course also describes the theoretical knowledge, practical skills, areas of application of intellectual data analysis, explaining the purposes of use, building a linear regression model. The correlation issue and its theoretical explanation include the importance of software tools in building artificial intelligence systems.
Objective:	- to have basic skills of using programming languages; - to have the experience of applying the theory of linear algebra in practice; - they should know the linear regression model.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understand how a Data mining. LO 2. Understand the process of data mining. LO 3. Understand how a Social Network Analysis. LO 4. Use Applications and Trends in Data Mining. LO 5. Learned how to use and analyze “Cluster Analysis”
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities; - communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods); - case-study method (analysis of situations);

<table>
<tr><td></td><td>- game technologies, in which students participate in business, role-playing, simulation games;
- Information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-15)</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 (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction of data mining. Classification of Data Mining Systems. Data Mining Functionalities
- Data Cleaning, Data Integration and Transformation
- Data Preprocessing
- Mining Data Streams. Mining Time-Series Data
- Data Warehouse and OLAP (online analytical processing) Technology: An Overview.
- Data Cube Computation and Data Generalization.
- Mining Frequent Patterns, Associations, and Correlations
- Classification and Prediction
- Classification and Prediction
- Cluster Analysis
- Mining Stream, Time-Series, and Sequence Data
- Using the data warehouse. The process of Data Mining from the data warehouse
- Mining Sequence Patterns in Transactional Databases, Mining Sequence Patterns in Biological Data
- Graph Mining, Social Network Analysis, and Multirelational Data Mining
- Mining the World Wide Web, Text Mining
- Mining Object, Spatial, Multimedia, Text, and Web Data
- Application layer protocols (HTTP, FTP, SMTP, DNS).
- Applications and Trends in Data Mining</td></tr>
<tr><td>Literature:</td><td>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</td></tr>
</table>

<table>
<tr><th colspan="2">6.24. Natural Language Recognition Algorithms</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>Jurayev Dilshod Boymuradovich, Abdullaeva Malika Ilkhamovna</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>Credit point:</td><td>4</td></tr>
<tr><td>Pre-requisites</td><td>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>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>Writing</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Current control, Mid-term control, Final control</td></tr>
<tr><td>Assessment requirements</td><td>Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control</td></tr>
<tr><td>Final control</td><td>The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes</td></tr>
<tr><td>Short content:</td><td>The Natural Language Recognition Algorithms course provides knowledge about algorithms for understanding and using natural language. This course explores modern technologies for language analysis, machine learning, and natural language processing...</td></tr>
<tr><td>Goal:</td><td>The purpose of mastering the subject is to provide students with theoretical and experimental research necessary to understand and analyze natural language, as well as to develop skills in the application of natural language in automated systems and the creation of algorithms.</td></tr>
<tr><td>Objective:</td><td>- understanding the basics of the Natural language recognition algorithms; - study the basics of understanding natural language; - testing algorithmic solutions and checking their efficiency; - carrying out experiments on the use of natural language; - acquisition of new knowledge and their application in systems.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Knowledge of natural language understanding algorithms.
LO 2. Learning the relationship between language modeling and data.
LO 3. Mastering the skills of using natural language techniques and applying them in systems.
LO 4. Ability to select algorithms for extracting knowledge from speech and applying them in fields.</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>

	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; Independent work: 10 — 40 Mid-term control — Written work: 10 Final control — Exam (Writing): 50 Total: 100
Topics of lectures:	– Introduction to Natural Language Recognition Algorithms. – Fundamentals of Natural Language Processing (NLP). – Statistical Models in NLP. – Machine Learning for Text Classification. – Deep Learning in Natural Language Recognition. – Word Embeddings and Their Applications. – Sequence Models: RNN, LSTM, GRU. – Attention Mechanisms and Transformers. – Named Entity Recognition (NER). – Sentiment Analysis and Opinion Mining. – Machine Translation Techniques. – Dialogue Systems and Chatbots. – Information Retrieval and Search Engines. – Speech Recognition and Synthesis. – Ethical and Social Issues in NLP.
Literature:	Literature 1. Jurafsky, D., & Martin, J. H. (2020). Speech and Language Processing. Pearson. 2. Goldberg, Y. (2021). Neural Network Methods in Natural Language Processing. Morgan & Claypool Publishers. 3. Manning, C., et al. (2020). Deep Learning with PyTorch. O'Reilly Media. 4. Bender, E. M., & Koller, A. (2021). Linguistic Fundamentals for Natural Language Processing: 100 Essentials from Morphology and Syntax. Morgan & Claypool Publishers. 5. Peters, M., et al. (2020). Deep Contextualized Word Representations. ACL.

6.25. Algorithms for intelligent data analysis (Data mining algorithms)	
Semestr:	8
Date of last modification:	31.08.2023
Teachers:	Kuchkarov Muslimjon Adhamjon ugli, Kobilov Sirojiddin Sherkulovich
Component:	Elective
Cycle:	Core
Credit point:	4
Pre-requisites	Database, Fundamentals of artificial intelligence
Workload:	**Types of classes** / **Hours** Total / 120 Lecture / 30 Practical works / 18 SAW (Student autonomous work) / 72 Form of final control / Exam Final assessment method / Writing
Control forms:	Current control, Mid-term control, Final control
Assessment requirements	Attendance at classes and 60% of academic progress in total for 2 types of control, to obtain admission to the final control
Final control	The final exam is written in the form of 5 questions of 10 marks each, the questions consist of 2 parts: 3 theoretical questions and 2 practical questions. Total exam time is 80 minutes
Short content:	This course provides each student with the methods and tools of intellectual analysis of data, based on theoretical knowledge, practical skills, and modern information technologies, to solve problems such as searching for, collecting, sorting, classifying, and providing information about the subject area being studied and to provide basic knowledge about the tasks of forming the use of tools and their application in practice.
Goal:	They learn how to use the methods and tools of intellectual data analysis and critically evaluate its problem areas. The course also describes the theoretical knowledge, practical skills, areas of application of intellectual data analysis, explaining the purposes of use, building a linear regression model. The correlation issue and its theoretical explanation include the importance of software tools in building artificial intelligence systems.
Objective:	- to have basic skills of using programming languages; - to have the experience of applying the theory of linear algebra in practice; - they should know the linear regression model.
Learning outcome:	After studying the discipline, students should be able to: LO 1. Understand how a Data mining. LO 2. Understand the process of data mining. LO 3. Understand how a Social Network Analysis. LO 4. Use Applications and Trends in Data Mining. LO 5. Learned how to use and analyze “Cluster Analysis”
Teaching methods:	In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized: - technology of problem- and project-based learning; - technologies of educational and research activities; - communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods); - case-study method (analysis of situations);

<table>
<tr><td></td><td>- game technologies, in which students participate in business, role-playing, simulation games;
- Information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "Know-Want to Know-Learned", "INSERT", hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th colspan="2">Type of task</th><th colspan="2">Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="2">Current control</td><td>Practical works (1-15)</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 (Writing)</td><td colspan="2">50</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- Introduction of data mining. Data Mining Functionalities
- Comparative analysis of classification algorithms for large-scale data
- Time series analysis and forecasting using data mining methods
- Anomaly detection in streaming data using data mining techniques
- K-mean Algorithm and Support Vector Machines in data mining
- Apriority Algorithm and Expectation-Maximization Algorithm in data mining
- Classification and Prediction
- PageRank and Ad boost Algorithm
- Cluster Analysis
- Mining Stream, Naive Bayes, and CART Algorithm
- Clustering, Decision Trees Algorithm
- Deep learning approaches for image and video data analysis
- Mining the World Wide Web, Text Mining
- Mining Object, Spatial, Multimedia, Text, and Web Data</td></tr>
<tr><td>Literature:</td><td>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</td></tr>
</table>

<table>
<tr><td colspan="2">6.26. Individual project</td></tr>
<tr><td>Semestr:</td><td>5</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Azomova Umida Asrolovna, Kuchkarov Muslimjon Adkhamjon ugli</td></tr>
<tr><td>Component:</td><td>Compulsory</td></tr>
<tr><td>Cycle:</td><td>Core</td></tr>
<tr><td>Credit point:</td><td>4</td></tr>
<tr><td>Pre-requisites</td><td>–</td></tr>
<tr><td>Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Total</td><td>120</td></tr>
<tr><td>Lecture</td><td>-</td></tr>
<tr><td>Practical works</td><td>48</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>72</td></tr>
<tr><td>Form of final control</td><td>Report</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Report</td></tr>
<tr><td>Final control:</td><td>The student defends the completed project by presenting it to the commission, and each member of the commission evaluates the work.</td></tr>
<tr><td>Short content:</td><td>This course is an independent scientific research work of the student, which is carried out independently on the basis of in-depth mastering of the scientific and theoretical foundations of specialized subjects, study, analysis and generalization of international and national economic problems.</td></tr>
<tr><td>Goal:</td><td>The goal of the individual project course is to deeply master the scientific and theoretical foundations of specialized subjects by students.</td></tr>
<tr><td>Objective:</td><td>Concept of individual project, project activity, project culture; Goals, design tasks, problems in the modern world.</td></tr>
<tr><td>Learning outcome:</td><td>After studying the discipline, students should be able to:
LO 1. Understand the problematic topic in the field of computer engineering.
LO 2. To develop students' ability to set a specific problem and solve it.
LO 3. Development of proposals and recommendations aimed at the implementation of a problematic topic.
LO 4. Increase the potential of students to effectively use scientific literature, practical analytical-statistical data and other materials in scientific-practical activities.</td></tr>
<tr><td>Teaching methods:</td><td>In the conditions of the credit system of education, classes are conducted mainly in active and creative forms. Among the effective pedagogical methods and technologies that promote active involvement of students in the search and management of knowledge, the acquisition of experience in independent problem solving should be emphasized:
- technology of problem- and project-based learning;
- technologies of educational and research activities;
- communication technologies (discussion, press-conference, brainstorming, educational debates and other active forms and methods);
- case-study method (analysis of situations);
- game technologies, in which students participate in business, role-playing, simulation games;
- information and communication (including distance learning) technologies.
In order to develop critical thinking among students, such methods as "Prediction with open questions", "Cluster", "Cross-discussion", "INSERT", "Fishbone" method, "I know, I found out, I want to know" hands-on activities, gamification and others are actively used during practical classes.</td></tr>
<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>0-100</td></tr>
</table>
</td></tr>
</table>

	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:	Muminov Elor Normurodovich, Khasanov Umidjon Komiljon ugli
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.

<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", "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>Type of task</th><th>Number of points (max)</th><th>Total</th></tr>
<tr><td>Complete and accurate completion of the task</td><td>0-50</td><td rowspan="3">0-100</td></tr>
<tr><td>Being able to demonstrate the ability to think independently within the framework of pre-graduate work practice</td><td>0-20</td></tr>
<tr><td>To answer the given questions clearly and succinctly</td><td>0-30</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>- The direct management of practice in enterprises is carried out by the engineering and technical staff of these enterprises. The head of the enterprise assigns the responsibility for the organization of the operation to the chief specialist or his deputy.
- Study of normative and technical literature on the topic of practice.
- Get technical safety instructions.
- Get the topics of the graduation thesis. Identifying problematic situations for graduate work. Forming a group.
- Determining the main goals and tasks of the graduate work.
- Standards for the development of a technical assignment for a graduate qualification work. Development of requirements for graduate work
- Projecting. Search and systematization of information on the topic of graduate work.
- Projecting. Creating a model on the subject of a graduate thesis.
- Analysis of information, implementation of graduation qualification work, formation of conclusions. Prepare possible forms for presenting results. Explanation of the obtained results.
- Recommendations and analysis of reported errors. Correction of defects. Search, compare, and identify strengths and weaknesses of similar graduate qualifications. Preparation of reports.
- Initial public presentation: topic, working hypothesis, relevance, research plan, expected results, thesis plan.
- Final presentation. Presentation of work carried out within the framework of pre-graduation qualification work</td></tr>
<tr><td>Literature:</td><td>1. Project Solving Basic Technique Third edition, Fujitsu Learning Media Ltd. – 2011, 2013. –62 p. 2. Andrew S. Tanenbaum. Computer Networks, Fourth Edition. Publisher; Prentice Hall, 2011. 3. James F. Kurose, Keith W. Ross "A Top-Down Approach: Computer Networking", 2017. Pearson Education Limited 4. Musaev M.M. "Computer systems and networks". Tashkent.: "Alokachi" publishing house, 2013. Chapter 8. 394 pages. - Guide for higher educational institutions. 5. Miryusupov Z. Z., Djumanov J. Kh. Computer networks: a study guide, named after Muhammad Al-Khorazmi. TATTOO. - T.: Alokachi, 2020. - 144 p.</td></tr>
</table>

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

<table>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th>Type of task</th><th>Number of points (max)</th><th>Total</th></tr>
<tr><td>Complete and accurate completion of the task</td><td>0-50</td><td rowspan="3">0-100</td></tr>
<tr><td>Being able to demonstrate the ability to think independently within the framework of pre-graduate work practice</td><td>0-20</td></tr>
<tr><td>To answer the given questions clearly and succinctly</td><td>0-30</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>
- The direct management of practice in enterprises is carried out by the engineering and technical staff of these enterprises. The head of the enterprise assigns the responsibility for the organization of the operation to the chief specialist or his deputy.
- Study of normative and technical literature on the topic of practice.
- Get technical safety instructions.
- Get the topics of the graduation thesis. Identifying problematic situations for graduate work. Forming a group.
- Determining the main goals and tasks of the graduate work.
- Standards for the development of a technical assignment for a graduate qualification work. Development of requirements for graduate work
- Projecting. Search and systematization of information on the topic of graduate work.
- Projecting. Creating a model on the subject of a graduate thesis.
- Analysis of information, implementation of graduation qualification work, formation of conclusions. Prepare possible forms for presenting results. Explanation of the obtained results.
- Recommendations and analysis of reported errors. Correction of defects. Search, compare, and identify strengths and weaknesses of similar graduate qualifications. Preparation of reports.
- Initial public presentation: topic, working hypothesis, relevance, research plan, expected results, thesis plan.
- Final presentation. Presentation of work carried out within the framework of pre-graduation qualification work
</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">6.29. Graduation qualification work</th></tr>
<tr><td>Semestr:</td><td>8</td></tr>
<tr><td>Date of last modification:</td><td>31.08.2023</td></tr>
<tr><td>Teachers:</td><td>Kuchkarov Muslimjon Adkhamjon ugli</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>
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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.