«Kazakh national research technical University named after K. Satpayev»
Institute of Cybernetics and Information Technology
Department SE and CDP&IS

CURRICULUM PROGRAM

«COMPUTER SCIENCE»

Bachelor of Science in Information and Communication Technologies under the educational programme «6B06102 Computer Science»

based on the expired specialty Classifier: « Informatics, computer engineering and software and Information systems »

2nd edition
in accordance with SSE of higher education in 2018

Almaty 2020

СӘТБАЕВ УНИВЕРСИТЕТІ SATBAYEV UNIVERSITY

The program was compiled and signed by the parties:

From KazNRTU named after K. I. Satpayev:

1. Director Of the Institute of Cybernetics and Information Technology (IC&IT), Candidate of Technical Sciences — N.A.Seylova

2. Head of the Department of Software Engineering (SE), PhD — M. Turdalyuly

3. Head of the Department of «Cybersecurity, Data Processing and Information Storage» (CDP&IS), Candidate of Technical Sciences — N.A.Seylova

4. Chairman of the educational-methodical group department of SE, Doctor of Engineering, Professor — R.I.Muhamedyev

Approved at a meeting of the Educational and methodological Council of the Kazakh National Research Technical University named after K.I.Satpaev, (Minutes №3 dated 15.12.2020)

Qualification:
Level 6 of the national qualifications framework.

Professional competence: Software development, Automation, Information systems, Artificial intelligence.

1. Brief description of the program

The purpose of the educational program is to teach students General educational, basic and specialized disciplines with the achievement of relevant competencies.

The development of the educational program was based on 3 documents, defining areas and specializations in the field of IT – SWEBOK, the purpose of which is to combine knowledge of software engineering; SE2004- educational guide for training specialists of University programs in the field of software engineering; CC2005- guidelines for developing training programs for IT professionals. A team of international IT specialists has identified a set of training areas and a set of disciplines, providing quality training in IT (CC2005), as well as the thematic composition of disciplines and a set of knowledge necessary and sufficient for professionals in the field of IT (SWEBOK, SE2004).

The present educational program «Computer Science» developed on the basis of the main normative documents:

- State compulsory standard of technical and professional education, approved by the government of the Republic of Kazakhstan dated August 23, 2012 No. 1080 (with changes as of 15.08.2017)**.** Footnote. Item 1 as amended by the resolutions Of the Government of the Republic of Kazakhstan No. 327 dated 25.04.2015 (put in force since 01.09.2016); from 13.05.2016 No. 292 (put in force since 01.09.2017). Footnote. Appendix 4 - as amended by order of the Minister of Education and Science of the Republic of Kazakhstan dated 05.05.2020 No. 182.
- Industry qualification framework (IQF). Industry: information and communication technologies. Approved by the minutes No. 1 dated 20 December 2016 meeting of the Sectoral Commission in the sphere of information, Informatization, communications and telecommunications.
- Law of the Republic of Kazakhstan "on education" No. 319-III of July 27, 2007;
- IEEE SWEBOK combining knowledge of software engineering;
- CC2005 guidelines for developing training programs for IT professionals;
- SE2004 educational guide for training specialists of University programs in the field of software engineering.

The program is designed to implement the principles of democratic education management, expanding the boundaries of academic freedom and authority of educational institutions, which will ensure the training of elite, highly motivated personnel for innovative and knowledge-intensive sectors of the economy.

The educational program provides an individual approach to students, ensures the transformation of professional competencies from professional standards and qualification standards to learning outcomes. Student-centered learning is provided-the principle of education that involves shifting the emphasis in the educational process from teaching (as the main role of the teaching staff in the "translation" of knowledge) to teaching (as an active educational activity of the student);

The educational program provides training of IT specialists in 3 areas:

- Software engineering. Software developers of a wide range. The educational program provides knowledge of various programming paradigms and operating systems, obtaining skills in designing and developing software products for any platform.

- Artificial intelligence. Data analysis specialists. The educational program provides knowledge of various models and methods of data analysis, including modern tools for extracting and processing large amounts of data, the use of artificial neural network models for classification and regression problems, methods and algorithms related to the field of artificial intelligence.

- Information system. Specialists in the field of information systems. The educational program provides knowledge of various methods and models for managing information systems infrastructure, organizing activities and business processes based on information technologies, building scalable information systems, managing software development, ensuring the continuous operation and operational activities of IT software.

The educational program was developed on the basis of the analysis of the labor functions of software engineers, system administrators, and data analysis specialists stated in professional standards.

Representatives of Kazakhstan companies in the field of software development participated in the development of the educational program.

The tasks and content of the EP are given in section 9 "description of disciplines".

In case of successful completion of the full course of bachelor's studies, the graduate is awarded the academic degree Bachelor of Science in Information and Communication Technologies under the educational programme «6B06102 Computer Scince».

The educational program has increased the volume of mathematical, natural science, basic and language disciplines.

The "Computer Science" undergraduate educational program is distinguished by the fact that it contains three areas of student development. A number of disciplines in these areas offer relevant content in accordance with the current challenges of science and technology.

In the field of Software engineering:

- Parallel programming
- Microservice technologies
- Game development
- High load programming platforms
- Enterprise Web Programming
- SPA Web Programming
- Interactive graphics systems
- Mobile app development
- Functional programming

In the direction of **Artificial intelligence**:

- Data analysis
- Scientific Python
- Theory of neural networks
- Deep Learning ANN
- Natural language processing
- Digital image processing
- Business Intelligence

In the field of **Information systems**:

- Human Computer Interaction
- Management in information systems
- Information security risk management
- Supply chain and logistics
- Social and Ethical Issues of the Internet
- Big data
- Production and operations management

In the course of training, there are industrial practices in advanced IT companies located in the Republic of Kazakhstan and training abroad within the framework of academic mobility.

2. Passport of the educational program

Name:

Computer Science. The name is chosen in English and is not translated into other languages intentionally, as a determining factor in orienting the content of an educational program with a predominance of subjects in English.

Purpose of the educational program:

- Provide practice-oriented training of graduates in the field of software development, information systems and specialists in the field of data analysis. Training of graduates who are able to apply various technologies, knowledge and skills of software development, definition and management of information systems, data analysis to perform operational and project activities.

- Prepare graduates for productive and technological activities related to the process of developing and modifying software products aimed at meeting the expectations and requirements of users, for organizational and managerial activities related to the maintenance of software products of various classes and categories, information systems management, data analysis..

- Create conditions for continuous professional self-improvement, development of social and personal competencies of graduates (broad cultural Outlook, active citizenship, commitment, organization, hard work, communication skills, ability to argue and make organizational and managerial decisions, knowledge of modern information technologies, fluency in several languages, the desire for self-development and commitment to ethical values and a healthy lifestyle, the ability to work in a team, responsibility for the final result of their professional activities, civic responsibility, tolerance), social mobility and competitiveness in the labor market.

Education level: higher

Skill levels for NQF / IQF: Covers the basic 6 levels, but does not limit.

Field of professional activity*: Bachelor of Science in Information and Communication Technologies under the educational programme “6B06102 Computer Science”.

Types of employment: project-designing;

- Industrial-technological;
- experimental research;
- organizational-managerial;
- exploitation;
- scientific.

Objects of professional activity:

- Computers, complexes, systems and networks;
- Computer systems for information processing and management;

- Automatic control system;
- Software for computer equipment; information systems (programs, software complexes and systems).

Program features**:** academic exchange program/credit training system/distance learning
Form of training: full-time
Period of study: from 4 to 7 years.
Language of study: Kazakh, Russian, **English (more than 70%)**
Amount of credits / hours: 240 credits

3. Requirements for applicants

Admission to the university is carried out according to the applications of an applicant who has completed full secondary, secondary special education on a competitive basis in accordance with the points of the certificate issued by the results of the unified national test with a minimum score of at least 65 points.

Special requirements for admission to the program apply to graduates of 12-year schools, colleges, applied baccalaureate programs, NIS, etc. Such applicants must pass diagnostic testing in English, mathematics, physics, and special disciplines.

Rules for transferring credits for accelerated (reduced) education based on a 12-year secondary, technical and higher education

Code	Type of competence	Description of competence	The result of the competence	Responsible
COMMON (Implies full training with possible additional training depending on the level of knowledge)				
G1	Communicativeness	- Fluent monolingual oral, written and communication skills - Ability to communicate fluently in a second language - Ability to use communicative communication in various situations - there are basics of academic writing in your native language - diagnostic test for language level	Full 4-year training with a minimum of 240 academic credits (including 120 contact classroom academic credits) with possible translation of credits into a second language, where students have an advanced level. The language level is determined by passing a diagnostic test.	Department of Kazakh and Russian languages, Department of English
G2	Mathematical literacy	- Basic mathematical thinking at the communication level - ability to solve situational problems based on the mathematical apparatus of algebra and the principles of mathematical analysis - diagnostic test for mathematical literacy in algebra	Full 4-year training with a minimum of 240 academic credits (including 120 contact classroom academic credits). If the diagnostic test is positive, the level of mathematics is 1, if it is negative, the level of algebra and the beginning of the analysis	Chair of mathematics
G3	Basic literacy in the natural science disciplines	- basic understanding of the scientific picture of the world with an understanding of the essence of the basic laws of science - understanding basic hypotheses, laws, and	Full 4-year training with a minimum of 240 academic credits (including 120 contact classroom academic credits). f the diagnostic test is positive, the level of Physics 1, General	Departments in the areas of natural Sciences

		methods, drawing conclusions, and evaluating errors	chemistry, if negative-the level of the Beginning of physics and Basic of chemistry	
SPECIFIC (it implies reduced training due to credit transfer depending on the level of knowledge on competencies for graduates of 12-year schools, colleges, universities, including humanitarian and economic areas)				
S1	Communicativeness	- Fluent bilingual oral, written and communication skills - ability to communicate fluently with a third language - writing skills of various styles and genres - skills of deep understanding and interpretation of your own work of a certain level of complexity (essay) - basic aesthetic and theoretical literacy as a condition for full-fledged perception and interpretation of the original text	Full credit transfer by language (Kazakh and Russian)	Department of Kazakh and Russian language
S2	Mathematical literacy	- Special mathematical thinking using induction and deduction, generalization and concretization, analysis and synthesis, classification and systematization, abstraction and analogy - ability to formulate, justify and prove statements - Application of General mathematical concepts, formulas, and extended spatial perception of mathematical problems - complete understanding of the basics of mathematical analysis	Transfer of credits in the discipline of Mathematics (Calculus) I	Chair of Mathematics
S3	Special literacy in natural Sciences (Physics, Chemistry, Biology, and Geography)	- Broad scientific perception of the world, which implies an understanding of natural phenomena - critical perception for understanding the phenomena of the surrounding world - cognitive abilities to formulate a scientific understanding of the forms of	Transfer of credits in Physics I, General chemistry, General biology, Introduction to Geology, Introduction to geodesy; Training practice, etc.	Departments in the areas of natural Sciences

		existence of matter, its interaction with nature		
S4	English language	- readiness for further self-study in English in various fields - readiness to gain experience in project and research work using English	Transfer of English language credits from academic to professional level (up to 15 credits)	Department of English
S5	Computer skills	- Basic programming skills in one modern language - using software and application for teaching various discipline	Credit transfer for the disciplin Introduction to information an communication technologies, Information and communication technologies	Department of software engineering
S6	Social and humanitarian competencies and behavior	- understanding and awareness of the responsibility of each citizen for the development of the country and the world - ability to discuss ethical and moral aspects in society, culture, and science	Transfer of credits in the Modern History of Kazakhstan (except for the state exam)	Department of social Sciences
		- critical understanding and the ability to debate for debates on contemporary scientific hypotheses and theories	Transfer of credits in philosophy and other Humanities	
PROFESSIONAL (means reduced training due to the transfer of credits depending on the level of knowledge on competencies for graduates of colleges, secondary schools, universities)				
P1	Professional competence	-critical perception and deep understanding of professional competencies at level 5 or 6 - ability to discuss and debate on professional issues in a learned programme	Transfer of credits in basic professional disciplines, including introduction to the specialty, engineering ethics, technology of robotic production, technological objects of automation, theoretical foundations of electrical engineering, technical and logical measurements and devices, mathematical foundations of control theory, electronic devices of automation.	Producing Department
P2	General engineering competencies	- basic General engineering skills and knowledge, ability to solve General engineering tasks and problems - be able to use application packages for processing experimental data, solving systems of algebraic and differential equations	Credit transfer in General engineering disciplines (engineering graphics, descriptive geometry, basics of electrical engineering, basics of microelectronics.)	Producing Department

P3	Engineering and computer competence	- basic skills of using computer programs and software systems for solving General engineering tasks	Transfer of credits in the discipline of computer graphics, computer modeling and programming in the MatLab environment.	Producing Department
P4	Socio-economic competence	- critical understanding and cognitive ability to reason on contemporary social and economic issues - basic understanding of the economic evaluation of the study objects and the profitability of projects.	Transfer of credits in social-humanitarian and technical-economic disciplines to the credit of the elective cycle	Producing Department

The University may refuse to transfer credits if the diagnostic level is low or the final grades for completed subjects were lower than A and B.

4. Requirements for completing training and obtaining a diploma

Mandatory standard requirements for graduating from high school and awarding an academic bachelor's degree: mastering at least 240 academic credits of theoretical training and the final thesis or a state exam in the specialty.

5. Working curriculum

MAJOR CURRICULUM for 2020-2021 academic year admission

Educational program 6B06102 - "Computer Science"

Group of Educational programs B057 - "Information technology"

Educational Tracks: **SE**-Software Engineering, **AI**-Artificial intelligence, **IS**-Information system

Full-time study Study duration : 4 years Academic degree: bachelor of engineering and technology

Year of study	Code	Trajectory	Name of discipline	Cycle	Total Credits	lec/lab/pr/ SIW	Code	pre-requisites	Code	Trajectory	Name of discipline	Cycle	Total Credits	lec/lab/pr/ SIW	Code	pre-requisites
1	**1st semester (autumn 2020)**								**2nd semester (spring 2021)**							
	LNG 1051		Beginner (A1)	G	6	0/0/3/3	S4	Diagnostic test	LNG 1052		Elementary English (A1)	G	6	0/0/3/3	S4	LNG 1051
	LNG 1052		Elementary English (A1)						LNG 1053		General English 1 (A2)					LNG 1052
	LNG 1053		General English 1 (A2)						LNG 1054		General English 2 (A2)					LNG 1053
	LNG 1054		General English 2 (A2)						LNG 1055		Academic English (B1)					LNG 1054
	LNG 1055		Academic English (B1)						LNG1056		Business English (B2)					LNG 1055
	LNG1056		Business English (B2)						LNG 1057		Professional English (B2+)					LNG1056
	LNG1012		Kazakh/Russian (A2)	G	4	0/0/2/2	S1	Diagnostic test	LNG1102.1		Academic Kazakh (Russian)language (B1)	G	4	0/0/3/3	S1	LNG10121
	LNG1012.1		Academic Kazakh/Russian language(B1)						LNG1102.2		Business Kazakh (Russian) language (B2)					LNG1012.1
	LNG1012.2		Business Kazakh/Russian language(B2)						LNG1161		Professional Kazakh language					
									LNG1162		Professional Russian language					
									LNG103		The culture of business communication (C1)					
	MAT00110		Algebra and introduction to calculus						LNG102		Rhetoric					LNG1012.2
	MAT101		Mathematics I	B	6	1/0/2/3	S2		MAT101		Mathematics I	B	6	1/0/2/3	no	MAT100
									MAT102		Mathematics II					MAT101
	PHY400		Introduction to Physics	B	6	1/1/1/3	S3		PHY111		Physics I	B	6	1/1/1/3	no	PHY110
	PHY111		Physics I						PHY112		Physics II					PHY111
	KFK101		Physical education I	G	4	0/0/2/2			KFK102		Physical education II	G	4	0/0/2/2		
	HUM113		Modern history of Kazakhstan	G	6	2/0/1/3	S6	no	HUM124		Philosophy	G	6	1/0/2/3	S6	no
	CSE624	SE	Introduction to Computer Science	B	6	1/1/1/3	P1-3		CSE155		Algorithmization and programming basics	B	6	1/1/1/3	P1-3	CSE624
	Total:				**38**	19			**Total:**				**40**	20		

	3rd semester (autumn 2021)								4th semester (spring 2022)							
2	HUM126		Social-political knowledge	G	8	4/0/0/4	S6	no	LNG 1054		General English 2 (A2)	G	6	0/0/3/3	no	LNG 1053
	LNG 1053		General English 1 (A2)	G	6	0/0/3/3	no	LNG 1052	LNG 1055		Academic English (B1)					LNG 1054
	LNG 1054		General English 2 (A2)					LNG 1053	LNG1056		Business English (B2)					LNG 1055
	LNG 1055		Academic English (B1)					LNG 1054	LNG 1057		Professional English (B2+)					LNG1056
	LNG1056		Business English (B2)					LNG1055	LNG109		IELTS Preparation					LNG1056
	LNG 1057		Professional English (B2+)					LNG1056	LNG110		Intercultural Communication					
									LNG117		Technical Writing					
									LNG118		Public speaking					
									LNG119		Productivity skills					
									LNG120		GRE preparation					
									LNG121		Academic Writing					
	MAT102		Mathematics II	B	6	1/0/2/3	no	MAT101	MAT103		Mathematics III	B	6	1/0/2/3	no	MAT102
	MAT103		Mathematics III					MAT102	MAT126		Ordinary Differentiation Equations MatLab					MAT103
	CSE164		Algorithms and data structures	B	6	1/1/1/3		CSE616	MAT128		Theory of Probability and Mathematical Statistics	B	6	1/1/1/3	no	MAT101-103
	MAT113		Discrete Math (IT-oriented)	G	6	1/1/1/3	S5	MAT101	CSE127	SE	Object-Oriented Programming	B	6	1/1/1/3	P1-3	CSE164, MAT101
	PHY112		Physics II	B	6	1/1/1/3	no	PHYS111	CSE626	SE	Databases	B	6	1/1/1/3	P1-3	CSE155
	MAT124		Linear algebra and analytic geometry			1/0/2/3			CSE605	SE	Algorithms	B	6	1/1/1/3		CSE155
	CSE625	IS	Information System Infrastructure	B	6	1/1/1/3	P1-3		ELC162	SE, IS,AI	Microelectronics			2/1/0/3		PHY111, ELC163
	CSE662	SE	Introduction to Web programming					CSE155								
	Total:				**44**	22			**Total:**				**36**	18		
3	**5th semester (autumn 2022)**								**6th semester (spring 2023)**							
	MAT126		Ordinary Differentiation Equations MatLab	B	6	1/0/2/3	no	MAT103	MAT127		Partial Differentiation Equations MatLab	B	6	1/0/2/3	no	MAT126
	MAT127		Partial Differentiation Equations MatLab					MAT126	MAT141		Optimization and control				no	MAT124, MAT00123
	CSE607		Computer Architecture and Consistency	B	6	1/1/1/3	P1-3	CSE624	CSE617	SE	Information theory	S	6	1/1/1/3	no	MAT102, MAT128
	CSE122		Computer Networks	B	6	1/1/1/3	P1-3	CSE616	CSE664	SE	Operating systems and system programming	S	6	1/1/1/3	no	CSE607
	CSE628	SE	Scientific Python	S	6	1/1/1/3	no	MAT128, CSE155	CSE186	IS,AI	Operating system					CSE624
	CSE403	SE	Network programming technologies					CSE127	GEN155	SE	Numerical methods for Solving Engineering Problems					PHY111
	CSE623	SE	Computer Science&Engineering Internship			0/0/3/3			CSE439	AI	Data analysis					MAT128
	CSE653	SE	Advanced Algorithms I						CSE658	SE	Computer Science&Engineering Internship II			0/0/3/3		
	CSE629	IS	Management information systems			2/1/0/3	P1-3	CSE625	CSE654	SE	Advanced Algorithms II					
	CSE663	SE	The concept of ACID	S	6	1/1/1/3	no	CSE626	CSE649	IS	Information security risk management	S	6	1/1/1/3	no	CSE625
	CSE630	IS,AI	Database management systems					CSE626	SEC129	SE	Fundamentals of information security					CSE624
	CSE627	IS	Human Computer Interaction						CSE631	IS	Industrial information systems					
	SEC163	SE, IS,AI	Digital Circuitry					PHY111, ELC162	CSE139	IS	Design of information systems					
	AUT146	IS	Basics of automation			2/1/0/3	P1-3		CSE632	SE	Industrial Web programming					CSE403
	Total:				**30**	15			CSE633	AI	R language in statistical analysis problems					MAT128
									Total:				**24**	12		
4	**7th semester (autumn 2023)**								**8th semester (spring 2024)**							
	CSE617	SE	Information theory	S	6	1/1/1/3	no	MAT102, MAT128	CSE634	AI	Neural network theory	S	6	1/1/1/3	no	CSE617
	SEC159	SE	Development of Software for information security systems			2/1/0/3		CSE632	CSE189	SE	Parallel programming					CSE164
	CSE635	IS	Supply chain & logistics			1/1/1/3			CSE647	SE	Microservice technologies					CSE127
	CSE636	SE	Mobile application development	S	6	1/1/1/3	no	CSE127	CSE213	IS	Cloud technologies					
	CSE637	AI	Operation research					CSE617	CSE619	IS	Introduction to Big data					
	CSE638	IS	Information systems for business						CSE645	SE	Programming of controllers and microcomputers	S	6	1/1/1/3	no	CSE155
	CSE639	SE	Functional programming	S	6	1/1/1/3	no	CSE155	CSE651	AI	Natural language processing					CSE439
	CSE114	AI	Intelligent robotic systems			2/1/0/3			CSE457	SE	Computer game development					CSE127
	CSE640	IS	Production and operations management			1/1/1/3			CSE646	IS	Introduction to enterprise resource planning					
	CSE665	SE	Development of single-page Web applications	S	6	1/1/1/3	no	CSE632	CSE648	SE	Development of high-load systems	S	6	1/1/1/3	no	CSE632
	CSE642	AI	Analog and digital signal processing					CSE439	CSE650	AI	Digital image processing					
	CSE641	IS	Internet technology						CSE643	IS	Business intelligence					
	CSE659	SE	Computer Science&Engineering Internship III			0/0/3/3			CSE116	IS	Internet of things					CSE150
	CSE655	SE	Advanced Algorithms III						CSE660	SE	Computer Science&Engineering Internship IV			0/0/3/3		
	ECA101		Preparation and writing of graduation work (project)	FA	4				CSE656	SE	Advanced Algorithms IV					
	Total:				**28**	12			ECA101		Preparation and writing of graduation work (project)	FA	4			
									ECA102		The defense of diploma work (project)	FA	6			
									Total:				**28**	9		

Additional academic programes (AAP)

Year of study	Code	Name of discipline	Credits	Semester
2	AAP122	Physical education III	0	3
2	AAP132	Physical education IV	0	4
1	AAP101	Internship	2	2
2	AAP109	Industrial internship I	2	4
3	AAP103	Industrial internship II	4	6
2-3	AAP500	Military training	0	3-6

Total number of credits

Cycles of disciplines	Credits: compulsory	elective	total
Cycle of general disciplines (G)	68	0	68
Cycle of basic disciplines (B)	90	24	114
Cycle of special disciplines (S)	6	66	72
Total of theoretical study:	164	90	**254**
Final attestation (FA)	14	0	**14**
Total:	178	90	**268**
Extra education	8		**8**
Overall:	186	90	**276**

6. Descriptors of the level and scope of knowledge, skills, and competencies

In the process of mastering the educational program, a Bachelor of Science in Information and Communication Technologies under the educational programme «6B06102 Computer Science» must have the following key competencies.

A-knowledge and understanding:

A1-Architecture and types of computing machines;
A2-Operating systems;
A3-programming Languages;
A4-programming Technologies;
A5-database Models;
A6 - methods for organizing authorized data access;
A7-Protocols for the interaction of computer systems;
A8-Architecture of interprocessor interaction;
A9 - methods for automating business processes;
A10-Models and types of data analysis;
A11 - principles and models of artificial intelligence;
A12-techniques for modeling, composition, and decomposition of systems;
A13 - principles of consistency and integrity;
A14-methods of system / structural analysis;
A15-software Lifecycle;
A16-UML - as a basic tool for describing technical systems;
A17-SQL - as a basic data management tool;
A18-Typical information system/software architectures;
A19-Types of software;
A20-process design Methods;
A21-Methods for designing software interfaces;
A22-software design/development/debugging/maintenance Tools;
A23-Basic algorithms and data structure;
A24-Standards, methodological and regulatory materials for SOFTWARE development;
A25-Methods and models of scientific activity;
A26-data processing Models;
A27-Basic approaches, tools and models for project management;
A28 – standards for the construction of the IT infrastructure.

B-applying knowledge and understanding:

B1 - analysis of the subject area, defining goals and ways to achieve them;
B2-Defining deadlines for completing tasks and creating a technical task;

B3-Formalization of the task, prioritization of execution;
B4-Selection of optimal solutions to problems;
B5-Planning project execution stages;
B6-Modeling the domain structure;
B7-Defining functional and operational requirements for system components;
B8-Using UML standards to present technical documentation, diagrams, and models;
B9-Maintaining project execution protocols;
B10-Formation of reporting documents;
B11-Designing database models;
B12 - development and design of software interfaces;
B13-Building algorithms for computational processes;
B14-Writing/testing/debugging/maintenance/integration of software codes and products;
B15 — the Creation of models and methods of data analysis;
B16-Creating decision-making systems based on Artificial intelligence models
B17-Creation/Support / Audit of IT infrastructure;

C – the formation of judgments:
C1-about trends in IT
C2-on the applicability of tools and technologies for solving the problem
C3-on the adequacy of the designed model
C4-on the effectiveness of the methods and models used

D – personal abilities*:*
D1 — Ability to set goals and plan ways to achieve them
D2 — Ability to conduct project/operational activities
D3 — Ability to conduct scientific research
D4 — Ability to organize the work of the IT Department
D5 — Ability to organize the collection, storage and processing of information used in the field of professional activity

7. Competencies at the end of training

COMPETENCE PROFILE	
The goal of training: Specialists in this educational program should be able to analyze requirements, design, develop, make quality assessments, and	After completion of the education programme, depending on the chosen track: - the graduates are able to analyze software requirements in order to determine their technical feasibility, to define technical specifications for software components and their interaction, to

manage large and complex software systems. The dynamics of development of the computer Science subject area is so great that the market requires constant changes in the quantity and quality of knowledge and skills from the graduate. Good specialists should be ready to quickly rebuild and learn new software development technologies. In this regard, professional standards should reflect the requirements for continuous professional development of software developers, especially in connection with career growth and transition to new levels of qualification.	carry out detailed software design, Develop the software according to the technical specification. - Graduate learns how to use mathematics and stochastic models of data analysis. Operate modern software products and libraries in the field of data analysis. Analyse subject area, requirements for data analysis, maintain documentation on the preparation of a scientific research report. Implement the detailed procedures... - the graduate is able to use knowledge of information systems infrastructure to build scalable solutions in the field of IT, maintain business processes and it infrastructure of the enterprise, automate processes, and manage the operational activities of IT departments.
Name of the section, section IQF, State compulsory standard of higher education	Technical Sciences and technologies Information and communication technologies
	specialist in engineering and technology of the "Computer Science" educational program can work in the following areas: - Software developer - System administrator - Data analyst - Research fellow - Heads of services and divisions in the field of information and communication technologies. A specialist in engineering and technology of the "Computer Science" educational program must perform: Analysis of business process requirements Analysis of requirements for data processing results Analysis of data processing tools

Сферы компетенций (трудовые функции)	Analysis of data processing models System administration Building IT infrastructure IT infrastructure management IT infrastructure audit Analysis of software requirements Analysis of business requirements and business tasks of the interface Formalization and algorithmization of tasks Writing program code using programming languages, defining and manipulating data. Development of technical specifications for software components and their interaction. Creating software code in accordance with the technical task (ready- made specifications) Developing the user interface Creating a prototype of the user interface using software design tools Optimization of software code using specialized software tools The deployment of the software product Testing the software product in accordance with the test plan Elimination of detected inconsistencies based on test results Recording test results Checking whether the hardware component meets the software requirements Installation of software and additional modules necessary for the correct functioning of the software being developed Ensuring safe and uninterrupted operation of the software product Development of integration procedures for software modules Integration of software modules and components and verification of software product releases

The list of competencies in the context of academic degrees

Competence code	Competences	
General competence		
ОК1	Possess knowledge of historical, cultural and scientific achievements of the Republic of Kazakhstan; use data from historical sources and special literature; analyze and evaluate historical facts and events	OOM1 The module of social Sciences
ОК2	To have a broad social, political and professional outlook	OOM1 The module of social Sciences
ОК3	Have an idea of the subject, functions, main sections and directions of philosophy; the place and role of philosophy in the life of society and man, apply knowledge of philosophical and methodological principles of knowledge in professional activities	OOM1 The module of social Sciences
ОК4	To think logically, to know the methods of induction and deduction, to determine cause-and-effect relationships; to know the methods of decomposition, analysis and synthesis of systems	OOM2 Language training module
ОК5	Knowledge of Kazakh, Russian, and foreign languages. Be able to work with scientific and technical literature in Kazakh, Russian and foreign languages; search for scientific and technical information; understand the information provided at a normal pace, with the subsequent transfer of its content to Conduct an intercultural dialogue, develop and deepen their knowledge, be open to new information; - establish professional contacts and develop professional communication in a foreign language - make business contacts in a foreign language - know terminology, read literature on the specialty in a foreign language	OOM2 Language training module
ОК6	Plan the stages of scientific research, organize search and select relevant information	OOM2 Language training module

ОК7	Structure and edit information, prepare technical and scientific documentation in accordance with existing requirements;	OOM2 Language training module
ОК8	Be able to build a reasoned and clear oral and written speech, explain your view of the problem.	OOM2 Language training module
Basic competencies		
БК1	to use the fundamental concepts of mathematics in professional activities; to prove mathematical statements, solve mathematical problems and problems, to identify their essence, to translate into mathematical language problems posed in terms of other subject areas, in particular IT-technologies; to set mathematical problems; to build mathematical models; to select suitable mathematical methods and algorithms for solving problems; to conduct qualitative mathematical research.	БМ1 Module of physical and mathematical Sciences
БК2	apply the basic methods of formalization of reasoning, the basic concepts of the theory of logical functions, the theory of algorithms, graph theory, coding theory; use the conceptual apparatus and methods of discrete mathematics to analyze mathematical models used in computer calculations for solving engineering and design problems;	БМ1 Module of physical and mathematical Sciences
БК3	to apply the theoretical knowledge for the solution of the generalized model physical problems in mechanics, molecular physics and thermodynamics, electricity; conduct a physical experiment; calculate, analyze, and process the results of a physical experiment;	БМ1 Module of physical and mathematical Sciences
БК4	select elements of electronic circuits, make the necessary calculations, make a mathematical description of the functioning of devices and determine their characteristics; determine the parameters of semiconductor devices and circuit elements	БМ1 Module of physical and mathematical Sciences

БК5	formulate technical requirements taking into account the functions performed by computer systems; justify the architecture; define tools for evaluating the performance of systems;	БМ2 Programming module БМ3 Computer system architecture module
БК6	use methods for building different models of data types and information processing algorithms; use the possibilities provided by the algorithmization technique rationally to solve practical problems;	БМ5 The module basics of computer science
БК7	formalize, factorize, normalize, decompose, and structure input, intermediate, and output data; build mathematical models of algorithms;	БМ5 The module basics of Computer science
БК8	to program in modern algorithmic languages, to understand the fundamental principles of software construction, to know different approaches in programming methodology, to know the paradigms of modular and object-oriented programming.	БМ2 Programming module
БК9	use a unified modeling language, set architectures and key points of distributed client-server applications, apply technologies for network interaction of communication systems, create applications for network interaction of tools, implement a structural and object- oriented approach to working with tools	БМ3 Computer system architecture module
БК10	to perform common tasks in the design, deployment and technical support of local and global networks; to administer the network in modern operating systems;	БМ3 Computer system architecture module
БК11	install architectures and key points of distributed client-server applications, apply network interaction technologies of communication systems, create network interaction applications;	БМ3 Computer system architecture module
БК12	Identify potential threats and hazards, apply methods and tools to ensure the safety of software products;	БМ4 Module fundamentals of

		information systems
БК13	Determine the boundaries of research on human-computer interactions, including ergonomics, versatile design, responsive design, design of interfaces of devices with a narrow/wide range of functionalities;	БМ4 Module fundamentals of information systems
БК14	Analyse the subject area and agree on the project requirements with the client; select the information processes from the business processes and model them for automation of the subject area;	БМ4 Module fundamentals of information systems
БК15	organize, manage and ensure the full testing life cycle processes; develop regulations, test plans, and schedules; model test processes, test data, and function responses to test impacts; analyze compliance of software characteristics in technical and project documentation; and generate test documentation;	БМ5 The module basics of Computer science
БК16	install the product on working computing hardware; automate the continuous update process; use isolation, crash recovery, and application and database extension tools;	БМ3 Computer system architecture module
БК17	use the basic concepts and methods of discrete mathematics, the basics of mathematical logic, methods of probability theory and mathematical statistics in the study of mathematical models of the subject area; establish links between different mathematical theories to develop integrated methods used to build mathematical models of the subject area	БМ1 Physical and Mathematical sciences
БК18	use the basic structures and mechanisms of various operating systems, and work with modern operating systems. apply the basic concepts of system programming, develop programs that cover the issues of system programming.	БМ3 Computer system architecture module
Professional competence		

ПК1	Design the domain information model; install, configure, use, and interact with the relational database management system; present data using various models; and create SQL queries.	ПМ1 Data storage module
ПК2	install and use non- relational data stores; perform various methods to perform database queries, optimize queries, perform data analysis using aggregation methods; apply the technique of dividing data across machines through distribution (sharding).	ПМ1 Data storage module
ПК3	Know XML, HTML5 layout, principles of stylistic design — CSS, mechanisms for processing the document model. Develop web scripts, program in PHP, JavaScript;	ПМ4 Internet and mobile application development module
ПК4	To be able to create and configure scalable applications using the — Object-oriented programming paradigm. Use well-established design patterns.	ПМ4 Internet and mobile application development module
ПК5	Be able to create scalable WEB applications using the design template-Model-View-Controller. Be able to create and configure advanced single page web applications based on modern libraries and frameworks and establish a relationship with the server;	ПМ5 Internet and web technologies module
ПК6	develop mobile applications and support services using different technologies; organize interaction and data transfer between storage and mobile devices;	ПМ4 Internet and mobile application development module
ПК7	be able to apply the General principles of creating distributed systems; own the tools and methods for building and organizing distributed systems; use the methodology for developing parallel programs, methods for evaluating the effectiveness of parallel algorithms and the maximum achievable parallelism on the target computing architecture, work with the basic set of tools for developing parallel programs;	ПМ3 Intelligent systems module
ПК8	perform decomposition of monolithic systems, possess deployment and control tools for	ПМ3 Модуль интеллектуальных систем

	loosely connected computing systems, and use a basic set of microservice development tools.	
ПК9	Plan and perform work on the organization /maintenance / audit of IT infrastructure.	ПМ3 Модуль интеллектуальных систем
ПК10	To plan and carry out work on the organization of processes of data collection, analysis and interpretation of data.	ПМ3 Модуль интеллектуальных систем

Special and managerial competencies	
СК 1	Ability to manage the process of developing system and application software
СК 2	Application of theoretical knowledge to develop and present your own conclusions when solving production problems in the field of IT. Ability to make decisions in complex and non-standard situations in the field of organization and management of the enterprise.

8. Additional education policy Minor
At least 12 credits in programme disciplines:

Direction -Software Engineering:
M1-Algorithms and data structures
M2-Databases
M3-Object-oriented programming
M4-Computer Architecture & Concurrency

In the direction of Information System:
M1-Algorithms and data structures
M2-Databases
M3- IP Infrastructure
M4-Business Information Systems

In the direction of Artificial Intelligence:
M1- Probability Theory and Mathematical Statistics
M2 - basics of artificial intelligence
M3- Data Analysis
M4-Theory Of Neural Networks

The graduate is assigned an additional specialty Minor with the issuance of an Appendix to the diploma of the established sample..

9 List of training modules and results

EP – Computer Science
Qualification: Bachelor of Science in Information and Communication Technologies under the educational programme «6B06102 Computer Science»

Name of module's	Learning outcome (in accordance with professional tasks)	Criteria for evaluating learning outcomes	Disciplines that form the module
General education modules (GEM)			
OOM1 The module of social Sciences	**Has an idea** of individual phenomena and events of the historical past with a common paradigm of world-historical development of human society **Able to** comprehend objectively and comprehensively the inherent advantages, features and significance of the Kazakhstan development model	Oral survey, testing, report, boundary control, term papers	**Доом1.1.** Contemporary history of Kazakhstan
	Has an understanding of the subject, functions, main sections and directions of philosophy; the place and role of philosophy in the life of society and human beings; and the main stages of development of world and Kazakh philosophical thought; **Able to** identify correct and incorrect forms of argument;	Oral survey, testing, report, boundary control, term papers	**Доом1.2.** Philosophy

	- analyze the meaning and forms of knowledge; - possess methods of decomposition of systems and objects, analysis and synthesis of complex systems.		
OOM2 Language training module	**Able to** conduct a dialogue in a foreign language, using the rules of speech etiquette; - establish professional contacts and develop professional communication in a foreign language.; - get information from the media, listen to and analyze news and reports about current events; - conduct interviews, clarify and confirm information, developing the most interesting points; - explain your point of view on the current issue, expressing all the arguments "for" and "against", defend your position during the debate, discuss; - Express your point of view in writing, maintaining the structure of the written response; - compose business letters, annotations, detailed messages on a given topic, reports, analyze graphs, and briefly describe the main idea of articles or texts.	Oral survey, testing, report, boundary control, term papers	ДООМ2.1. Foreign language Beginner (A1) Elementary English (A1) General English 1 (A2) General English 2 (A2) Academic English (B1) Business English (B2) Professional English (B2+)

	Able to conduct a dialogue in the Kazakh language, using the rules of speech etiquette; - establish professional contacts and develop professional communication in the Kazakh language; - receive information from the media, listen to and analyze news and reports on current events; - conduct interviews, clarify and confirm information, developing the most interesting points; - explain your point of view on the current issue, expressing all the arguments "for" and "against", defend your position during the debate, discuss; - Express your point of view in writing, maintaining the structure of the written response; - compose business letters, annotations, detailed messages on a given topic, reports, analyze graphs, briefly describe the main idea of articles or texts.	Oral survey, testing, report, boundary control, term papers	**Доом2.2.** Kazakh (Russian) language Kazakh (Russian) language (A2) Academic Kazakh (Russian) language (B1) Business Kazakh (Russian) language (B2)
Basic module (BM)			
BM1 Module of physical and mathematical Sciences	**Has an understanding** of the differential calculus of functions of several variables, ordinary differential equations, multiple integrals, numerical and functional series.	Oral survey, testing, boundary control, term papers	**Дбм1.1.** Mathematics Algebra and introduction to mathematical analysis Mathematics I

	Able to: - use knowledge about the basic provisions of the theory of differential and integral calculus of functions of several variables, the theory of differential equations, the theory of series.		Mathematics II Mathematics III Ordinary differential equation Matlab Partial differential equations Matlab Probability theory and mathematical statistics
	Has an understanding of the basic concepts, laws, and models of mechanics, molecular physics, electricity, magnetism, thermodynamics, and statistical physics **Able to**: apply theoretical knowledge to solve generalized typical physical problems in mechanics, molecular physics, thermodynamics, and electricity; - work with measuring devices; - conduct a physical experiment; - calculate, analyze, and process the results of a physical experiment.	Oral survey, testing, boundary control, term papers	**Д$_{БМ1.2.}$** Physics Beginning of physics Physics I Physics II
BM2 Programming module	**Has an understanding** of the concepts of the program, algorithm, types of processes, and formal rules for describing algorithms. **Able to:** create algorithms for solving problems;	Oral survey, testing, report, boundary control, term papers	**Д$_{БМ2.1.}$** Algorithmization and programming basics

	- develop programs using C and Python tools; - organize the necessary data structures; - fix program errors; - write programs in a good style.		
	Has an understanding of the effective use of data structures and algorithms for solving various problems, logical relationships between data structures **Able to:** use methods for building various data models and information processing algorithms; -rational use of the opportunities provided by the technology of algorithmic, for the solution of practical problems; - formalize, factorize, normalize, decompose, and structure input, intermediate, and output data; - build mathematical models of algorithms.	Oral survey, testing, report, boundary control, term papers	**Д**$_{\textbf{БМ2.2.}}$ Algorithms and data structures Algorithms
	Has an understanding of the principles of object-oriented programming: encapsulation, inheritance, polymorphism, abstraction, relations between classes. **Able to:** to carry out the decomposition of the problem	Oral survey, testing, report, boundary control, term papers	**Д**$_{\textbf{БМ2.3.}}$ Object-oriented programming

	create data abstractions and their interaction to use the tools of polymorphism to implement integrated solutions apply design patterns correctly		
	Has an understanding of the functional programming paradigm based on the Clojure language, functional programming paradigms in creating modules with limited liability, basic constructions and patterns of problem solving and code writing, the basics of efficiency and productivity. **Able to:** acquire skills and competencies in writing programs using the functional programming paradigm: to carry out the decomposition of the system use tools for formal description and implementation of the data processing business process use the Clojure programming language to implement network applications correctly apply functional programming patterns	Oral survey, testing, report, boundary control, term papers	**Д**$_{\textbf{БМ2.4.}}$ Functional programming
BM3 Computer system architecture module	**Has an idea** about the computer architecture; principles of organization of multiprocessor and multi-machine computing systems; directions of	Oral survey, testing, report, boundary	**Д**$_{\textbf{БМ3.1.}}$ Fundamental of electronics Digital Circuitry

	development of computers with traditional, parallel and non- traditional architecture; principles of building data transmission networks **Able to:** formulate technical requirements taking into account the functions performed by computer systems; justify the architecture; define tools for evaluating the performance of systems.	control, term papers	Computer architecture and concurrency OS & System level programming
	Has an understanding of modern computer networks, network models, principles of administration of network devices under The CiscoIOS operating system, principles of functioning of the main OSI levels, methods of transmission, storage, search, processing and presentation of information. **Able to:** performing typical design, deployment, and technical support tasks for local and global networks; - administer networks in modern operating systems	Oral survey, testing, report, boundary control, term papers	**Д$_{БМ3.2.}$** Computer network
BM4 Module fundamentals of information systems	**Has an understanding** of fundamental knowledge and skills in programming, operating systems, the Internet, data transfer, the life cycle of IP development, the use of standard software packages (SOFTWARE), including text	Oral survey, testing, report, boundary control, term papers	**Д$_{БМ4.1.}$** Information systems infrastructure

	processing, spreadsheets, databases, and presentation graphics **Able to** explain the purpose of software and hardware, data, procedures, and people in a business computer system; identify the main hardware elements of a computer system and describe the purpose of each element; understand the role and use of various widely used SOFTWARE packages, including spreadsheets, word processors, databases, and presentation SOFTWARE; demonstrate an understanding of the operating system and correctly execute the commands associated with it;		
	Has an idea of the goals and objectives of information protection, the characteristic properties of the protected information and the main information threats, the directions of protection, the possibilities of building methods and rules of information protection., about cryptographic algorithms. **Able to:** provide information security of a computer system using cryptographic methods; simulate a cryptographic	Oral survey, testing, report, boundary control, term papers	**ДБМ4.2.** Fundamentals of information security

	system and evaluate its advantages and disadvantages.		
БМ5 The module basics of computer science	**Has an understanding** of the features of artificial intelligence problems and the role of logical programming as a methodology for solving these problems, knowledge representation models, methods for developing and creating expert systems and expert shells **Able to** build models of simple non-formalizable tasks using a logical paradigm	Oral survey, testing, report, boundary control, term papers	**Д**$_{\text{БМ5.1.}}$ Introduction to the specialty-Computer Science Discrete Mathematics Information theory Basics of artificial intelligence
	Has an understanding of the structure and main functions of the database management system, database modeling, model types, relational models, and normal forms, database design based on normalization, conceptual, logical, and physical design. **Able to:** - design a domain information model for an information system; - use modern DBMSs for building databases in IP; - present data using different models; - create SQL queries. - generate reports; - manipulate data; - create and manage tables;	Oral survey, testing, report, boundary control, term papers	**Д**$_{\text{БМ5.2.}}$ Data base

	- create and manage database objects (sequences, indexes, views).		
Professional modules (ПМ)			
ПМ1 Data storage module	**Has an understanding** of the types of data isolation in a competitive access environment, transactional models, and algorithms for blocking States and managing data access schedules. **Able to: -** work with relational data models on the data warehouse side, manage transactions, and manage the integrity of data and operations.	Oral survey, testing, report, boundary control, term papers	**ДПМ1.1.** conception of ACID
	Has an understanding of the basic concepts of Big Data technology - basic concepts of forecasting-basic forecasting technologies **Able to** define big data arrays, analyze big data clusters, and make various forecasts for the development of socio-political processes	Oral survey, testing, report, boundary control, term papers	**ДПМ1.2.** Big Data
ПМ2 System administration module	**Has an understanding** of the basic principles of DBMS organization, technologies for creating databases, storing data and processing data using DBMS tools **Able to** document the processes of creating information systems at all stages of the life cycle	Oral survey, testing, report, boundary control, term papers	**ДПМ2.1.** Database management systems

	conduct a survey of organizations, identify information needs of users, form requirements for the information system, participate in reengineering of application and information processes		
	Has an understanding of the principles of construction, architecture, organization and operation of operating systems, the current level of development of platforms**.** **Able to:** installing and configuring modern operating systems; - ensure effective protection of information by means of the operating system; - manage the processes and organization of effective operation of the computer system.	Oral survey, testing, report, boundary control, term papers	**ДПМ2.2.** Operating system
	Has an understanding of the principles of construction, architecture, organization and functioning of virtual operating systems, virtual contexts, and the current level of development of virtualization and containerization platforms. **Able to:** install and configure a modern virtualization platform, containerization; - administer a fleet of virtual operating systems;	Oral survey, testing, report, boundary control, term papers	**ДПМ2.3.** Virtualization and containerization

	- manage the container fleet and orchestrate their interdependencies and interactions.		
ПМ3 Intelligent systems module	**Has an idea** of modern models of biological and artificial neural networks, methods of their application for information processing and image recognition **Able to** set tasks and develop algorithms for solving them for the implementation of software implementations of neural networks for the purpose of processing static and video images use different models of neural networks for solving information processing problems to develop a software implementation of the neural networks to process both static and video images	Oral survey, testing, report, boundary control, term papers	**ДПМ3.1.** Processing analog and digital signals Digital image processing Theory of neural networks Deep learning ANN Natural language processing Intelligent robotic systems
	Has an understanding of modern Data Mining methods, understanding the main problems that arise in data analysis, and ways to solve them **Able to** use the appropriate mathematical apparatus and tools for processing, analysis, and systematization of information on the research topic	Oral survey, testing, report, boundary control, term papers	**ДПМ3.2.** Scientific Python Data analysis R language in statistical analysis problems

ПМ4 Internet and mobile application development module	**Has an understanding** of the basics of web development when creating a web page using HTML, CSS and JavaScript, as well as basic programming concepts (functions, loops, conditional operators) and methods for solving other problems that occur when programming web pages **Able to** think critically about how to solve problems with programming; can write JavaScript programs using functions, loops, and conditional operators; can use HTML to create a web page with formatting, using blocks, images, links, and lists; can add styles to a web page with CSS IDs and classes; and can create an interactive web page using JavaScript commands such as alert, onClick, and onChange	Oral survey, testing, report, boundary control, term papers	**ДПМ4.1.** Web programming fundamentals Network programming technologies Software Engineering
	Has an understanding of the basics of web development using the model View Controller, Model View-View Model paradigms. It also has a representation of the HTTP request processing cycle. About technologies for batch deployment, reuse of code and blocks of computing structures, implementation of dependencies, singleton pattern, statefull and stateless applications. Extensible and	Oral survey, testing, report, boundary control, term papers	**ДПМ4.2.** Enterprise web programming High Load programming platforms Parallel programming Microservice technologies Game Development Interactive graphics systems

	non- extensible architectures and applications. **Able to** think critically, automate business processes, and manage the data lifecycle. it can create WEB applications in a high -level language using multi-level and scalable application design templates. Use modern tools and approaches to data storage. Able to choose the correct application architecture based on the initial conditions		
	Has an understanding of the basics of web development using the multi - functional client application paradigm based on a high level of scripting language implementation. Has an idea of asynchronous interaction with the server software module. About modern HTML/CSS/Javascript/Typescript models. About technologies for batch dependencies, code reuse and blocks of computing structures, dependency injection, session and browser context. The model of reactive programming. **Able to** use modern frameworks and tools for building multi-functional interactive WEB applications in a high-level language using Component — Data	Oral survey, testing, report, boundary control, term papers	**ДПМ4.3.** SPA Web programming

	- Service templates. Use modern tools and approaches to authentication, authorization, data storage, and transmission protocols. Able to choose the correct application architecture based on the initial conditions.		
	Has an understanding of modern mobile technologies; the main components of the architecture of mobile platforms; the life cycle of mobile applications and their structure, the main elements of the user interface of mobile applications; the principles of mobile application development; **Able to** develop mobile applications and support services using different technologies. They will be able to organize interaction and data transfer between storage and mobile devices.	Oral survey, testing, report, boundary control, term papers	**ДПМ4.4.** Mobile app development Programming of microcomputer controllers
ПМ5 Internet and web technologies module	**Has an idea** about the possibilities and prospects of development of Internet technologies, principles of interaction between client and server, software, web publishing, programming languages and technologies for creating web applications **Able to** navigate the web application development software market,	Oral survey, testing, report, boundary control, term papers	**ДПМ5.1.** Internet technology Enterprise Computing

	manage web sites and navigate the WWW, develop simple web sites that include interactive components, server – side (php) scripts that provide dynamic content generation and client functions		
	Has an understanding of the structures and principles of the world wide web WWW, the main types of modern web technologies and the principles of their operation **Able to** structure information for publication on web resources, use modern web technologies in professional activities	Oral survey, testing, report, boundary control, term papers	**ДПМ5.2.** Modern web technologies
ПМ6 Information systems module	**Has an understanding** of the basics of human-computer interaction, user interface design, and usability analysis **Able to** understand the basics of human and computational abilities and their limitations; understand the basic theories, tools, and methods in HCI; understand the fundamental aspects of interface design and evaluation; understand various simple methods for evaluating the quality of the user interface; apply appropriate HCI methods to design systems that can be used by people.	Oral survey, testing, report, boundary control, term papers	**ДПМ6.1.** Human Computer Interraction

	Has an understanding of the principles, methods, approaches and tools for effective information security management in a modern organization **Able to** conduct experiments according to a given method, process, evaluate the error and reliability of their results, and organize the work of a small team of performers in professional activities	Oral survey, testing, report, boundary control, term papers	**ДПМ6.2.** Information security risk management
	Has an understanding of the infrastructure of information systems, the integral parts of the system and the principles of their interaction and interdependence. **Able to** design / audit information system infrastructure	Oral survey, testing, report, boundary control, term papers	**ДПМ6.3.** Introduction To Enterprise Computer Environment Management in information systems Information systems design Business Information Systems Production and Operations Management Supply chain and logistics Introduction to Enterprise Resource Planning Internet of Things Business Intelligence

10 Matrix of competences

	Mathematical, natural science and digital literacy	Proficiency in social and business communication languages	Critical and creative thinking	Goal setting, leadership skills and social responsibility	Technologies and programming languages	Models and methods for managing processes and projects	Data analysis models and methods
Communication skills and business etiquette		+	+	+			
Language literacy	+	+					
Basic technical competencies	+				+		
Time management and teamwork			+	+		+	
Programming and automation of business processes	+		+		+		+
Data collection, storage, processing and analysis	+				+		+
Analysis, design, implementation and maintenance of Information Systems			+	+	+	+	

Horizontal: Learning Results
Vertical: Competencies

11 Description of disciplines

Algebra and the beginning of mathematical analysis
CODE – MAT00120
CREDIT – 3 (1/0/2)
PREREQUISITE-diagnostic test

COURSE GOALS AND OBJECTIVES
The purpose of the course is to introduce students to the basic ideas and concepts of algebra and mathematical analysis and to form the basic knowledge necessary for studying the course "Mathematics 1".
The objectives of the course are to develop skills for studying mathematical disciplines and effective use of mathematical methods for solving research and practical problems in the professional field.

BRIEF DESCRIPTION OF THE COURSE
The course "Algebra and introduction to analysis" provides the basic concepts of algebra, mathematical analysis, differential and integral calculus.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
Student need to know:
- basic concepts of algebra;
- basic concepts of mathematical analysis;
- basic elementary functions;

must be able to:
- find solutions to equations and inequalities, systems of equations and inequalities;
- convert algebraic and trigonometric expressions;
- to solve word problems;
- find the derivative of elementary functions;
- explore functions using a derivative;
- find an indefinite integral of elementary functions;
- find a specific integral;
- find the area of a curved trapezoid.

Mathematics I
CODE – MAT00121
CREDIT – 3 (1/0/2)
PREREQUISITE-Elementary mathematics-school course/diagnostic test

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COURSE GOALS AND OBJECTIVES
The main goal of the course is to give the future specialist a certain amount of knowledge on the sections of the course "Mathematics-I", necessary for studying related engineering disciplines. Introduce students to the ideas and concepts of mathematical analysis. The main attention is paid to the formation of basic knowledge and skills with a high degree of understanding of differential and integral calculus.
Objectives of the course: acquisition of knowledge necessary for effective use of rapidly developing mathematical methods; getting the skills to build and study mathematical models; possession of fundamental sections of mathematics necessary for solving research and practical problems in the professional field.

BRIEF DESCRIPTION OF THE COURSE
The course "Mathematics-I" provides a summary of the sections: introduction to analysis, differential and integral calculus

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
Studying this discipline will allow students to apply the course "Mathematics-I" to solving simple practical problems, find tools sufficient for their research, and get numerical results in some standard situations.

Mathematics II
CODE – MAT00122
CREDIT – 3 (1/0/2)
PREREQUISITE – Mathematics I

COURSE GOALS AND OBJECTIVES
The purpose of teaching the course "Mathematics II" is to form a bachelor 's idea of modern mathematics as a whole as a logically coherent system of theoretical knowledge.
The objectives of the course are to instill in students solid skills for solving mathematical problems and bringing the solution to a practically acceptable result. Develop primary skills in mathematical research of applied issues and the ability to independently understand the mathematical apparatus contained in the literature related to the student 's specialty.

BRIEF DESCRIPTION OF THE COURSE
The course "Mathematics-II" provides an accessible presentation of the sections: elements of linear algebra and analytical geometry, differential calculus of functions of many variables, multiple integrals. "Mathematics II" is a logical continuation of the course "Mathematics I".

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
The study of this discipline will allow you to apply in practice the received theoretical knowledge and skills with a high degree of their understanding in the course sections, use them at the appropriate level; translate into mathematical language the simplest problems posed in terms of other subject areas; acquire new mathematical knowledge using educational and information technologies; solve applied problems in the field of professional activity

Mathematics III
CODE – MAT00123
CREDIT – 3 (1/0/2)
PREREQUISITE – Mathematics I, Mathematics II

COURSE GOALS AND OBJECTIVES
The purpose of teaching the course "Mathematics-III" is to form basic knowledge and skills with a high degree of understanding of the course sections that help to analyze and solve theoretical and practical problems.
Objectives of the course: instilling students with the ability to independently study educational literature, conduct theoretical-probabilistic and statistical analysis of applied problems; develop of logical thinking and increase the overall level of mathematical culture.
SHORT DESCRIPTION OF THE COURSE
The course "Mathematics-III" includes sections: series theory, elements of probability theory and mathematical statistics and is a logical extension of the discipline "Mathematics II.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE
The student should know:
- the theory of numerical series;
- theory of functional series;
- Fourier series;
- elements of probability theory and mathematical statistics;
must be able to:
- to solve problems for all sections of the theory of series;
find the probability of events;
- find numerical characteristics of random variables;
- use statistical methods for processing experimental data;

Physics I, II
CODE – PHYS111-112
CREDIT – 6 (2/2/2)
PREREQUISITE-diagnostic test/PHYS110-111

COURSE GOALS AND OBJECTIVES
the main purpose of teaching the course Physics I and Physics II is to form ideas about the modern physical picture of the world and scientific worldview.

SHORT DESCRIPTION OF THE COURSE
The disciplines of Physics I and Physics II are the basis of theoretical training for engineering and technical activities of graduates of the higher technical school and represent the core of physical knowledge necessary for an engineer operating in the world of physical laws. The course "Physics 1" includes sections: physical basics of mechanics, the structure of matter and thermodynamics, electrostatics and electrodynamics. The discipline "Physics II" is a logical continuation of the study of the discipline "Physics 1", and forms a holistic view of the course of General physics as one of the basic components of General theoretical training of bachelors of engineering and technical profile. The discipline "Physics II" includes sections: magnetism, optics, nano-structures, fundamentals of quantum physics, atomic and nuclear physics.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
- the ability to use knowledge of fundamental laws, theories of classical and modern physics, as well as the use of methods of physical research as the basis of the system of professional activity.

Contemporary history of Kazakhstan
CODE – HUM113
CREDIT– 3 (1/0/2)
PREREQUISITE – no

COURSE GOALS AND OBJECTIVES
The aim of the course is to familiarize engineering students with the basic theoretical and practical achievements of Soviet historical science on the history of modern Kazakhstan, a comprehensive and systematic study of the main stages of formation and development of Kazakhstan society.
- analyze the features and contradictions of the history of Kazakhstan in the Soviet period;
To reveal the historical content of the foundations of the laws of political, socio-economic, and cultural processes at the stages of formation of an independent state;
Contribute to the formation of students ' civic position;
- educate students in the spirit of patriotism and tolerance, belonging to their people, the Fatherland;
SHORT DESCRIPTION OF THE COURSE
The course Modern history of Kazakhstan is an independent discipline and covers the period from the beginning of the twentieth century to the present day. Modern history of Kazakhstan studies the national liberation movement of the Kazakh intelligentsia at the beginning of the XX century, the period of creation of the Kazakh ASSR, as well as the process of formation of a multinational society
KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
- knowledge of events, facts and phenomena of the modern history of Kazakhstan;
- knowledge of the history of ethnic groups living in Kazakhstan;
- knowledge of the main stages of the formation of the Kazakh state;
- ability to analyze complex historical events and predict their further development;
- ability to work with all types of historical sources;
- ability to write essays and scientific articles on the history of the Fatherland;
- ability to operate with historical concepts;
- ability to conduct a discussion;
- skills of independent analysis of historical facts, events, and phenomena;
- public speaking skills.

Kazakh/Russian language
Code – LNG1012-1102.1
CODE – 4 (0/0/4)
PREREQUISITE-diagnostic test

COURSE GOALS AND OBJECTIVES
- teach students to listen to statements on well-known topics related to home, school, and leisure time;
- understand texts on personal and professional topics that contain the most frequent words and expressions;
- be able to conduct a conversation on everyday topics; describe your experiences; Express your opinion; retell and evaluate the content of the book you read, the movie you saw;
- be able to create simple texts on well-known topics, including those related to professional activities.

SHORT DESCRIPTION OF THE COURSE
The language material of the course is selected in such a way that the student, learning the lexical and grammatical minimum, has the opportunity to get acquainted with typical communicative situations and find himself in such situations, was able to correctly assess them and choose the appropriate model (strategy) of speech behavior.
The main focus of training is transferred from the process of knowledge transfer to training in the ability to use the language being studied in the course of various types of speech activities, such as reading (if you understand what you read), listening (under the same condition) and producing texts of a certain complexity with a certain degree of grammatical and lexical correctness.
Material for lessons matched to students learning the Kazakh/Russian language, acquired the skills of reading, writing and understanding oral speech on the basis of simultaneous development of the basics of grammar (phonetics, morphology and syntax) and word usage in the course of constant repetition with gradual complication of tasks.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
Student with the active organizing work in the classroom and diligent homework by the end of the first semester acquires skills corresponding to the European A2 level (Threshold for classification ALTE), that is, is on the threshold of a level of independent proficiency.

English
CODE – LNG1051-1057
CREDIT – 12 (0/0/12)
PREREQUISITE-diagnostic test/LNG1051-1056

LNG1051
COURSE GOALS AND OBJECTIVES
The English language discipline " Beginner English" is designed primarily for learning from scratch. This course is also suitable for those who have only General basic knowledge of the language. After passing this level, the student will be able to confidently communicate on basic topics in English, learn the basics of grammar and lay a certain Foundation that will allow them to improve their skills at the next stage of learning English.
Post- requisites of the course: Elementary English.
LNG1052
COURSE GOALS AND OBJECTIVES
The "Elementary English" discipline is the Foundation for learning English, which is aimed at developing students ' receptive skills (reading and listening) and productive skills (writing and speaking), analyzing basic knowledge, using and memorizing the main grammatical rules and mastering the features of pronunciation and elementary vocabulary, as well as encouraging independent learning and critical thinking.
Course prerequisites: Beginner.
Prerequisites of the course: General 1.
LNG1053
COURSE GOALS AND OBJECTIVES
The goal of the General English 1 course is to provide students with the opportunity to gain sufficient knowledge to become more fluent in everyday social and academic settings. Students are working to improve their pronunciation, vocabulary, and grammar. At this level, the main task will be to consolidate the skills acquired earlier, to learn how to compose and correctly apply complex syntactic structures in English, and to achieve a really good pronunciation.
Prerequisites of the course: Elementary English.
Post- requisites of the course: General 2.
LNG1054
COURSE GOALS AND OBJECTIVES
The "General English 2 "course is intended for students who continue to study "General English 1". The course focuses on the ability to actively use in practice most aspects of English tenses, conditional sentences, phrases in a passive voice, etc.at this stage, the student will be able to maintain a conversation with several interlocutors or Express their point of view. The student significantly expands their vocabulary, which will allow them to freely Express their thoughts in any environment. In this case, the speech will be supplemented with various synonyms and antonyms of already familiar words, phrasal verbs and stable expressions.
Course prerequisites: General 1.
Post-requisites of the course: Academic English.

LNG1055
COURSE GOALS AND OBJECTIVES
The main goal of the Academic English course is to develop academic language skills. The discipline is a language style that is used when writing academic papers (paragraph, abstract, essay, summary, etc.).

This course is designed to help students become more successful and effective in their learning, developing critical thinking skills and independent learning.
Course prerequisites: General 2.
Post- requisites of the course: Professional English.
LNG1056
COURSE GOALS AND OBJECTIVES
"BusinessEnglish" (Business English) is an English language for business communication, business and career. Knowledge of business English is useful for conducting negotiations and business correspondence, preparing presentations and informal communication with business partners.
The peculiarities of training are that it is necessary not only to master the vocabulary, but also to master new skills: presentation, communication, language, and professional.
Course prerequisites: IELTS score 5.0 and / or Academic English
Post-qualification course: Professional English, IELTS score 5.5-6.0
LNG1057
COURSE GOALS AND OBJECTIVES
The "Professional English" course is designed for B2+ students, whose goal is to improve the language competence of students in their respective professional fields. The main goal of the course is to teach students to work with texts, both audio and written, in their specialty. The curriculum is based on the necessary vocabulary (words and terms) often used in English for special purposes. Students will acquire professional English skills through integrated content-and language-based learning, acquire a vocabulary to read and understand original sources with a high degree of independence, and practice various communication models and vocabulary in specific professional situations.
Prerequisites of the course: Business English.
Course post-requirements: any elective course.

Philosophy
CODE – HUM 124
CREDIT – 3 (1/0/2)
PREREQUISITE – **Contemporary history of Kazakhstan**

COURSE GOALS AND OBJECTIVES
The aim of the course is to develop cognitive, operational, communicative, and self- educational competencies for solving problems:
- to promote the development of an adequate philosophical orientations in the contemporary world;
- to form creative and critical thinking among students;
- to distinguish the ratio of spiritual and material values, their role in the life of a person, society and civilization;
- to help define your attitude to life and search for harmony with the world around you.
SHORT DESCRIPTION OF THE COURSE
"Philosophy" is the formation of a holistic worldview that has developed in the context of the socio-historical and cultural development of mankind. Introduction to the main paradigms of the methodology of teaching philosophy and education in the classical and post-classical traditions of philosophy. Philosophy is designed to develop stable life guidelines, finding the meaning of one's being as a special form of spiritual production. Contributes to the formation of the moral image of the individual with the ability of critical and creative thinking. The theoretical sources of this course are the concepts of Western, Russian, and Kazakh scientists on the history and theory of philosophy.

- KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
- - knowledge of the main terms, main concepts and problems of philosophy;
- - knowledge of the main philosophical ways of solving worldview issues in the context of culture;
- - ability to analyze the history of the development of philosophical thought;
- - ability to determine alternative ways of setting and solving worldview issues in the history of human development;
- - ability to identify the main theoretical approaches in the relationship between a person and society;
- - ability to master the technique of performing independent work;
- - skills of searching for systematization of material;
- - skills to freely discuss and make rational decisions;
- - skills of ethical principles in professional activity.

Social-political knowledge
CODE – HUM126
CREDIT – 2 (2/0/0)
PREREQUISITE – no

PURPOSE AND TASKS OF THE COURSE

This course involves the study of four scientific disciplines - psychology, political science, sociology and cultural studies, each of which has its subject, terminology and research methods. Interactions between these scientific disciplines are carried out based on the principles of information complementarity; integrability; methodological integrity of research approaches of these disciplines; generality of result-oriented teaching methodology; unified system representation of the typology of learning outcomes as formed abilities.

The theoretical sources of this course are the concepts of Western, Russian, and Kazakh scientists in the field of sociology, political science, and cultural studies.

Differential equations in partial derivatives
CODE – MAT00125
CREDIT – 3 (1/0/2)
PREREQUISITE – Mathematics I-III

COURSE GOALS AND OBJECTIVES
The purpose of teaching the course " partial Differential equations. Matlab " is the formation of basic knowledge on the sections of the course that help to analyze, model and solve theoretical and practical problems.
Course objectives: apply the theory of partial differential equations to solve and research applied problems from various fields of natural science, economics, medicine, biology and ecology; form ideas about the implementation of numerical methods for solving boundary value problems using Matlab.
SHORT DESCRIPTION OF THE COURSE
Basic equations of mathematical physics. Classical boundary value problems for partial differential equations. Analytical and numerical methods for solving classical boundary value problems. Using Matlab for numerical solution of boundary value problems.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
- master this mathematical apparatus that allows you to analyze, model, and solve classical boundary value problems;
- to master the methods of solution of classical boundary value problems;
-be able to set a problem, choose methods of solving it, both in analytical form and using computer technologies;
- use modern software-Matlab package;
- master the methodology and skills of numerical implementation of a mathematical model, analysis of the results obtained, and interpretation of them to Refine the model;
- independently expand your mathematical knowledge.

Basics of electronics
CODE – ROB156
CREDIT – 3 (2/1/0)
PREREQUISITE – Physics I

COURSE GOALS AND OBJECTIVES
Teaching students the choice of elements of the theoretical foundations of electrical engineering, principles and methods of calculating electrical circuits, scientific foundations and the current state of electrical engineering. It deepens and develops the training of engineers who master the modern technology of construction and calculation, as well as the selection of electrical devices.

SHORT DESCRIPTION OF THE COURSE
The discipline covers: basic concepts and definitions used in electrical engineering; modern methods for modeling electromagnetic processes; methods for analyzing electric and magnetic circuits; numerical methods for analyzing electric circuits; basic laws and principles of electrical engineering, properties and characteristics of electric circuits; methods for analyzing electric circuits in steady-state and transient modes; choosing the optimal method of calculation, to determine the main parameters and characteristics of electric circuits.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
The course " Theoretical foundations of electrical engineering" gives students knowledge about electrical and magnetic phenomena and their use for practical purposes and provides comprehensive training for future specialists: high professional level, development of creative abilities, the ability to formulate and solve problems of the studied specialty at a high scientific level, the ability to creatively apply and solve problems independently.

Digital circuitry
CODE – SEC163
CREDIT – 3 (2/1/0)
PREREQUISITE - Basics of electronics

COURSE GOALS AND OBJECTIVES
The main goal of the course is to teach basic knowledge, modern technologies, and practical skills for hardware development.

SHORT DESCRIPTION OF THE COURSE
The course "Digital circuitry" is aimed at studying the theoretical foundations and providing practical skills in the design and use of digital electronic circuits and digital devices.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
At the end of the course "Digital circuitry", the student must know:
- modern circuitry of digital devices, its parameters, characteristics, and application features;
- basics of circuit design of digital circuits and microelectronic devices;
- conditional graphic designations of elements in accordance with current standards;
- current state, trends and prospects of development of circuit design tools of computer technology.

be able to:
- describe the operation of synthesized nodes and devices with truth tables and time diagrams;
- measure and analyze the physical parameters of digital devices;
- select and justify the selection of the element base for building computer nodes and devices;
- make a comparative assessment of elements, nodes and circuits, taking into account the main parameters;
- build functional and schematic diagrams of computer device nodes in compliance with the requirements of standards;

have the skills:
- synthesis and analysis of digital circuits using the existing element base
- design of digital circuits in software applications using the existing element base
- measurement and analysis of physical parameters of digital devices;

Information systems infrastructure
CODE – CSE250
CREDIT – 3 (2/1/0)
PREREQUISITE-Introduction to the specialty – Computer Science

COURSE GOALS AND OBJECTIVES
This discipline teaches fundamental concepts of information systems (is), namely hardware and software in relation to computers used in the business environment.

SHORT DESCRIPTION OF THE COURSE
Within this discipline, students gain fundamental knowledge and skills in programming, operating systems, the Internet, data transfer, the life cycle of IP development, the use of standard software packages (SOFTWARE), including text processing, spreadsheets, databases, and presentation graphics. In General, the discipline is aimed at developing an understanding of the role of IP in the business community and familiarization with the computer skills of the "end user". To pass this discipline, you need practical experience working with personal computers in laboratories and basic mathematical knowledge.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
Upon completion of this discipline, the student will be able to:
explain the purpose of software and hardware, data, procedures, and people in a business computer system;
identify the main hardware elements of a computer system and describe the purpose of each element;
understand the role and use of various widely used SOFTWARE packages, including spreadsheets, word processors, databases, and presentation SOFTWARE;
demonstrate an understanding of the operating system and correctly execute the commands associated with it;
demonstrate an understanding of the programming process and the role of SOFTWARE in solving business-related problems;
describe how communication and network technologies are used;
understand the role and use of the Internet;
define requirements when selecting specific hardware systems and SOFTWARE packages for a specific environment;
explain the role of information and how management information systems (ISMS) are developed and used in the organization;
explain what a database is according to the terminology and what role it plays in the business environment, including questions about using databases on the Internet;
understand how multimedia is used to improve communication;
identify and describe the different stages of the IP development lifecycle and the type of actions performed at each stage;
to understand computer-related ethical issues, issues of security, privacy and legal issues.

Discrete mathematics
CODE – CSE603
CREDIT – 3 (2/1/0)
PREREQUISITE – Mathematical analysis

COURSE GOALS AND OBJECTIVES
formation of fundamental knowledge among students in the study of questions of set- theoretic description of mathematical objects, the main problems of graph theory and methodology of using the apparatus of mathematical logic that make up the theoretical Foundation of the description of functional systems.

SHORT DESCRIPTION OF THE COURSE
The discipline deals with: General principles of set-theoretic description of mathematical objects, the main problems of graph theory and the methodology of using the apparatus of mathematical logic; methods for setting sets, Boolean functions and graphs, as well as the main methods of operating with them; the choice of optimal methods for solving problems of set theory, mathematical logic and graph theory.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
As a result of mastering the discipline, the student will:
Know:
- methods for setting sets, basic operations on them, relations between elements of sets, their properties and types of relations;
- displays and functions, types of displays, basic operations on displays;
- basic concepts of combinatorics, methods for solving combinatorial problems;
- basic combinatorial configuration, the method of inclusion-exclusion;
- basic concepts of graph theory, connected graphs, graph isomorphism;
- methods for solving extreme problems on graphs, algorithms for coloring vertices and edges of a graph.

Be able to:
- use special mathematical symbols to Express quantitative and qualitative relationships between objects;
- prove the basic theorems of set theory perform operations on sets, use the set theory apparatus to solve problems, and investigate binary relations for given properties;
- build normal forms and determine the functional completeness of systems of functions of the algebra of logic;
- solve optimization problems on graphs.

Own:
- practical experience in solving problems of set theory, mathematical logic, combinatorial and graph-theoretic problems;
- skills in using the language and tools of discrete mathematics.

Introduction to the specialty - Computer science
CODE CSE624
CREDIT– 3 (1/1/1)
PREREQUISITE – no

COURSE GOALS AND OBJECTIVES

The purpose and objectives of the course are to reveal the field of information technology for students of the 1st year of study and to determine the 3 main trajectories of development within the educational program: Artificial intelligence, software development, information systems. Training in the first skills of working with a computer, to give the basic terminology, modern trends in the development of information technologies, to lay the basic concepts of algorithmization and programming. The course objectives include:

- Reveal the basic concepts of computer system architecture;
- Reveal the basic concepts of information and communication technologies and subject terminology;
- Learn how to work with software interfaces of operating systems;
- Reveal the concepts of data formats and multimedia content. Learn how to work with typical multimedia data processing applications. To use modern approaches of the presentation of the material;
- Reveal the concepts of modern social, cloud, and email platforms and how to work with them;
- To teach to use methods of algorithmization and programming for solving problems of automation of business processes.

This course covers the basic concepts and properties of the algorithm. We study the data types supported by the technical hardware of the computer, the mechanisms of working with variables, values, and literals. Number systems. The structure of the program code, the content of the program project. The structure of a linear and branching process, the principles of repetitive operations, and I / o tools. Introduction to algorithmization and programming is based on a high – level language-Python.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE

As a result of the course, students will get an idea of the 3 directions of development, which will allow them to determine the trajectory of their learning. Students will be able to use the operating system and work with different types of files. Know the principles of programming technology in an imperative language, be able to design algorithms and write program code, build and run a program, and use tools for debugging program code.

Algorithms and data structures
CODE CSE164
CREDIT – 3 (1/1/1)
PREREQUISITE: Basics of algorithmization and programming

COURSE GOALS AND OBJECTIVES
This course is aimed at studying the effective use of data structures and algorithms for solving various problems. The student will learn to understand the logical relationships between data structures related to tasks and their live examples and applications. The course contains topics such as-algorithms, data construction, arrays, search algorithms, stack, queues, single and TLD linked lists, trees, sorting, hash tables, heaps, arithmetic algorithms, graphs. The course is based on the C language as the main high-level language for building system applications and the basic language for studying data types, data structures, mechanisms for calling functions and working with memory.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE
The student will be able to determine the asymptotic complexity of the algorithm. Be able to determine the correct form of data storage depending on the task, determine the most optimal ways to solve the problem based on the architecture of the computer. The student will get acquainted with the most well-known data processing algorithms. Learn how to use data structures such as array, stack, queue, linked list, hash table, tree, graph.
The student will be able to effectively apply various data structures to find the most optimal solutions to the problem. Programming in C language.

Algorithms
CODE CSE605
CREDIT – 3 (1/1/1)
PREREQUISITE: Algorithms and data structures

COURSE GOALS AND OBJECTIVES

This course is a continuation of the discipline Algorithms and data structures with a focus on the study of complex algorithms for processing structured and unstructured information. The issues of dynamic programming, operations on strings, prefix trees, geometric algorithms, Fenwick trees, and Descartes are covered. Advanced graph algorithms, global optimization methods, NP complex problems, and approximation methods.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
The student will be able to solve complex problems using a set of knowledge about algorithms and their applicability. Be able to determine the correct form of data representation and projection for solving the problem. Find optimal solutions based on the architecture of the computer. Programming in C++.

Web Programming Fundamentals
CODE – CSE273
CREDIT – 3 (2/1/0)
PREREQUISITE – Basics of algorithmization and programming

COURSE GOALS AND OBJECTIVES
The main purpose of studying the discipline in the training of specialists is to teach the basics of developing WEB sites and WEB applications using modern tools.

SHORT DESCRIPTION OF THE COURSE
The course is designed to learn the basics of Web programming and development. Before the end of the course, students will have to study:
* basics of operation, configuration, and administration of software that implements Internet services;
• the HTML markup language;
* basics of web page layout using CSS;
• the basics of the JavaScript language;
• basic web page design templates;
* basics of the PHP server language;

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
Students will know:
- Development of static sites (HTML, JS, CSS)
- Development of dynamic sites (PHP)
- Placing projects on the server- hosting side.
Be able to:
Create static and dynamic web sites and applications yourself. They will have the necessary knowledge for further and deeper study of the direction of web development.

Human-computer interaction
CODE – CSE627
CREDIT – 3 (1/1/1)
PREREQUISITE – Introduction to the specialty – Computer Science

COURSE GOALS AND OBJECTIVES
This discipline aims to help students understand that user interface development is a continuous process throughout the product lifecycle, and human-computer interface development is an integral part of the cycle, not something that needs to be done at the last minute when the "rest of the system" is finished.

SHORT DESCRIPTION OF THE COURSE
This course provides an introduction to the basics of human-computer interaction, user interface design, and usability analysis. Students will learn the principles and recommendations for usability, methods of quantitative and qualitative analysis, and apply them through in-depth analysis of existing interfaces and the development of new ones. Topics covered will also include cognitive models, problem analysis, psychology, experimental design, and prototyping methods. Human-computer interaction is an interdisciplinary field that combines theories and methodologies from computer science, cognitive psychology, design, and many other fields. The course aims to introduce students to the basic concepts of human interaction with a computer. It will cover the main theories and methods that exist in this field. The discipline includes the study of design and evaluation. Among the topics studied in this discipline is the development and evaluation of effective user interaction schemes, including principles and guidelines for designing interactive systems. In addition, much attention is paid to the process of developing user interaction projects as an integral and important part of interactive software development. User interaction development stages include analysis of requirements and tasks, usability specifications, design, prototyping, and evaluation.
During the course, students will be involved in an actual problem solving / SOFTWARE development project. Students will need to collect functional requirements, identify the problem, form a solution, and submit this solution.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE
Upon completion of this discipline, students will:
- understand the basics of human and computational abilities and their limitations;
- understand the basic theories, tools, and methods in HCI;
- understand the fundamental aspects of interface design and evaluation;
- understand various simple methods for evaluating the quality of the user interface;
- apply appropriate HCI methods to design systems that can be used by people.

Scientific Python
CODE CSE628
CREDIT – 3 (1/1/1)
PREREQUISITE: Basics of algorithmization and programming, mathematics, probability theory

COURSE GOALS AND OBJECTIVES
The purpose of studying this discipline is for students to master such a powerful tool in data processing as the Python language and the SciKit library, which includes-NumPy-working with matrices, SciPy-data analysis tools, MatplotLib-data visualization tools.

SHORT DESCRIPTION OF THE COURSE
Currently, Python is recognized as the most common programming language for data processing tasks. This is due to its simplicity and intuitive syntax, which abstracts the connection with the hardware of the computer with a strong emphasis on creating small efficient algorithms. The course provides a quick overview of the syntactic features of the language and its strengths.

The main attention is paid to the mechanisms of working with data, such as: loading, filtering, transformation, analysis and interpretation of data using well- known models of classification, clustering, regression, etc. the main methods of working with matrices and matrix operations based on the NumPy library are Studied. We study MatPlotLib data visualization tools in the form of various types of graphs that allow us to analyze performed operations, calculation results, or understand the nature of the data.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE

As a result of completing the course, students get the necessary knowledge about the Python language. Get knowledge in the field of matrix operations programming and working with data. They will learn how to use tools for loading, filtering, processing, and interpreting data. Learn how to use data analysis models such as classification, clustering, and regression. Learn how to use effective approaches when writing software code in Python.

Network programming technologies
CODE CSE403
CREDIT– 3 (1/1/1)
PREREQUISITE: Object-oriented programming

COURSE GOALS AND OBJECTIVES

The course is a continuation of the object- oriented programming course and a prerequisite for Enterprise Web Programming. This course covers the fundamentals of network applications and the TCP/IP UDP Protocol stack.

SHORT DESCRIPTION OF THE COURSE

During the course, students are introduced to the OSI network model from the point of view of developing application-level network applications. The concept of Socket is studied. The concept of broadcast data transmission is studied. The concept of connection stability and data serialization is studied. Problems of asynchrony and multiplexing are considered. It provides in-depth material on extensible applications and access to network relational databases through various approaches. The course is based on a high-level object-oriented programming language. The main focus is on design patterns.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE

Know:
- mechanisms for the implementation of inter-process communication in a heterogeneous network environment
- mechanisms of TCP and UDP connections
- data serialization mechanisms
- multiplexing mechanisms for connections
- some well- established design patterns

Be able to:
- create network applications for data transfer

Information systems management
CODE –
CREDIT – 3 (2/1/0)
PREREQUISITE – Introduction to the specialty – Computer Science

COURSE GOALS AND OBJECTIVES
This discipline focuses on developing an understanding of management information systems (ISMS) and their application in organizations including management, analysis, design and implementation of ISMS, methodology, quality, decision-making, modeling, reengineering, software and hardware, and ethics.

SHORT DESCRIPTION OF THE COURSE
This discipline presents problems related to the development of such systems and their application in business, as well as some basic methods of mathematical modeling that provide information management systems with the ability to solve problems. This course is an introduction to the implementation of ISMS through the concept of "business-oriented information systems". The focus is on business concepts and the technologies that support them. Special attention is paid to individual and organizational methods of work necessary for developing effective solutions for implementing information systems in a business context. In parallel, certain business communication and decision-making skills are being developed. Students will be given the opportunity to apply their knowledge and skills. This approach will allow them to understand that business initiatives and priorities determine the choice of Isus and decision-making.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
At the end of the course, students will be able to:
- develop and create solutions to business problems;
- document and communicate solutions on a professional level;
- use a wide range of tools for end users;
- to propose effective approaches to the development of the IMS, the use of information and building of it capabilities in a specific environment.

Data base
CODE CSE626
CREDIT– 3 (2/1/0)
PREREQUISITE – Introduction to the specialty – Computer Science, algorithmization and programming basics

COURSE GOALS AND OBJECTIVES
The purpose of the course is to give the basic concepts of data storage, types of storage. Define a physical and conceptual data model. To determine the differences between them and approaches to the task of building databases. Various types of data storage are considered, algorithms for organizing effective access to data, and the differentiation of data access rights are considered. The practical and theoretical part of the course focuses on the relational data model and the SQL language. The course is designed for all three areas of the educational program, knowledge of SQL as the main tool for working with databases is a basic requirement in IT.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE
At the end of the course, the student will know the basic data storage models. Be able to distinguish between the physical and conceptual data model. Be able to work with file stores — text and binary. Examine the relational data model. Will know the process of normalization of the data. Master the SQL language.
As a result of studying the module, the student will be able to:
- Install, configure, and interact with the relational database management system;
- Describe, define, and apply the main components of the relational database model to the database design;
- use the structured query language (SQL) to define and manipulate the database;
- use the database modeling method for a single entity class, a one-to-one (1:1) relationship between entity classes, a one-to-many (1:M) relationship between entity classes, a many-to-many (M:M) relationship between entity classes and recursive relationships;
- define, develop, and process individual entities, tables 1: 1, 1: M, and M:M;

Object-oriented programming
CODE –
CREDIT – 3 (2/1/0)
PREREQUISITE - basics of algorithmization and programming

COURSE GOALS AND OBJECTIVES
The purpose of studying this discipline is for students to master models for creating software based on high-level languages that allow them to operate on user- defined data topics and set rules for working on them-object-oriented languages.

SHORT DESCRIPTION OF THE COURSE
The Object-oriented programming paradigm fundamentally defines the principles of creating scalable software using a high-level method of designing business environment concepts in the programming language. Today, there are many object-oriented and object-oriented programming languages. for an academic course, the most appropriate languages are Java and C#, on the basis of one of which the program of the discipline is built. The principles of abstraction, encapsulation, inheritance, and polymorphism are studied. The most frequently used software design patterns are studied.
The main focus is on developing practical skills for creating software products. The course is aimed at solving a large number of problems by writing program codes using the OOP paradigm.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE
As a result of the course, students get the necessary knowledge about the object-oriented programming approach. They will learn to identify abstractions of business processes and mechanisms of interaction between these abstractions. Learn how to use inheritance, data encapsulation, and polymorphism tools. Learn how to use effective approaches when writing software code using established design patterns.

Conception ACID
CODE _____
CREDIT – 3 (2/1/0)
PREREQUISITE: Databases

COURSE GOALS AND OBJECTIVES

The course is a continuation and in-depth study of data stores of the integrity model. The purpose of the course is to reveal the principles of ACID-Atomicity Consistency Integrity Durability. Using the example of relational data stores, we will examine the problems of consistency of operations on data, access logs, and serializability of the process. Various models of data isolation and transaction control will be considered.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE
At the end of the course, the student will know the basic models for organizing data integrity and operations. Be able to distinguish between the physical and conceptual data model. Master the imperative language of operating data on the DBMS side.
As a result of studying the discipline, the student will be able to:
- implement the principles and concepts of information integrity, security, and confidentiality.
- understand the concept of operation atomicity, integrity, and stability. Be able to use data isolation models.

Database management systems
CODE_____
CREDIT– 3 (2/1/0)
PREREQUISITE: Databases

COURSE GOALS AND OBJECTIVES
The course is primarily aimed at enabling students to:
Apply database design principles and effectively use various database management systems in terms of administration.

SHORT DESCRIPTION OF THE COURSE
This course is intended for mastering database system management skills. Built on the basis of relational databases. The issues of physical storage organization, installation, distribution of access rights, data partitioning, efficient construction of indexes, views and materialized views, interaction with environment variables, and third- party data sources are considered. Stability and backup issues are considered.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
Student:

- must know the principles and concepts of DBMS management.
- must have skills:

Installations, settings, and interactions with the relational database management system; using database modeling methods for a single entity class, a one-to-one (1:1) relationship between entity classes, a one-to-many (1:M) relationship between entity classes, a multi-to-many (M: M) relationship between entity classes, and recursive relationships;

OS & System level programming
CODE–
CREDIT – 3 (2/1/0)
PREREQUISITE – Computer Architecture & Concurrency, basics of algorithmization and programming

COURSE GOALS AND OBJECTIVES

Study of the concepts, structure and mechanisms of various operating systems, as well as their capabilities and speed of operation of machines, their purpose and requirements for their system maintenance
Familiarization of students with the main theoretical and practical aspects of system programming at the level of program development, which allows them to obtain modern programs with a complex logical structure with the lowest cost. The objective of the discipline is to obtain systematic knowledge about the composition and management principles of the VM, systems and networks, the purpose of the components of operating systems, the principles of functioning of various elements of operating systems and their interaction, generation and development of processes in the system.

SHORT DESCRIPTION OF THE COURSE
The article describes the basic principles of operating system design, the possibility of applying fundamental concepts based on the achieved technological level and specific requirements for a specific implementation, their relationship with various innovations in this area, as well as with modern trends in the development of operating systems.
The discipline is a natural science discipline that introduces students to the fundamentals of system programming in Linux: tools, low-level I / o, multitasking, file system, interprocess communication, and error handling.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
Students will know:
- fundamental principles of design, analysis, and the most important features of modern operating systems;
- the main structures and mechanisms of operating systems, as well as the most important conventions and design solutions used in their development, such as: the concept of a process, process interaction, deadlock problems, memory organization, file system structure, I / o system description, networks, and operating system security;
- basic concepts of system programming, be able to develop programs that cover issues of system software.

Students will be able to:
- Run on the command line;
- Program in bash;
- With AWK text tables;
- Manage files and I / o;
- Manage the process
- Configure network services
- Programming work with the basic operations of input / output;
- Write programs using buffered I / o;

- Work with extended file I / o
- Work with the file system;
- Work with processes and threads;
- Work with memory;
- Manage interprocess communication

Operating system
CODE -
CREDIT – 3 (2/1/0)
PREREQUISITE – Computer Architecture & Concurrency

COURSE GOALS AND OBJECTIVES

Study of the concepts, structure and mechanisms of various operating systems, as well as their capabilities and speed of operation of machines, their purpose and requirements for their system maintenance

SHORT DESCRIPTION OF THE COURSE
The article describes the basic principles of operating system design, the possibility of applying fundamental concepts based on the achieved technological level and specific requirements for a specific implementation, their relationship with various innovations in this area, as well as with modern trends in the development of operating systems.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE

Students will know:

- fundamental principles of design, analysis, and the most important features of modern operating systems;
- the main structures and mechanisms of operating systems, as well as the most important conventions and design solutions used in their development, such as: the concept of a process, process interaction, deadlock problems, memory organization, file system structure, I / o system description, networks, and operating system security.

Students will be able to:

- Run on the command line;
- Program in bash;
- With AWK text tables;
- Manage files and I / o;
- Manage the process
- Configure network services

Data analysis
CODE – CSE439
CREDIT – 3 (1/1/1)
PREREQUISITE – Algorithmization and programming basics, probability Theory and mathematical statistics

COURSE GOALS AND OBJECTIVES
The objectives of this course are as follows:
introduce students to the mathematical foundations of computing, including automata theory; the theory of formal languages and grammars; the concepts of algorithm, solvability, complexity, and computability.
improve / develop students ' ability to understand and conduct mathematical proofs for calculations and algorithms.

SHORT DESCRIPTION OF THE COURSE
Elementary statistical methods and applications to engineering problems, samples and populations, frequency distributions, probability theory, basic distributions, random sampling, estimation of point and interval values, hypothesis testing, and linear regression and correlation are studied.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
The student must know the basic rules of probability, including the laws of additivity and multiplication, independent and mutually exclusive events; random variables and probability, including discrete and continuous random variables, mathematical expectation and coefficients, and the Poisson distribution.
- must be able to:
use linear regression and correlation principles, including the least squares method that predicts a specific y value for a given x value and the value of the correlation coefficient;
- must have skills:
analyze statistical data graphically using frequency distributions and cumulative frequency distributions;

Enterprise Web programming
CODE – CSE274
CREDIT – 3 (1/1/1)
PREREQUISITE – Network programming technologies

COURSE GOALS AND OBJECTIVES

The discipline is a continuation of the course for developing skills in creating network applications. The training objectives of this course are as follows: Consideration of issues and methodologies for creating supported and extensible web application projects used in enterprises.

SHORT DESCRIPTION OF THE COURSE

MVC models based on high-level languages are studied. We study application technologies with and without saving States about client connections. Various mechanisms for reducing code volumes and reuse are considered. The issues of authentication and authorization, access to data and operations on them are considered.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE

The student will know the model for creating applications using the MVC template. It will know the mechanisms for implementing dependencies, logging, and accessing data.
Will be able to create scalable web applications with a full -featured authentication and authorization mechanism.

R programming language in statistics
CODE – CSE633
CREDIT – 3 (2/0/1)
PREREQUISITE – Probability theory and mathematical statistics

COURSE GOALS AND OBJECTIVES
The main goal of the course is to introduce students to the R language as one of the powerful data processing tools for statistical analysis.

SHORT DESCRIPTION OF THE COURSE
This course covers in detail all the main stages of data analysis using R. Students will learn how to manipulate data using both standard R and Rstudio methods, as well as special packages and libraries. The main methods of statistical analysis are described: t-test, correlation, regression, variance and regression analysis, etc. We will also learn how to write our own functions in R. special attention will be paid to the visualization of the results obtained in the course.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
Students will learn how to make a complete analysis in the programming language R.
To collect, classify data, to look for the optimal solution and based on them to create forecasts and schedules. They will learn the basics of Statistics and machine learning - text coloring, product demand, the probability of an action, and other life tasks.
Students will learn how to use data visualization tools: Histograms and graphs,
Plotly, ggplot2, qplot, Power Bi
They can use data processing models: Brosh Paganitest, Shapirotest, variance analysis, multivariate variance analysis, decision tree, random forest, regression, model ensemble, Xgboost, Catboost Time series, xgboost, mlbayesoptimisation, search greed, boruta, prophet, flyers.

Theory of neural networks
CODE CSE634
CREDIT – 3 (1/1/1)
PREREQUISITE: Fundamentals of algorithmization and programming, mathematics, probability theory and mathematical statistics

COURSE GOALS AND OBJECTIVES

The purpose of studying this discipline is to master the theoretical basis for building artificial neural networks, study the mathematical model of building networks with reverse error propagation, and methods for optimizing learning and convergence. Study of various topologies of neural networks.

SHORT DESCRIPTION OF THE COURSE
Currently, artificial neural networks are widely used in machine learning tasks. This is due to innovative learning models and technological advances that allow performing trillions of operations per second using specialized processors. Artificial neural networks are built with an attempt to resemble biological prototypes. The mathematical model is based on linear algebra operations. The problems faced by neural network architects are the selection of a model that best meets the requirements of the subject area and the solution of the problem. The process of modeling new topologies of artificial neural networks is a time-consuming task, but it is no less time-consuming to train and optimize such networks, as well as to test their performance.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
As a result of the course, the student will receive basic knowledge about artificial neural networks. Learn how to create models of the simplest perceptron, a multi-layer neural network. Will study the learning patterns and problems of convergence. Get acquainted with the problems of dimension of the feature space. This course is a theoretical Foundation for continuing to apply practical skills in machine learning.

Interactive graphics systems
CODE CSE405
CREDIT – 3 (1/1/1)
PREREQUISITE: Basics of algorithmization and programming

COURSE GOALS AND OBJECTIVES

The purpose of studying this discipline is to master the theoretical basis for building applications with an interactive graphical interface.

SHORT DESCRIPTION OF THE COURSE
The course is designed for developers of software for personal computers using windowed data presentation forms. At the moment — it is a separate niche of software development of a narrowly focused profile. This type of application is created when you need to use a wide range of tools and hardware element of graphics acceleration. The category of such applications includes applications for working with images, video sequences, three-dimensional graphics, and computer games. The course is based on the use of the C++ programming language and the Qt library as a universal platform for creating applications for all available modern operating systems.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE
Students will know how the graphical interfaces of various operating systems work. Students will learn how to create window applications and message processing loops. Students will learn how to use the basic components of visual display and data management.
Students will be able to create full- featured applications for personal computers running on the client side with a windowed view of information.

Software engineering
CODE – CSE620
CREDIT – 3 (2/0/1)
PREREQUISITE: – Basics of algorithmization and programming

COURSE GOALS AND OBJECTIVES
The purpose of the course is to provide an understanding of the principles and practices of software development, including software development processes, system requirements analysis, modern software design and implementation, software testing, and software maintenance.

SHORT DESCRIPTION OF THE COURSE
This course covers the basic concepts and methodologies of software development. It highlights the main stages of the software lifecycle, such as requirements, design, implementation, testing, and project planning. The difference between a software product and a process is also highlighted. The course includes a group project. Students will work in groups to design and develop the app according to specifications.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
Student
must know: understanding the various software processes and how to choose between them; Design in General, including the fundamental choice of software architecture, the use of modules and interfaces to enable individual development, and design patterns. Understanding good coding practices, including documentation, contracts, regression tests, and daily builds. Various quality assurance methods, including unit testing, functional testing, and automated analysis tools.
must be able to: work with version control, configuration management, module / regression testing, problem tracking, and debugging tools; Create a project plan; Create and analyze design models; and Create engineering compromises
must have the skills to: work in a team; Implement the software process in practice;

Mobile app development
CODE – CSE1562
CREDIT – 3 (1/2/0)
PREREQUISITE – no

COURSE GOALS AND OBJECTIVES
The purpose of mastering the discipline "Programming for mobile devices" is theoretical and practical training of students in the field of software development for mobile devices (smartphones on Android, IOS) using various modern programming languages (Java, Kotlin, Swift). The main objective of the course is to train highly qualified specialists by mastering the basics of developing mobile applications and mobile technologies. As a result of the training, students will be able to implement and develop mobile applications thanks to their acquired skills in different technologies and templates.

SHORT DESCRIPTION OF THE COURSE
The objectives of the discipline are to study the architecture of mobile devices, their operating systems, platforms for mobile development and to gain skills in programming mobile applications using the languages Java, Javascript, Swift using mobile DBMSs (SQLite and others).

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
As a result of studying the discipline, students must:
- they will know about modern mobile technologies;
- main components of the mobile platform architecture;
- life cycle of mobile applications and their structure;
- main elements of the mobile app user interface;
- will understand the principles of mobile app development;
- will be able to develop mobile applications and support services using different technologies.

SPA Web Programming
CODE:
CREDIT: 3 (2/1/0)
PREREQUISITE: Network programming technologies, Object-oriented programming

COURSE GOALS AND OBJECTIVES
Train students to create modern WEB applications based on the active use of asynchronous queries and scripting programming languages. Single -page applications today have a wide range of frameworks, one of which is Angular, on the basis of which the discipline is built. Javascript and Typescript languages will be studied.
A brief overview of the JQuery framework and DOM will be given;

SHORT DESCRIPTION OF THE COURSE
Single Page Application (SPA) WEB programming - programming using a single-page approach. The task is to provide tools for preparing full-featured applications based on a Web browser and a scripting language. The main points of creating such applications and conceptual elements of various frameworks for implementing this approach will be studied. The main focus will be on the Angular framework.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
- Create single-page applications based on a Web browser.
- Use the Angular framework
- Organize data transfer and interaction with server code

Functional programming
CODE:
CREDIT: 3 (2/1/0)
PREREQUISITE: Network programming technologies, Object-oriented programming

COURSE GOALS AND OBJECTIVES
The purpose of the course is to teach students to use the functional programming paradigm for solving practical problems. One of the functional programming languages is being studied.

SHORT DESCRIPTION OF THE COURSE
The course is devoted to the study of the functional programming paradigm. Functional programming languages and their concepts are actively used in the development of software that works under high load and imposes increased requirements for security and scalability. Many functional programming techniques can also be used in traditional procedural and object-oriented languages, especially given the fact that languages such as Java, C++, C#, and Python are borrowing more and more tools from pure functional languages over time. An explanation of the basic concepts of the functional approach to writing programs in the course is illustrated using one of the programming languages. At the end of the course, students will be able to apply the basic concepts of functional programming when writing programs in any language, as well as gain experience in using a functional programming language to solve practical problems.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
Be able to solve application programming problems using basic functional programming techniques.

Processing analog and digital signals
CODE_____
CREDIT – 3 (2/1/0)
PREREQUISITE: probability Theory and mathematical statistics, basics of algorithmization and programming

COURSE GOALS AND OBJECTIVES

Study of the basic principles of representation and conversion of analog and digital signals, models for working with them and interpreting data -decryption. The main focus is on processing sounds and human speech.

SHORT DESCRIPTION OF THE COURSE
Analog and digital signals are the main way to store knowledge about the natural environment. At the same time, the nature of signals imposes its own limitations in the application of processing models. The purpose of the course is to familiarize students with the diversity of such data representation and types of processing. The use of models, such as filtering, decoding. Application of well-established signal conversion algorithms-approximation, detail. The discipline is located at the intersection of such disciplines as machine learning and artificial intelligence. Therefore, we consider models of data classification and clustering, and the use of mathematical models to identify qualitative and quantitative features of signals.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
They will know: what is an analog and digital signal. Formal features and content of digital and analog data. Mathematical models of digital and analog data compression. Mathematical models for filtering and decrypting digital and analog data.
As a result of the course, students get the necessary skills to work with digital and analog signals by writing specialized SOFTWARE.

Programming of controllers and microcomputers
CODE –AUT
CREDIT– 3 (2/0/1)
PREREQUISITE-Microelectronics

COURSE GOALS AND OBJECTIVES
The discipline is aimed at preparing students for:
- development of tools, methods and methods of science and technology aimed at automating existing and creating new automated and automatic technologies and productions;
- creation and application of algorithmic, hardware and software systems for automation, management and control of technological processes and productions that ensure the production of high-quality, safe, competitive products that free a person completely or partially from direct participation in the processes of receiving, transforming, transmitting, using, protecting information and managing production;
- research for the purpose of ensuring highly effective functioning of automation, control, control and testing facilities and systems according to the specified requirements, while observing the rules of operation and safety.

SHORT DESCRIPTION OF THE COURSE
The discipline "Programming of controllers and microcontrollers" is one of the main disciplines of the specialty. The course is devoted to the study of such issues as the composition and structure of control systems with microcontrollers, tools and programming languages for automation devices on microcontrollers. Tools for debugging programs are being studied. The study of the course "Programming of controllers and microcontrollers" is the basis for the subsequent study of disciplines related to the design and operation of automation equipment, has a practical significance for solving practical problems in the design of hardware and software, commissioning and operation of automation of enterprises in various fields, will help develop students ' necessary knowledge and practical skills, sufficient for their further activities and allowing them to independently develop new knowledge based on the achievements of science in the relevant industry.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
In the field of application of microprocessors and microcontrollers in measurement and control systems; principles of construction and structure of microprocessors and microcontrollers, their parameters, features and operating conditions, principles of construction of measurement and control systems using microprocessors and microcontrollers, Assembly programming language and methods of debugging programs.
Skills: in matters of microcontroller programming and operation of microprocessor measurement and control systems, be able to: develop software for microcontrollers at the "lower" level; develop software for the control computer at the "upper" level; understand the existing hardware and software system and configure it.
Skills: developing programs for the microcontroller and debugging them, selecting elements of microprocessor measurement and control systems.

Microservice Technologies
CODE –
CREDIT – 3 (2/1/0)
PREREQUISITE - basics of algorithmization and programming

COURSE GOALS AND OBJECTIVES

This course covers the fundamental concepts of microservices to help the student determine whether this architectural model is appropriate when developing a system by a development team. Tasks of the student

- Learn about development methodologies
- Explain monolithic and microservice architecture
- Agile/Scrum
- find outsmart endpoints and dump pipes

SHORT DESCRIPTION OF THE COURSE

Microservices - also known as microservice architecture-is an architectural style that structures an application as a collection of loosely coupled services that implement business capabilities. The microservice architecture provides continuous delivery / deployment of large complex applications. It also allows the organization to develop its technology stack. This course will allow students to gain knowledge of the basic concepts of microservices, including limited contexts and the API level. Also consider some of the more complex areas of architecture, as well as the importance of embracing the DevOps culture.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE

As a result of studying the discipline, students should:

- know why microservices are well suited for today 's cloud environments that require short development and delivery cycles;
- understand which architectures are best used when scaling the system;
- know about the tools needed to successfully deploy, manage, and monitor microservice-based applications;
- understand why microservices are so well suited for cloud environments, DevOps environments that run microservices;
- understand the interaction of microservices.

Natural language processing
CODE –
CREDIT – 3 (2/1/0)
PREREQUISITE – Probability theory and mathematical statistics

COURSE GOALS AND OBJECTIVES

The goal is to Master the theory and practice of natural language processing
Tasks:

- explore the main applications of NLP and the methods used for word processing;
- master basic text processing skills for solving problems of information retrieval, tonality analysis, information extraction, text classification, etc.

SHORT DESCRIPTION OF THE COURSE

Natural language processing (NLP) is a rapidly developing field of research, the results of which are actively used in the form of speech and text processing technologies. The need to develop this area is related to the huge amount of information currently generated. NLP as a research area includes a wide range of applied topics, which include: automatic translation, automatic abstracting, generating responses to user requests, information extraction, information retrieval, tonality analysis, etc. in solving these problems, linguistic, statistical methods, special language models, machine learning, etc. are used. The course covers the theoretical aspects of NLP, including basic information from the field of linguistics, and practical methods of text processing using the Natural Language ToolKit.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE

At the end of the course, students will:
Understand:

- what is NLP,
- what is a statistical language model,
- what software methods and algorithms are used in the NLP field

Know:
-Basic concepts of NLP, methods and algorithms for text processing, methods of text classification, methods and algorithms for solving the main problems of NLP.
Be able to:

- To develop software for word processing, database, NLTK
- Use text processing methods to solve specific information processing tasks

Development of high- load systems
CODE –
CREDIT – 3 (2/1/0)
PREREQUISITE

COURSE GOALS AND OBJECTIVES
The goal is to develop models for building high- load systems
Tasks:
- Analysis of tasks where models of high- load systems are used
- Principles of operation of high- load systems and restrictions
- Analysis of software products designed to solve problems of building high- load systems.

SHORT DESCRIPTION OF THE COURSE
The course is based on modern problems of building scalable systems. The main task is to get out of the system of restrictions imposed by hardware by optimally distributing the load on each of the computer links. Thus defining the architecture that best meets the requirements for the number of requests processed by end systems. Building high-load systems is not a trivial task, which led to the appearance of a large number of software products, as well as forced large companies to expand the product line and functionality of existing ones. In many tasks for building high-load systems, combinations of approaches and software products are used to achieve maximum system efficiency. Such practical approaches are studied within the disciplines and software products such as Redis, RabbitMQ, Orleans, and Ceph.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE
At the end of the course, students will be:
- know the nature of the problem of high- load systems
- class of tasks for high- load systems
- models for building high- load systems
- software products for building high- load systems

Know:
- software for building high- load systems

Umet:
- apply models and techniques for building high- load systems

Digital image processing
CODE –
CREDIT – 3 (2/1/0)
PREREQUISITE: Fundamentals of algorithmization and programming, probability theory and mathematical statistics

COURSE GOALS AND OBJECTIVES

Study of the basic principles of digital image representation, models for working with them, and data interpretation-decryption.

SHORT DESCRIPTION OF THE COURSE
A digital image is an attempt to describe the visual world using digital data methods. The study of colors, textures, methods and models of image processing, such as filtering, decoding. Application of well-established algorithms related to the category of computer vision. The discipline is located at the intersection of such disciplines as machine learning and artificial intelligence. Therefore, we consider models of classification and clustering of data, the use of mathematical models to identify qualitative and quantitative features of the image.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
They will know what a digital image is. Formal features and content of digital images. Mathematical models of digital image compression. Mathematical models for filtering and decrypting digital images.
As a result of the course, students get the necessary skills to work with digital images by writing specialized SOFTWARE.

Development of computer games
CODE –
CREDIT – 3 (2/1/0)
PREREQUISITE: Fundamentals of algorithmization and programming, probability theory and mathematical statistics

COURSE GOALS AND OBJECTIVES
Study of the basic principles and models for building computer games.

SHORT DESCRIPTION OF THE COURSE
Computer game development is a separate area of software development that requires special competencies, often requiring excellent knowledge of the disciplines of algorithms and data structures, interactive graphics systems, and object-oriented programming. Computer game development covers the design and planning of the game type, the event development plan, the interaction of game elements, and the mechanisms for synchronizing and transmitting data over the network. Many questions remain unanswered in the course, such as three-dimensional modeling, design, and game scenarios. We consider only game models and various algorithms for solving problems, including dynamic systems and emulators of physical models. The discipline is based on the Unity platform.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE
They will know: Types of computer games, principles of operation and models of games.
As a result of the course, students get the necessary skills to create computer games.

Information systems design
CODE –
CREDIT – 3 (2/1/0)
PREREQUISITE – ICT, Databases, programming Languages

COURSE GOALS AND OBJECTIVES
Understand General design patterns; be able to identify suitable patterns for design tasks; be able to evaluate high-quality software source code; be able to correctly identify an incorrectly designed program using templates; apply various software design strategies and methods.

SHORT DESCRIPTION OF THE COURSE
The course focuses on describing key designations and methods used in software specification and design, using object-oriented methods, including UML, MDA, and design patterns. This course is about the software development process, design presentation forms, and software development plans for the programmer; logical and physical aspects of the design process, design strategies, and the historical role of step-by-step refinement, an introduction to model-driven architecture: models and metamodels, and model transformations. At the end of this course, students will learn the principles of proper software design strategies and patterns, as well as how and when to apply specific architectures and design patterns.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE
Student
- must know the key designations and methods used in the software specification and design. Also templates, strategies, and design methods;
-must be able to use object-oriented methods, including UML, MDA, and design patterns;
- must have the skills to determine the correct software design strategies and patterns, and apply a specific architecture;

Business analytics

CODE –
CREDIT – 3 (2/1/0)
PREREQUISITE – Databases

COURSE GOALS AND OBJECTIVES
Main objective:
1. Teach students the basics of Microsoft Business Intelligence.
2. Teach students MS BI components (SSIS, SSAS, SSRS), architecture, and user interface.
3. Teach students analytical problem solving based on MS BI

SHORT DESCRIPTION OF THE COURSE
The course begins with basic concepts related to business Analytics and multidimensional modeling. The course includes descriptions of the components that make up the Microsoft BI architecture. Students will learn the Microsoft BI user interface in Visual Studio, including SSAS, which is used for creating, editing, and organizing analytical queries to MS SQL, SSIS-integration service, and SSRS - service for creating reports.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
At the end of the course, students must:
Know:
-What is Business Intelligence?
-What services does Business Intelligence consist of?
-What is OLAP?
-What is DataWarehouse (DWH) and how to work with It?
-What is an info cube and how to build it?
Be able to:
- Define business tasks and provide analytical solutions based on Microsoft BI
- Define and describe the functionality of BI systems
- Describe the relationship between the components of Microsoft BI (SSIS, SSAS, SSRS)
- Build multi-dimensional models
- Create info cubes, MDX queries, and reports (dashboards) in Microsoft BI

Parallel programming
CODE –
CREDIT – 3 (2/1/0)
PREREQUISITE -

COURSE GOALS AND OBJECTIVES
Course objective
- learning the basics of parallel programming, developing thinking related to parallel programming.
- systematization of knowledge about methods and algorithms of parallel programming, models of parallel computing.
Course objective
- to study and to consolidate the methods and techniques of parallelization and build
parallel program
- research and implement a set of parallel algorithms for standard typical problems: a) solving systems of linear algebraic equations b) solving problems using grid methods.
SHORT DESCRIPTION OF THE COURSE
The training course focuses on the fundamental knowledge of the subject
areas – methods of parallel programming on distributed systems
memory and shared memory systems and methods for building parallel
programs for solving SLAE problems and problems solved by grid methods.
KNOWLEDGE, SKILLS AT THE END OF THE COURSE
At the end of the course, students must:
know
- about the parallel algorithm
- about models of computation with parallel and serial control structures
- about parallel-serial programming models
- about asynchronous computing models
- about synchronous computing models
Know:
- algorithm definition, algorithm representation, General representation of a parallel algorithm.
- methods of parallel programming with shared variables,
synchronization of processes through access to shared resources, the concept of critical intervals, semaphores, programming parallel algorithms using critical intervals and semaphores.
- methods of distributed parallel programming, synchronization of processes, interaction of distributed processes.
- MPI and OpenMP parallel programming systems.
be able to
- create parallel programs for matrix problem algorithms: parallel matrix-to-vector multiplication and matrix-to-matrix multiplication in several ways.
- create parallel programs for solving systems of linear equations using the Gauss method
- create parallel programs for solving systems of linear equations using iterative methods.
- create parallel programs for sorting tasks using different methods.
- create parallel programs for matrix problem algorithms on computer systems with two- and three-dimensional lattice topology.

Cloud technologies
CODE– _____
CREDIT – 3 (2/0/1)
PREREQUISITE –

COURSE GOALS AND OBJECTIVES
Course objective
Getting theoretical knowledge and practical skills in the cloud architecture» technologies, methods and features of designing "cloud" services, as well as getting the skills to develop applications for the main existing "cloud" platforms.
Course objective
Consider the main characteristics of "cloud" technologies; the main differences from solutions based on server- side technologies; the benefits and risks associated with using cloud computing, as well as prerequisites for switching to cloud computing» infrastructure and the use of "cloud" services.

SHORT DESCRIPTION OF THE COURSE
This course provides an overview of the main trends in the development of infrastructure solutions that led to the emergence of the concept of cloud computing. Attention is paid to virtualization technologies. Next, the course examines the main models for providing cloud computing services. A review of solutions from the leading vendors-Microsoft, Amazon, and Google. The course participant gets basic knowledge and skills of developing "cloud" applications on the Microsoft Azure platform, as well as experience in using ready -made cloud services such as Windows Live and Office 365..

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE

At the end of the course, students must:
Know:
- goals and objectives of cloud technologies
- prerequisites for migration to the cloud
- basic concepts, functions, and trends in cloud technologies
- types of cloud architectures
Be able to:
- identify automated and business processes that are more efficient to migrate to the cloud
- evaluate possible risks of using cloud technologies
- choose the optimal strategy for switching to cloud technologies
Own:
- methods for estimating the cost of software systems in the cloud
- methods for developing the company's exit strategy for using cloud technologies

Fundamentals of information security
CODE – _____
CREDIT – 3 (2/0/1)
PREREQUISITE –

COURSE GOALS AND OBJECTIVES
The purpose of the discipline "Basics of information security" is to form students ' knowledge and ideas about the meaning, goals and objectives of information protection, the characteristic properties of protected information, the main information threats, existing (current) areas of protection and the possibilities of building models, strategies, methods and rules of information protection.
The acquired knowledge will allow students to correctly navigate the categories of protected information values and acquire the minimum necessary horizons in the problems of information security. On the basis of this discipline, it is assumed to study in more detail various areas of computer security protection.

SHORT DESCRIPTION OF THE COURSE
The discipline "Basics of information security" is a discipline
professional cycle. The discipline is an introduction to the problems of information security.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
At the end of the course, students must know:
- goals, objectives, principles and main directions of information security
- state security;
- main normative legal acts in the field of information security and
- information protection;
- role and place of information security in the national security system;
- threats to information security of individuals, society, and the state;
- content of the information war, methods and means of its conduct;
- principles and methods of organizational information protection;
- modern approaches to construction of systems of information protection;
- technical channels for information leakage, technical intelligence capabilities;
- principles and methods of countering unauthorized information impact on computer systems and information transmission systems;
- principles for organizing information systems in accordance with information security requirements;

be able to:
- analyze and evaluate threats to the object's information security;
- select and analyze quality indicators and criteria for evaluating systems and individual methods and means of information protection;
- to use the normative documents on protection of information;
- use up-to-date scientific and technical information on the studied problems and tasks;
- apply the acquired knowledge when completing coursework and graduation qualification work, as well as in the course of scientific research;

own:
- professional terminology;
- skills of formal formulation and solution of the problem of information security, security of computer systems and Informatization objects.

Cloud computing
CODE –
CREDIT – 3 (2/1/0)
PREREQUISITE - Introduction to the specialty – Computer Science

COURSE GOALS AND OBJECTIVES
The purpose of this discipline is to study the large-scale paradigm of distributed computing, which has become the driving force of information technology over the past few years.

SHORT DESCRIPTION OF THE COURSE
This course covers topics and technologies related to cloud computing and its implementation. Students will learn various cloud computing architecture models, cloud virtualization and orchestration concepts, and gain hands-on experience with various features of popular cloud platforms such as Google App Engine, IBM Bluemix, and Amazon Web Service. The course also includes advanced cloud programming paradigms such as MapReduce Hadoop and the concept of modern big data analysis on cloud platforms using various data mining tools and methods.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
At the end of the course, students will know:
- various basic concepts related to cloud computing technologies;
- architecture and concept of various cloud models: IaaS, PaaS, SaaS
- tools and methods for big data analysis;
- the basic principle of cloud virtualization, cloud storage, data management, and data visualization;
- various cloud programming platforms and tools;
- cloud programming using the Google Go programming language;
- development and deployment of applications using cloud platforms;
- how to create an app using cloud platforms such as Google App Engine and Amazon Web Services (AWS);
- how to develop scalable applications using AWS features;
- basic concepts of MapReduce programming models for big data analysis in the cloud.

Corporate computing
CODE –
CREDIT – 3 (2/1/0)
PREREQUISITE - Introduction to the specialty – Computer Science

COURSE GOALS AND OBJECTIVES
This discipline studies the impact of information technology on enterprises, with particular attention to both theoretical foundations and practical examples.

SHORT DESCRIPTION OF THE COURSE
This course examines the protocols and applications that enable simultaneous and uninterrupted interaction of millions of computers over the Internet and corporate networks. To develop and implement enterprise-class applications, students will need to study the Java Enterprise Edition application programming interface (Java EE API) in depth. To understand the practical aspect of enterprise computing, the student will create a working example of a dynamic, secure web application for the enterprise. Topics that will be covered include service-oriented architecture (SOA) and service component architecture (SCA).

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
After successful completion of this discipline, the student will be able to demonstrate the following abilities:
- explain Internet concepts, including HTTP (hypertext transport Protocol) and other protocols, client-server interactions, etc.
- explain the benefits of using Java technology for enterprise web applications.
- use different classes in the Java EE API.
- design and implement web applications based on Java EE.
- work with the team to create a dynamic and secure website based on the database.

Production and operations management
CODE–
CREDIT – 3 (2/1/0)
PREREQUISITE - Introduction to the specialty – Computer Science

COURSE GOALS AND OBJECTIVES
This discipline is aimed at studying the issues of careful management of the processes of production and distribution of products and services. The main functions of POM include purchasing management, inventory management, quality control, storage, logistics, and evaluation, with a particular focus on the efficiency and effectiveness of processes.

SHORT DESCRIPTION OF THE COURSE
Any organization is a system of operations linked together in a logical sequence to obtain some useful result. The ultimate goal of such a system is to produce goods and/or services and transport them to the point of time and place of consumption. Therefore, operations management includes everything the organization does, and therefore every Manager is an operations Manager. Production and operation management is a subject that applies to all levels of the hierarchy in the organization, but within this discipline, much attention will be paid to the functions and sub-functions of high-level POM related to creating or bringing the organizational structure in line with international standards.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
Upon successful completion of this discipline, students will demonstrate the ability and skills to::
- demonstrate an understanding of production as a process of converting or converting resources into products;
- demonstrate an understanding of the Manager's interest in effective planning, organization, management, and control of production operations to achieve the organization's goals;
- demonstrate an understanding of performance, quality, and cost indicators, both direct and indirect; and
- use various problem-solving methods to help in effective decision-making.

Social and ethical issues in computing
CODE–
CREDIT – 3 (2/1/0)
PREREQUISITE-Introduction to the specialt – Computer Science

COURSE GOALS AND OBJECTIVES
This discipline is aimed at studying the issues of careful management of the processes of production and distribution of products and services. The main functions of POM include purchasing management, inventory management, quality control, storage, logistics, and evaluation, with a particular focus on the efficiency and effectiveness of processes

SHORT DESCRIPTION OF THE COURSE
This discipline examines ethical issues arising from advances in computer technology, as well as the responsibility that IT professionals and users bear with regard to the use of computers, focusing on the inextricable link between ethics and law, how the latter try to determine the validity of human actions, and paying attention to the moral and ethical dilemmas created by computer technology that challenge traditional ethical and moral concepts.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE
Upon completion of this discipline, students will know:
- existing computer abuse, laws on such abuse, and legal " grey areas»;
- code of ethics Of the Association for computing machinery (ACM) and the Institute of electrical and radio electronics engineers (IEEE);
- context for evaluating the value of technology and understanding that technology is not neutral, that it creates ethical and moral obstacles that need to be addressed;
- how to create and maintain an ideal atmosphere for academic dialogue, discussions, and question-and-answer sessions for a deep understanding of technology and its impact on society;
- improve oral and written communication skills.

Supply chains and logistics
CODE–
CREDIT – 3 (2/1/0)
PREREQUISITE-Introduction to the specialty-Computer Science

COURSE GOALS AND OBJECTIVES
This discipline covers key activities related to logistics and supply chain management, including transportation, warehousing, inventory management, customer service, and purchasing.

SHORT DESCRIPTION OF THE COURSE
In this introductory course, you will learn the elements of integrated business logistics, as well as the role and application of logistics principles for managing the supply / demand / value chain. Logistics and the closely related concept of supply chain management (SCM) are at the heart of a business or corporate strategy, as they reflect the company's goals for sales, market share, share price, shareholder returns, investments, and assets.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
After successfully completing this course, you will be able to:
- use key logistics and supply chain management concepts for effective communication across different business contexts;
- apply logistics and supply chain management strategies to facilitate other functional areas of the business organization;
- apply leadership and organizational skills to use group resources and develop solutions to operational issues;
- effectively interact and communicate in a team to solve problems in supply chain management.

Introduction to enterprise resource planning
CODE–
CREDIT – 3 (2/1/0)
PREREQUISITE-Introduction to the specialty – Computer Science

COURSE GOALS AND OBJECTIVES
The purpose of this discipline is to study the concepts of enterprise resource planning systems (ERP) and the importance of integrated information systems in the organization, as well as to illustrate the business processes of procurement, production and sales based on well-known ERP software tools.

SHORT DESCRIPTION OF THE COURSE
This course will allow students to understand the issues and decisions that must be made at the beginning of the ERP selection and implementation process. This will also lead to an understanding of the problems associated with managing existing ERP systems. In the course of training, students will become familiar with the need and organizational conditions leading to the acquisition of such enterprise systems. Students will be able to identify existing and missing organizational competencies that can be used to create an appropriate ERP implementation method. This course is therefore suitable for students studying both it and management.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
After completing the course, the student will:
- understand and understand processes in organizations and the tools and methods used to create “as-is” and “to-be " models”;
- apply the methods of simulation of processes in one or more environments;
- know and be able to apply key technical terms in corporate information systems, in various ERP products and development methods;
- understand the key differences between the main ERP applications (such as SAP R/3 and Oracle / PeopleSoft/Sibel), their problems specific to these applications, their configuration and management;
- analysis of the current architecture and effective gap analysis before implementing ERP;
- be able to compare the resources of the enterprise architecture with a modern display tool;
- understand and be able to formulate the lifecycle stages of any ERP implementation;
- effectively describe problems typical of ERP implementation projects and use this information to anticipate and formulate problems related to managing ERP systems after implementation;
- be able to synthesize preliminary theoretical and experienced knowledge in the field of IT development and project management with current literature and knowledge on corporate systems development;
be able to evaluate the progress of the ERP implementation project.

Internet of things
CODE – CSE1562
CREDIT– 3 (1/2/0)
PREREQUISITE – no

COURSE GOALS AND OBJECTIVES
The explosive growth of the Internet of things is changing our world, and the rapid drop in prices for typical IoT components allows people to implement new developments and products at home. Tasks of the student:
- learn about the importance of IoT for society
- current components of typical IoT devices
- trends for the future
- IoT design issues
- restrictions and interaction between the physical world and your device.
- learn key network components so that students understand how to connect their device to the Internet

SHORT DESCRIPTION OF THE COURSE
This course will allow students not only to get theoretical knowledge and practical skills of working with a laboratory stand, but also a complete and practically applicable solution. And taking into account the possibility of individual choice of the final work, students will have a practical implementation of the" Internet of things " focused on their own needs. The course will teach you how to build smart models based on low -cost solutions using practical examples of building the Internet of things.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
As a result of studying the discipline, students should:
- analyze the main components of IoT;
- to build a system of sensors/actuators using an Arduino microcontroller;
- create Python programs that provide IoT functionality for a single-Board raspberry Pi computer;
- use Cloud and Fog technologies in the IoT system;
- understand IoT systems that can solve global production problems,
- health or energy systems;
- design and build an IoT prototype on real devices or in Packet Tracer 7.0.

Information security risk management
CODE– CSE1562
CREDIT – 3 (1/2/0)
PREREQUISITE – no

COURSE GOALS AND OBJECTIVES
Teach the student to use information systems for effective operation and development of the enterprise. Whether an organization is a new entrepreneurial startup, an established business, a non-profit, or a state-owned enterprise, its ability to fulfill its mission and implement its strategy can be significantly hampered without knowledgeable people who will lead the design, acquisition, effective use, and support of the information systems that provide the Foundation for the organization.

SHORT DESCRIPTION OF THE COURSE
This course provides a broad overview of the challenges that managers face when choosing, using, and managing information technology (it). It is increasingly being used as a tool for implementing business strategies and gaining competitive advantages, rather than just supporting business operations. Using a case study- based approach, topics include information technology and strategies, information technology and organizations, and information technology asset management.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE
As a result of studying the discipline, students should:

- understand how information systems are used in organizations to achieve strategic and operational goals.
- understand and formulate fundamental concepts of information technology management.
- evaluate and apply it to solve common business problems.
- offer and protect effective solutions to business problems, as well as develop a database application for solving business problems.

discuss the ethical aspects of using information technology in the organization and its management.

Organization of client-server systems
CODE–
CREDIT – 3 (1/2/0)
PREREQUISITE – ICT

COURSE GOALS AND OBJECTIVES
The purpose of the course "organization of client-server systems" is to master the technologies, principles of organization and functioning of client-server systems, training in methods of designing applications of client-server systems.
The course aims to develop skills in analysis, technology selection, and application design methods for client-server systems of various architectures.
As a result of studying the discipline, students must:
- know the principles of organization and operation of client-server systems;
- be able to create software applications for client-server systems based on modern technologies;
- have an idea of current prospects and trends in the development of client-server systems.

SHORT DESCRIPTION OF THE COURSE
The course "organization of client-server systems" gives the basic concepts of organization of client-server systems of different architectures, various aspects and features of technological solutions for client-server systems applications. Client-server applications implemented in FS, RDA, DBS, and AS models are considered in a comprehensive manner. Rest and RPC technologies, CORBA and SOA architectures are considered. The models of transaction processing and the mechanism of interaction between client-server applications based on sockets are studied. The components of middleware client-server systems are considered.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
The student should know:
- principles of organization and functioning of client-server systems;
- methods for creating software applications for client-server systems based on modern technologies;
- prospects and trends in the development of client-server systems.
must be able to:
- apply technologies for effective selection of architectural solutions for client-server systems;
- apply technologies for developing client-server systems for various purposes and scales in practice;
- effectively use software tools for developing client-server systems;
- justify the use of client-server system development technologies based on various criteria.

Information systems design
CODE–
CREDIT – 3 (2/1/0)
PREREQUISITE - Management in information systems

COURSE GOALS AND OBJECTIVES
The purpose of the discipline "information systems Design " is to master the terminology, standards, methodologies and methods of designing enterprise information systems.
The course aims to consolidate the practical skills acquired in previous courses for designing enterprise information systems.

SHORT DESCRIPTION OF THE COURSE
The discipline " information system Design" deals with theoretical and practical aspects of using standards, methodologies and methods for designing enterprise information systems. The lecture course discusses the features of the enterprise information system architecture, the main approaches and design standards for all types of information system support, including mathematical, technical, software, information, organizational and legal, linguistic and ergonomic.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE
Student
need to know:
- basic concepts and terminology of information system design;
- basic design standards, methodologies, and methods;
must be able to:
- analyze the existing enterprise management system and offer solutions for its modernization, taking into account modern information technologies.

Introduction to Big Data
CODE –SCE 158
CREDIT – 3 (2/1/0)
PREREQUISITE – MAT 102 Mathematics 3

COURSE GOALS AND OBJECTIVES
The purpose of the discipline "BIG DATA " is to master the terminology, principles of organization and technologies for storing, converting and analytical processing of big data, as well as to gain practical skills in using these technologies.
The objectives of the course are to develop skills for researching the use of big data in information systems to solve practical problems

SHORT DESCRIPTION OF THE COURSE
The discipline "BIG DATA" deals with theoretical and practical aspects of using big data technologies in information systems. The lecture course examines the features of terminology, trends in the development of infrastructure solutions in Big Data, the place of data services in the enterprise architecture, as well as the issues of big data Analytics, trends and prospects for the development of this technology.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
Student
need to know:
- basic concepts and terminology of big data;
- basic principles of using big data in enterprise architecture;
- basic methods of analytical processing of big data;
must be able to:
- create programs for analytical processing of big data in the R language;
- use Hadoop and MapReduce technologies when working with big data.

Basics of artificial intelligence
CODE –
CREDIT – 3 (2/1/0)
PREREQUISITE – Programming

COURSE GOALS AND OBJECTIVES

The purpose of this course is to study a number of AI algorithms, including some machine learning algorithms.

SHORT DESCRIPTION OF THE COURSE

This course focuses on artificial intelligence(AI), specifically what is known as weak or soft AI, i.e. methods and algorithms that can make software smarter and more useful. While early AI focused on creating intelligent machines that mimic human behavior (otherwise known as Strong AI), much of AI research and practice today focuses on practical purposes. They include embedding AI algorithms and methods in software to give them properties characteristic of intelligence: the ability to learn, optimize, and reason. The course focuses on optimization algorithms based on simulation of natural processes in living and non-living nature, expert systems, clustering algorithms that provide personalized user services, prediction methods based on regression models, and direct propagation neural networks.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE

At the end of the course, students will:
Understand:

- what is weak artificial intelligence
- various artificial intelligence methods

Know:

- basic concepts of problem solving in the context of applying human intelligence from a computational point of view
- the main aspects of AI applications for the development of "smart" programs.
- the basic methods of knowledge representation, problem solving, and "learning" programs in the creation of intelligent systems

Be able to:

- develop software using the studied set of AI algorithms

Deep learning
CODE–
CREDIT – 3 (2/1/0)
PREREQUISITE - Theory of neural networks

COURSE GOALS AND OBJECTIVES
The aim of the course is to master the theory and practice of deep learning methods
Main objectives of the course:
- Consider the main features of deep learning models, the main models and the tasks they solve
- Gain understanding and experience of convolutional neural networks
- Consider modern methods of image classification
- Study sequence-to-sequence models in the context of practical tasks using machine translation as an example
- Learn Deep Reinforcement Learning using The openai-gym environment
- Study of current trends in the study of deep learning models

SHORT DESCRIPTION OF THE COURSE
The course focuses on deep learning models. As an area within machine learning, deep learning models illustrate the quantitative-qualitative transition. New models and their properties require separate study and practice of setting meta parameters of such models. Another feature of these models is the need for high-performance systems for their training, which is also reflected in the course in the form of using the technology of NVIDIA CUDA.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
At the end of the course, students will:
Understand:
- Features of deep learning models
- Current research areas in the field of AI
Know:
- Tasks and areas of application of deep learning models
Be able to:
- Use on the DL model to solve the classification problem (including images)
- Use Seq2Seq models to solve various tasks, including machine translation
- To develop a Reinforcement Learning model on the basis of existing simulations

Information theory
CODE–
CREDIT – 3 (2/1/0)
PREREQUISITE – Probability theory

COURSE GOALS AND OBJECTIVES

The aim of the course is to master the fundamental concepts of information theory.
Main objectives of the course:

- Reveal the concepts of entropy and information
- Learn to apply the methods of quantitative evaluation of information
- Reveal the theoretical and practical aspects of optimal (effective) coding
- Reveal the theoretical and practical aspects of noise immunity coding.
- Show models of signals, data transmission systems, modulation and demodulation, and signal sampling.
- Develop skills for applying the theory of noise-tolerant coding in data processing systems.

SHORT DESCRIPTION OF THE COURSE

The course is devoted to information theory, which is the theoretical basis of information and communication technologies. Information theory explains key aspects of information communication and data processing. The course covers the concepts of entropy, information, optimal coding methods, noise-tolerant coding methods, and signal models. The course provides some methods for prototyping signal and data processing software based on linear algebra and information theory.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE
At the end of the course, students will:
Understand:

- what is entropy and information,
- what are effective coding methods and noise-tolerant coding methods
- mathematical models of signals
- when and why certain signal and data processing methods should be used.

Know:

- basic concepts of data transmission, methods and algorithms for effective encoding, methods of noise-resistant encoding, signal models, applications of information theory.

Be able to:

- develop software for data processing based on information theory
- apply information theory methods to solve practical problems (noise-resistant coding, cryptography, data processing)

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