

Considered at the meeting of the University
Academic Council
APPROVED
Protocol № 15
30 05 2019



Chairman of the Board of JSC S.Seifullin
Kazakh Agrotechnical University
A.K. Kurishbayev
30 05 2019

Educational program

«Software engineering»
(name of the program)

Code and classification of the field of education:

6B06 Information and communication technology

Code and classification of training areas:

6B06088 Interdisciplinary programs related to information and communication technologies

Code in the International Standard Classification of Education: **6B06**

Qualification: **bachelor** / specialist

Bachelor in Information and Communication Technologies in the educational program "6B061002 - Software Engineering"

Training period: **4 years**

The author's team:

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7. Sagandykov Salauat Kamaridenovic – student of educational program 6B06101 – "Software Engineering”.

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Educational program 6B06101 - «Software Engineering» considered at the meeting of the Department "Information Systems" №7 of "09" March 2023 y.

Approved by the Faculty of the CSaPE
council protocol №10 of "16" March 2023 y.

Passport of the educational program 6B06101 - «Software Engineering» has been updated in the Unified platform of higher education from 16.05.2023 y.

CONTENTS

№	Name of the component	Page
1.	Passport of the educational program	4
2.	General characteristics of the educational program	5
3.	Competence model (portrait) graduate	6
4.	The base of passing professional practices	9
5.	Structure of the educational program	11
6.	Appendix 1. Academic Calendar	12
7.	Appendix 2. Working curriculum	14
8.	The relationship between the achievability of the formed learning outcomes according to the educational program and academic disciplines	16

1 Description of the educational program

1.1 Passport of the educational program

OP "Software Engineering" is aimed at meeting the needs of society for qualified personnel in the field of information technology and computer technology, capable of solving complex engineering tasks.

The purpose of the Educational Program «Software Engineering» is to prepare software engineers, qualified developers of software systems and software architects, software quality specialists, software development project managers capable of successful independent and team professional activities.

Objectives of the Educational Program “Software Engineering”:

– development of students' theoretical knowledge and practical skills that allow them to understand and apply the construction of complex software products that require the coordinated work of a team of programmers of different specializations and qualifications.

– teaching students the systematic process of designing, developing and maintaining software tools.

– formation of theoretical and practical knowledge for service and operational activities in the field of operation of automatic, automated and information systems, means of data transmission and information flows, diagnostics, control and management.

1.2 Learning outcomes

LO 1. Determine the language tool for solving problems and process information using the tools of programming languages and application programs.

LO 2. Solve problems of varying complexity using programming technology, inspect software components.

LO 3. Apply the mathematical apparatus of ICT to build algorithms for analysis, transformation, processing and to optimize information processes in various application areas.

LO 4. Apply methods and means of organizing calculations in network systems, methods and means of organizing databases and knowledge bases in computer systems and networks, control and operation of hardware and software, as well as demonstrate knowledge in the field of classical and modern physics.

LO 5. To present IT projects, demonstrate entrepreneurship skills, observe a culture of academic integrity, critically evaluate and interpret information in the field of ICT, ecology, economics and law.

LO 6. Apply methods of analysis of the applied field at the conceptual, logical, mathematical and algorithmic levels.

LO 7. To carry out professional communication in various forms in Kazakh, Russian and foreign languages to solve professional tasks in the field of ICT.

LO 8. Use technologies, principles of organization and functioning of the Internet, analyze threats to information security.

LO 9. Evaluate and select modern operating environments and ICTs for

informatization and automation of solving applied problems and creating IS.

LO 10. Plan the work of an IT project, take part in the implementation, adaptation and customization of software and applied, as well as in scientific research.

2 General characteristics of the educational program (relevance, features, competitive advantages, uniqueness, stakeholders, etc.).

The creation of the information and communication infrastructure of the digital economy of the future requires good specialists in the field of software engineering at the bachelor's, master's and highly qualified scientific personnel.

But, the need for competent specialists in this field far exceeds the capabilities of universities to prepare these specialties.

At the same time, the qualification requirements imposed by employers in most cases are much more than the competencies that a student receives within the walls of a university.

These circumstances determine the relevance of developing and improving the educational program for training programmers of a wide profile at the bachelor's level.

"Software engineering" is the subject of professional activity of specialists in software development and management of large-scale ICT projects.

EP "Software Engineering" in the direction 6B061 Information and Communication Technologies is aimed at meeting the needs of society for qualified personnel in the field of information technology and computer technology, capable of solving complex engineering tasks.

The competitive advantages of a graduate of the OP "Software Engineering" are:

- in–depth knowledge of modern and advanced methods of software development, testing and operation (DevOps);
- ability to apply the acquired knowledge at all stages of application development, from server logic to client code running directly on users' devices.
- ability and readiness the ability to analyze big data using artificial intelligence;

The proposed project of the educational program contributes to the acquisition by students of a large number of trending professional skills, thus allows them to provide employment and high wages.

Stakeholders are IT companies, large commercial and industrial enterprises, oil companies, banks, etc.

3 Competence model (portrait) graduate

3.1 Areas of professional activity

Areas of professional activity of graduates of the EP "Software Engineering" in the direction 6B061 Information and communication technologies:

- the sphere of industrial software production;
- the sphere of material production (industry, agriculture and forestry, construction, etc.)
- non-productive sphere (healthcare, education, housing and communal services, trade, etc.)

3.2 Types of professional activity

Types of professional activity of graduates of the EP "Software Engineering" in the direction 6B061 Information and communication Technologies:

- design activities in design organizations, IT companies, telecommunications companies as the head of the research and development department, developer and analyst of software and applications, software engineer;
- production and technological activities at industrial enterprises, telecommunications companies, companies for the design and assembly of digital devices, in financial organizations as the head of the production process, head of services and departments in the field of information and communication technologies, an engineer for automated control systems, an engineer for network security;
- research and experimental research activities in research institutions, design and scientific production organizations as a senior researcher, head of a research group, software engineer, electronics engineer;
- organizational and managerial activities in public administration bodies, in the service sector, administrative management, in business structures as an information security administrator, head of the project management department, an expert analyst, an engineer for automated management systems.

3.3 General education competencies

After successful completion of this program, the student will possess the following general education competencies:

- 1) assesses the surrounding reality on the basis of worldview positions formed by knowledge of the fundamentals of philosophy, which provide scientific understanding and study of the natural and social world by methods of scientific and philosophical cognition;
- 2) interprets the content and specific features of the mythological, religious and scientific worldview;
- 3) argues his own assessment of everything that is happening in the social and industrial spheres;
- 4) shows a civic position based on a deep understanding and scientific analysis of the main stages, patterns and peculiarities of the historical development of Kazakhstan;
- 5) uses methods and techniques of historical description to analyze the causes

and consequences of events in the history of Kazakhstan;

6) assesses situations in various areas of interpersonal, social and professional communication, taking into account basic knowledge of sociology, political science, cultural studies and psychology;

7) synthesizes knowledge of these sciences as a modern product of integrative processes;

8) uses scientific methods and techniques of research of a specific science, as well as the entire socio-political cluster;

9) develops his own moral and civic position;

10) operates with social, business, cultural, legal and ethical norms of the Kazakh society;

11) demonstrates personal and professional competitiveness;

12) applies in practice knowledge in the field of social and humanitarian

13) selects methodology and analysis;

14) summarizes the results of the study;

15) synthesize new knowledge and present it in the form of humanitarian socially significant products;

16) enters into communication in oral and written forms in Kazakh, Russian and foreign languages to solve the problems of interpersonal, intercultural and industrial (professional) communication;

17) carries out the use of language and speech means based on the system of grammatical knowledge; analyze information in accordance with the communication situation;

18) assesses the actions and actions of the communication participants.

19) uses various types of information and communication technologies in personal activities: Internet resources, cloud and mobile services for the search, storage, processing, protection and dissemination of information;

20) builds a personal educational trajectory throughout life for self-development and career growth, focus on a healthy lifestyle to ensure full-fledged social and professional activities through methods and means of physical culture;

21) knows and understands the basic laws of the history of Kazakhstan, the basics of philosophical, socio-political, economic and legal knowledge, communication in oral and written forms in Kazakh, Russian and foreign languages;

22) applies the acquired knowledge for effective socialization and adaptation in changing socio-cultural conditions;

23) has the skills of quantitative and qualitative analysis of social phenomena, processes and problems.

3.4 Basic competencies

After successful completion of this program, the student will have the following basic competencies:

1) demonstrate knowledge and understanding in the field being studied based on advanced knowledge in the field being studied;

2) apply knowledge and understanding at a professional level, formulate

arguments and solve problems of the studied area;

3) to collect and interpret information for the formation of judgments taking into account social, ethical and scientific considerations;

4) apply theoretical and practical knowledge to solve educational, practical and professional tasks in the field under study;

5) learning skills necessary for independent continuation of further education in the field of study;

6) know the methods of scientific research and academic writing and apply them in the field under study;

7) apply knowledge and understanding of facts, phenomena, theories and complex dependencies between them in the field under study;

8) understand the importance of the principles and culture of academic integrity.

3.5 Professional competencies

After successful completion of this program, the student will possess the following professional competencies:

design activity:

- the ability to conduct a pre–design survey of the design object, a system analysis of the subject area, their interrelations;

– ability to conduct modeling of processes and systems;

– the ability to assess the reliability and quality of the functioning of the design object;

production and technological activity:

– ability to create application software: decision support systems, automated control systems, intelligent systems, multimedia systems, business software products, web portals, databases and knowledge, diagnostic and certification software systems, information security software in computer systems and networks;

– ability to use languages describing architecture and interface, templates, notations, strategies;

– the ability to master the methods of parallel data processing;

– the ability to own methods and tools for interactive data visualization;

research and experimental research activities:

- the ability to collect, analyze scientific and technical information, domestic and foreign experience on the subject of research;

– the ability to justify the correctness of the chosen model by comparing the results of experimental data and the solutions obtained;

– ability to use mathematical methods of processing, analysis and synthesis of professional research results;

organizational and managerial activity:

- the ability to form technical specifications, the ability to plan and manage the development process;

– ability to evaluate and choose a methodology for designing objects of professional activity;

– ability to assess the degree of difficulty, risks, consequences of organizational and managerial decisions.

4 Base of professional practices (all types of practices)

The training practice takes place on the basis of the Department of "Information Systems" of the S.Seifullin Kazakh Agrotechnical in the first year.

Practical training takes place on the basis of public or private organizations in IT departments after the 2nd, 3rd courses and after the first semester of the 4th course lasting 4-6 weeks.

Pre-graduate practice takes place at the Department of "Information Systems".

№	Name	Telephone	Mail	Website
1)	Astana IT, Astana, Saryarka Avenue, 31/2	+7 775 188 8007	info@astana-it.kz	http://astana-it.kz
2)	IT Holding Samgau; Astana, Imanbayeva str., 5 V	+7 717228 1815 +7 777003 3311	Info@samgau.com	http://samgau.com
3)	Oul Kazakhstan Association of IT Companies, Astana, Kabanbai Batyr Avenue, 6/5	+7 717292 5552		http://itk.kz
4)	JSC "National Infocommunication Holding "Zerde", Astana, Almaty street, 1	+7 717257 0778		http://zerde.gov.kz
5)	JSC "Transtelecom", Astana, Abay Avenue, 13	+7 717260 0029		http://ttc.kz
6)	Computer Academy "Step", Astana, Aliimoldagulova Street, 23	+7 717 231 3328 +7 717 291 1458	astana@itstep.org	http://astana.itstep.kz
7)	TOO "Net.com ", Astana, Kazhymukanamunaytpasova Street, 22	+7 717 247 8177		http://netcom.kz
8)	Corporate Business Systems, Astana, Kabanbai Batyr Avenue, 3	+7 727 262 2218		http://cbs.kz
9)	InesSoft LLP, Astana, MukhtarAuezova Street, 8	+7 717 272 8510		http://inessoft.kz

10)	Training Center "Expert-A", Astana, Bauyrzhanamomyshtuly Avenue, 2/1	+7 771 909 4456 +7 717 262 5266	info@expert- a.kz	http://expert-a.kz
11)	Somnium Astana LLP, Astana, Kunaeva str., 12/2,	+7 7172 68-98-14;		
12)	JSC "AstanaInavation"			
13)	JSC "Electronic Finance"			
14)	JSC "National Information Technologies" Astana, Astana, Orynbor str., 8	+7 7172 74-10-70; +7 7172 74-10-81;		
15)	Republican Association "Union of Farmers of Kazakhstan"	87019996661; 87172509928; Ibrayev Serik	ibrayev.sn@g mail.com	www.sfk.kz
16)	"PLATONUS" LLP	87055166919; 87172472525; Aidar Manas	ISPUSINOV @PLATONU S.KZ	PLATONUS.KZ
17)	Global Services International, Mukhitov Azat	87077555273;	maz@gse.kz	
18)	TerraPoint LLP	87015333406;	Aida_mullash eva@mail.ru	Mullasheva Aida Financial Director

5 Structure of the undergraduate education program

№	Name of cycles and disciplines	Total workload	
		in academic hours	in academic credits
1	2	3	4
1	General Education Disciplines (GER) cycle	1680	56
1)	Mandatory component	1530	51
	History of Kazakhstan	150	5
	Philosophy	150	5
	Foreign language	300	10
	Kazakh (Russian) language	300	10
	Information and communication technology	150	5
	Socio-political knowledge module (sociology, political science, cultural studies, psychology)	240	8
	Physical education	240	8
2)	A university component and/or an optional component	150	5
2	Cycle of core and core disciplines (DB, PD)	At least 5280	At least 176
1)	A university component and/or an optional component		
2)	Professional practice		
3	Additional training (VET)		
1)	Optional component		
4	Final certification	At least 240	At least 8
	Total	At least 7200	At least 240

Academic Calendar

Approve

Chairman of the Academic Council
NJSC "Seifullin KATIUS "

Tireuov K.M.

« 29 » 05 2023 y.

ACADEMIC CALENDAR
for 2023-2024 academic year*
by levels of training
(BACHELOR)

1	Presentation week, registration for disciplines	1 course August 28 - 31
2	I semester	September 1 - December 15
3	<i>Constitution day</i>	<i>August 30</i>
4	Knowledge Day	September 1
5	<i>Republic Day</i>	<i>October 25</i>
6	<i>Independence Day</i>	<i>December 16</i>
7	Exam session	December 18 - 29
8	Passing FX	December 18 -29
9	<i>New Year's Holiday</i>	<i>January 1, 2</i>
10	Holidays	January 1-26
11	II semester	January 29 to May 10
12	<i>International Women's Day</i>	<i>March 8</i>
13	<i>Holiday Nauryz</i>	<i>March 21,22,23</i>
14	<i>Holiday of unity of the people of Kazakhstan</i>	<i>May 1</i>
15	<i>Defender of the Fatherland Day</i>	<i>May 7</i>
16	<i>Victory Day</i>	<i>May 9</i>
17	Exam session	from May 13 to May 24
18	Passing FX	May 13 - 31
19	Registration for the summer semester	May 27 - 31
20	Final examination	until June 30
21	Summer semester	from June 3 to July 12
22	Holidays	from May 27 to August 31
23	<i>Capital Day</i>	<i>July 6</i>
	Practice*	

Approved by the Academic Council of NJSC «S. Seifullin KATIUS»,
protocol № 16, 29.05. 2023 y.

Note: If it coincides with a weekend or a holiday, the lesson begins on the next working day.

* Types and terms of professional practice are determined by the working Curriculum of Educational Programs.

Annex 2 (continued)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA				
55	31		BS	ES	SDI 4290	Statistics for IT			7			5/150	15	30.0				20	85												
56	32		BS	ES	MMI 4291	Mathematical modeling of technical systems in IT					8	5/150	15	30.0				20	85												
57	33		BS	ES	SMP 4286	Specialized Mathematical Packages	5	8			8	5/150	15	30.0				20	85									5.0			
58	34	Design of software systems	BS	ES	AKOS 2277	Computer architecture and operating systems			3			5/150	15	30.0				20	85												
59	35		BS	ES	CSAK 2291	Digital circuitry and architecture of computer	5	3	3			5/150	15	30.0				20	85		5.0										
60	36		BS	U	IM 4242	Simulation modeling	5	7	7			5/150	15	30.0				20	85									5.0			
61	37		AS	O	PAPS 4324	Design and architecture of software systems	5	7	7			5/150	15	30.0				20	85									5.0			
62	38		BS	O	BD 2246	Database	5	4			4	5/150	15	30.0				20	85				5.0								
63	39	Software development	BS	U	PRMP 3294	Design and development of mobile application	7	5	5			7/210	30	45.0				28	107				5.0		7.0						
64	40		BS	ES	ISRC 3295	Software development technologies and standards	5	6	6			5/150	15	30.0				20	85									5.0			
65	41		BS	ES	ISRP 3288	Tools and programming	5	6	6			5/150	15	30.0				20	85										5.0		
66	42		AS	U	IGAK 2316	Engineering graphics (AutoCad, Compas)	5	4	4			5/150	15	30.0				20	85			5.0									
67	43		AS	O	KATP 3290	Development and analysis of software systems	5	5			5	5/150	15	30.0				20	85					5.0		5.0					
68	44	High performance computing	AS	O	TPO 3317	Software testing	5	6	6			5/150	15	30.0				20	85								5.0				
69	45		BS	ES	RDIV 2280	Development for the Internet of Things	5	4	4			5/150	15	30.0				20	85				5.0								
70	46		BS	ES	PDI 2283	Programming for IoT	5	4	4			5/150	15	30.0				20	85				5.0								
71	47		BS	ES	VII 4279	Introduction to artificial intelligence	5	7	7			5/150	15	30.0				20	85										5.0		
72	48		BS	ES	TMO 4285	Machine learning technology	5	7	7			5/150	15	30.0				20	85										5.0		
73	49	Network Technologies and Information Security	BS	ES	NSIP 4278	Neural networks and their applications	5	8	8			5/150	15	30.0				20	85										5.0		
74	50		BS	ES	ONS 4289	Basics of neural networks	5	8	8			5/150	15	30.0				20	85										5.0		
75	51		AS	U	VPIAD 4312	Visual programming and data mining	5	7	7			5/150	15	30.0				20	85										5.0		
76	52		AS	O	MKPP 4321	Microprocessor complexes and industrial applications	5	7	7			5/150	15	30.0				20	85										5.0		
77	53		AS	O	PP 4313	Parallel programming	5	8	8			5/150	15	30.0				20	85										5.0		
78	54	Network Technologies and Information Security	BS	O	ST 3244	Network technologies	5	5	5			5/150	15	30.0				20	85					5.0							
79	55		BS	ES	STBD 3245	Modern database technology (Oracle)	5	5			5	5/150	15	30.0				20	85					5.0							
80	56		BS	ES	TBD 3284	Database technologies	5	5			5	5/150	15	30.0				20	85										5.0		
81	57		BS	U	TSVK 3243	Server virtualization and containerization technologies	5	6	6			5/150	15	30.0				20	85										5.0		
82	58		BS	ES	ITEK 3261	Internet technologies and e-commerce	5	6	6			5/150	15	30.0				20	85										5.0		
83	59		BS	ES	RIP 3293	Internet application development	5	6	6			5/150	15	30.0				20	85										5.0		
84	60		AS	U	SOS 2318	Network operating systems	5	4	4			5/150	15	30.0				20	85				5.0								
85	61		AS	U	WP 3320	Web development	5	5	5			5/150	15	30.0				20	85					5.0							
86	62		AS	U	IB 3322	Information Security	5	6	6			5/150	15	30.0				20	85										5.0		
87	63		Professional practices	AS	C	PP 2325	Internship	2	4				2/60					60					2.0								
88	64	AS		C	PP 3326	Internship	5	6				5/150						150										5.0			
89	65	AS		C	PP 4327	Internship	6	8				6/180						180											6.0		
90	66	AS		C	PP 4328	Pre diploma practice	1	8				1/30						30											1.0		
91	Additional modules beyond qualification																														
92	Modules of choice																														
93	Scientific research																														
94	Weekly average workload at hours																														
95	1	General education subjects(GER)					56	10	4	0	1680	90	30	450	0	0	0	224	886	25	17	12	2	0	0	0	0	0	0	44	
96		Core subjects(GER/CS)					51	9	4	0	1530	75	30	420	0	0	0	204	801	25	17	7	2	0	0	0	0	0	0	0	
97		University component(GER/UC)					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
98		Electives(GER/ES)					5	1	0	0	150	15	0	30	0	0	0	20	85	0	0	0	5	0	0	0	0	0	0		
99	2	Base requirements(BS)					112	18	0	4	3360	345	600	90	0	30	0	444	1851	5	13	16	18	20	15	15	10	10			
100		Core subjects(BS/CS)					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
101		University component(BS/UC)					59	9	0	2	1770	195	300	60	0	30	0	232	953	5	13	11	8	12	5	5	0	0			
102		Electives(BS/ES)					53	9	0	2	1590	150	300	30	0	0	0	212	898	0	0	5	10	8	10	10	10	0			
103	3	Profession requirements(VRS)					64	9	0	1	1920	150	300	0	0	0	0	420	200	850	0	0	0	12	10	15	15	12			
104		Core subjects(VRS/CS)					14	0	0	0	420	0	0	0	0	0	0	420	0	0	0	0	2	0	5	0	7	0			
105		University component(VRS/UC)					50	9	0	1	1500	150	300	0	0	0	0	200	850	0	0	0	0	10	10	10	15	5			
106		Electives(VRS/ES)					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
107		Total on curriculum					331	4	5	6960	585	930	540	0	0	0	450	868	338	80	50	56	64	80	50	60	60	24			
108	4	Additional courses																													
109	5	Module of final certification (MoFC)														Number of credits				Semester				Number of hours				Number of weeks			
110		Total including FC\$														8				240.0				7200.0							
111																240															

Appendix 3. Matrix of achievability of the formed learning outcomes according to the educational program with the help of academic disciplines

№	Name of the discipline	Brief description of the discipline	Number of credits	Generated learning outcomes										
				L O1	L O2	L O3	L O4	L O5	L O6	L O7	L O8	L O9	L O10	
Cycle of general education disciplines University component/Component of choice														
1	Methodology of academic research	The study of various techniques and methods of scientific research: analysis, synthesis and design in General. Determination of the purpose, objectives and factors affecting the design. Ability to apply research results in design. Work with sources. Analysis of analogues. Preparation of the concept.	5					v		v				v
2	Basics of anti-corruption culture	The discipline examines the theoretical and methodological foundations of the concept of "corruption" and examines the improvement of socio-economic relations of the Kazakh society as a condition for combating corruption, psychological features of the nature of corrupt behavior, formation of anti-corruption culture, features of formation of anti-corruption culture of youth, ethnic features of formation of anti-corruption culture, moral and ethical responsibility for corruption in various spheres. Discipline allows you to learn about legal responsibility for corruption offenses	5					v		v				
3	Basics of economics and law	The discipline promotes knowledge of the subject of economic theory and methods of research, the basis of public production and forms of public economy, the mechanism of functioning of the market system, production, costs and income of the firm, national economy. Give an assessment of economic growth and instability of the market economy, inflation and unemployment as manifestations of economic instability. Demonstrate knowledge and skills in the financial and monetary credit system in the national economy and economic security. To master the basics of the theory of the state and law, the basics of constitutional, administrative, civil, labor, family, criminal law.						v		v				
4	Entrepreneurship	The discipline reveals the conceptual apparatus that defines the essence of entrepreneurial activity, shows the role and place of small enterprises in the modern conditions of the functioning of the economy, outlines the basic principles and reveals the content of the business plan of business entities. The organizational forms of entrepreneurial activity, the procedure for its registration and termination of activity are considered. Cardiological aspects and the formation of tolerance in the process of organization and functioning of business structures are taken into account.	5					v		v				
5	Ecology and life safety fundamentals	The laws of ecology, as a theoretical basis for nature conservation and rational nature management, the relationship of organisms with environmental factors and habitat conditions, the biosphere-noosphere concept of V.I. Vernadsky, concepts and concepts of sustainable development.	5					v		v				

Cycle of basic disciplines University component													
6	Algorithms, data structures and programming	The course studies abstract data types and methods for their implementation in a high-level language, taking into account the principles of object-oriented design of programs. We consider data processing algorithms of complex structure, including graphs and trees. also elements of the theory of formal languages, grammars and automata, as well as questions of the complexity of algorithms.	5	v	v	v			v				
7	Databases	Three-level DBMS architecture. General information about the Relational Data Model (RMD). Structural and integral parts of the relational data model (RMD). The manipulative part of the RMD. Structured Query Language (SQL). Optimization of the query execution plan. Indexing. Database design . Overview of DB description notations. CASE system. Development of stored functions, procedures, triggers. Overview of Nosql technologies. Comparison of data access technologies LINQ Nhibernate, ADO, Entityframework, etc. Client-server technologies	5			v	v	v			v	v	
8	Probability and statistics in computer science	Basic concepts of probability theory (Elements of combinatorics. Basic formulas of combinatorics. Basic concepts of probability theory. Geometric probabilities). Formulas for calculating probabilities (Corollaries from the theorems of addition and multiplication of probabilities. Probability of occurrence of at least one event. Poisson's formula). Discrete random variables (Random variables, their types. The law of distribution of a random variable). Continuous random variables The Law of Large Numbers. Chebyshev's inequality. Probability distribution function of a random variable. Numerical characteristics of a continuous random variable.	5			v			v			v	
9	Simulation modeling.	leaving the production flow diagrams, their mathematical models as objects of management, determine the criteria for the quality of functioning and the goals of management; Choose a functional automation scheme for a specific technological process; develop algorithms for centralized control of the coordinates of a technological object.	5			v	v					v	v
10	Mathematical foundation of information technologies	Methods and typical problems of linear algebra, Methods and typical problems of analytical geometry, Methods and typical problems of differentiation of functions, Methods and typical problems of integration of functions.	5	v		v			v			v	
11	Machine-oriented programming in C / C ++	The discipline provides for programming hardware-dependent parts of operating systems, developing software management functions for digital control systems equipment, and programming high-performance applications, where it is very important to take into account the features of the C and C ++ environment as tools for modeling computer tools.	6	v	v		v		v				
12	Object-oriented programming (C#,Java)	The main approaches and principles of object-oriented programming in Java (C #). The use of algorithmic structures, technologies and methods of object-oriented approach for analyzing and modeling the subject area, as well as the acquisition of object-oriented programming skills using examples from	7	v	v		v		v				

		various subject areas.											
13	Design and development of mobile application	Introduction to mobile application development. Basic OS modules. Setting up the development environment. Interface design. Markup elements of user applications. User interface controls. Designing interfaces for mobile devices and tablets. The layout and fragment creation service. Support for Bluetooth/Wi-Fi protocols. Installing the gateway via Wi-Fi Direct. Animation control. Push notification service. Managing threads and asynchronous tasks. Animation based on keyframes. Interprocess communication.	7	v	v		v		v				
14	Network technologies	Basic concepts, logical and physical principles of building computer and telecommunications networks; principles of interaction between computers and network equipment at the hardware and software level; basic knowledge of the following topics:network technologies that can be applied at the beginning of work as a network specialist; principles of functioning of computer networks, principles of interaction of network elements, methods for calculating and building networks based on standard equipment and software.	5			v	v					V	v
15	Server virtualization and containerization technologies	Server virtualization, virtualization at the operating system level; application virtualization; view virtualization. Monolithic hypervisor architecture. Micro-core architecture of the hypervisor. Cross-platform software. Oracle VirtualBox, Microsoft Hyper-V, Windows starting with Windows Server 2008, Red Hat KVM	5			v	v					v	v
16	Physics	To form a system of fundamental knowledge in physics among students, contributing to the effective solution of practical problems of agricultural production, as well as further personal development; the basics of scientific worldview and modern physical thinking; to get acquainted with scientific equipment and methods of physical research, to acquire the skills of conducting a physical experiment; to apply the knowledge gained for the correct interpretation of basic physical phenomena.	5			v			v				
Cycle of basic disciplines Component of choice													
17	English for special purposes	The discipline is aimed at studying general scientific terminology and terminology for the language of the corresponding specialty in English, forms skills in four types of communicative activity: reading with a full understanding of authentic texts in the specialty, the ability to write an essay on a specialty problem, the ability to listen to authentic messages containing professional information, the ability to discuss specialty issues	3					v		v			v
18	Computer architecture and operating systems	Modern computer hardware. X86 architecture: development history, hardware implementation, and assembly language. Linux operating system: deploy and work with the command-line interface. Tools for developing and debugging programs in the Linux OS. The GNU toolkit. The Linux family of operating systemsLinux: architecture and programming at the OS kernel level.	5		v	v	v					v	v
19	Introduction to Artificial Intelligence	Representation of knowledge in intelligent systems. Algorithms for logical inference based on knowledge.	5	v	v	v					v		

		Representation of fuzzy knowledge. Decision making under conditions of incomplete certainty. Stages of development of expert systems. Modern Machine Learning. Problems of classification and regression. Evaluation of the quality of machine learning algorithms. Clustering tasks. Search for outliers and anomalies in data.											
20	Tools and programming	Types of software development methodologies, depending on life cycle models: cascading, iterative (1- RIP; 2 - flexible methodologies: SCRUM, KANBAN, DSDM, MSF, ALM,XP. The RAD approach. The stage of logical design of the program. A systematic approach. A conceptual model. Subject area. Business modeling. Business process models and their types (graphical, simulation, executable and/or functional behavioral, informational.) Types of approaches to software development: structural; object-oriented. Methods of modeling business processes.	5	v	v	v			v				v
21	Internet technologies and e-commerce	Internet technologies and e-commerce as an integral part of electronic business. Organizational and technological foundations of e-commerce on the Internet. Characteristics of objects and subjects of electronic commerce. E-commerce in the consumer market for goods and services: business-to-consumer technologies. Organization of interfirm interaction in e-commerce processes: business-to-business technologies. Features of mobile and television commerce. Problems and prospects for the development of e-commerce in Kazakhstan.	5		v	v			v		v		
22	Mathematical modeling of technical systems in MatLab	The essence of computer modeling of a complex system. Architectural construction of modeling complexes of dynamic systems. Modeling and analysis of dynamic processes in technical devices by the equivalent circuit method. Functional modeling of technical systems.	5	v		v			v	v			
23	Neural networks and their applications	Artificial neural networks. Architecture of artificial neural networks. A set of tools for creating, initializing, training, modeling and visualizing a network. Methods and algorithms for training artificial neural networks. Gradient learning algorithms. Algorithms based on the use of the conjugate gradient method. Application of neural networks for designing control systems for dynamic processes.	5	v	v				v	v			
24	Basics of Neural Networks	Introduction to the theory of neural networks. Models of neurons. Methods of learning a single neuron. Algorithms for learning networks of general form. Analytical teaching methods. Programming neural networks. Genetic Algorithms. Selection of the optimal architecture of neural networks.	5	v	v				v	v			
25	Programming for IoT	Arduino IoT and a set of functions; EEPROM library; Connection of the Arduino keyboard and mouse Arduino and touch panel, temperature, humidity, gas content sensors, etc. Network exchange using Arduino, Arduino and memory card, LED arrays, Radio frequency identification (RDIF).	5	v	v		v				v	v	
26	Programming in Python	Features of the Python language. Data types, operations, operators. Input/Output features. Built-in object types: numbers, strings, tuples, lists, dictionaries, sets.	5	v	v	v			v	v			

		File Input/Output. Reading lines with file iterators. Working with binary files. The numpy library for implementing mathematical objects and calculations. Functions and recursion. Range function. Sorting. Lambda functions.											
27	Professionally-oriented foreign language	To form the professional foreign language speech of future specialists to increase the level of professional competence, proficiency in a professional foreign language for the implementation of written and oral information exchange, further development of speech activity (reading, writing, listening and speaking - monologue and dialogic speech). Rules of speech behavior in accordance with situations of professional communication, depending on the style and nature of communication in the social, household and academic spheres.	3					v		v			v
28	Development for the Internet of Things	Introduction to the "Internet of Things" (IOT). Hardware: End devices-controllers, sensors, actuators. Network technologies and IOT: IPv4 and IPv6 protocols. Principles of connecting devices to the network and methods of transmitting information. Data processing in IOT: examples of data collected and processed in IoTsystems. Application of cloud technologies and service-oriented architectures in IOT. IV services, applications, and business models.	5	v	v		v				v	v	
29	Internet Application Development	Technologies for using web programming languages in client applications; technologies for using Node.JS in server-side applications; application of web application development tools; application of modern Webtechnologies for creating Internet applications. CMS layouts (Tilda, WordPress, Bitrix, Opencard). SEO principles.	5		v	v			v		v		
30	Modern Database Technologies (Oracle)	Modern database technologies. Purpose and basic principles of database management systems architecture. Theoretical bases of relational database management systems. Using the SQL language in application programs. The concept of an active database. Stored procedures and triggers. Basic principles of database structure design. Fundamentals of transactional processing in database management systems. Security of database management systems. Elements of DataWarehousing technology.	5		v	v	v		v	v			
31	Modern programming languages	provide algorithms for solving Algorithms for solving common data processing problems. Algorithms on graphs. Libraries of programs and classes. General characteristics of assembly languages. The solution of computational problems in assembler. The interaction of programs with the OS and modular programming. Features of programming in multiprogram and multitasking environments. Programming Wiindows applications.	5	v	v	v			v	v			
32	Specialized mathematical packages	Modern mathematical software: main types, capabilities, and areas of application. Programming languages and libraries of programs for numerical calculations. Specialized and universal math packages. Approaches to organizing the interface, command language. Computer algebra systems and universal numerical calculation systems (Mathematica, Maple, Matlab, Mathcad).	5	v		v			v	v			

		Open source mathematical packages (Octave, Scilab, Sage, Axiom, Maxima).												
33	Statistics for IT	Methods for statistical description of observation results. Fundamentals of correlation analysis. Fundamentals of regression analysis. Solving standard examples. Fundamentals of variance analysis. Nonparametric methods of statistics.	5			v	v		v				v	
34	Statistical methods of data analysis	Multi-dimensional samples. Preliminary analysis of multidimensional data. Methods for modeling random variables. Robust statistical estimation. Methods of statistical estimation and comparison of samples. Non-parametric methods for testing sample homogeneity. Dispersion analysis. Methods for processing rank data. Component analysis. Methods for multidimensional data classification	5			v	v		v				v	
35	Database technologies	Purpose and basic principles of the architecture of database management systems. Theoretical foundations of relational database management systems. Using the SQL language in application programs. The concept of an active database. Stored procedures and triggers. Basic principles of database structure design. Fundamentals of transactional processing in database management systems. Security of database management systems. Elements of Data Warehousing technology.	5		v	v	v		v	v				
36	Software development technologies and standards	The main stages of software development technology development. Evolution of software lifecycle models. Standards that govern the software development process. Requirements development and external software design. A structural approach to software design. Design and programming of modules. Design and development of the software interface. Testing, debugging, and building software. Software maintenance at the operational stage. Managing software development. Development and standardization of information technologies.	5	v	v	v			v				v	
37	Machine learning technologies	Logical models of machine learning. Ranking trees. Learning ordered lists of rules. Learning unordered sets of rules. Rule-based training of descriptive models. Probabilistic learning models. Probabilistic models of categorical data. Discriminant learning by optimizing conditional likelihood. Probabilistic models with hidden variables. Compression-based models. Metric models.	5	v	v	v						v		
38	Digital circuitry and computer architecture	Fundamentals of the algebra of logic. Basic logic elements. Decoders, encoders, code converters. Purpose and principle of operation of multiplexers. Purpose of digital comparators. Theorem de Morgana. The scheme and principle of operation of digital comparators. Purpose and principle of operation adders. Truth tables of adders. Appointment and classification of triggers. Passive and active logic levels. Asynchronous RS-triggers on the elements NAND, NOR.	5		v	v	v						v	v
Cycle of profile disciplines University component														
39	Visual programming and data mining	Multidimensional representation of data. Methods and algorithms for solving the main problems of data analysis: classification, clustering, etc. Practical application of DataMining in industries. DataMining methods and models. Methods of statistical analysis	5	v		v	v		v				v	

		and modeling focused on finding models and relationships hidden in the data set.												
40	Engineering graphics (AutoCAD, Compass)	Methods for automating drawing and graphic works using the AutoCAD computer program. Execution of drawings, development of spatial models of engineering and architectural objects, visualization methods. 3D design technology.	5	v		v		v					v	
41	Information Security	International and national standards in the field of information security; main types of information security threats and ways to counter these threats; basic regulatory documents in the field of information security; basic applied cryptography algorithms; basic means of ensuring information security; public key infrastructure; formal security models. Implementing applied cryptographic algorithms in programming languages, working with cryptographic providers, using cryptographic primitives in programming languages.	5		v	v	v					v		
42	Microprocessor complexes and industrial programming	Classification of operating principles, main characteristics of microprocessor systems. Structural and logical scheme of the microprocessor. Automation tools for the purpose of building microprocessor systems. Industrial controller program preparation systems. Microprocessor-based tools for building and diagnosing control systems.	5		v	v	v		v				v	v
43	Parallel programming	Basic information about parallel computers. Performance Analysis. First steps towards parallel programming. Scalable algorithmic methods. Stream programming. MPI standard and other local level languages. ZPL language and other global languages. Perspective directions in parallel programming	5	v	v	v	v		v					
44	Design and architecture of software systems	A set of parallel running programs. Layered architecture. Software interaction tools. Methods and tools of information security of software systems. Standards and profiles in the field of software systems. Methodological foundations of software system design. Requirements analysis. Bottom-up and top-down methods of software development. Designing interfaces. Models of software tools with a structural and object-oriented approach. Documentation of software systems. Automation systems for designing and documenting software products.	5		v	v	v						v	v
45	Development and analysis of software requirements	Documented, feasible, testable requirements, with a level of detail sufficient for system design. Functional and non-functional requirements. Types of activities of a programmer when analyzing requirements. Methodology for the development of project working technical documentation. Managing content, timing, cost and quality, human resources, and risks in software development.	5		v	v		v						v
46	Network operating systems	Architecture Windows, Unix / Linux, OS Administration. The basic functions of the OS. Time sharing systems. Functional components of the network OS. The main functions of the client. Approaches to building a network OS. Peer and server network operating systems.	5		v		v					v		v
47	Software testing	Methods and practices of designing complex software, as well as the study of the main theoretical issues of standardization, certification and quality	5		v		v	v						v

		assurance according to the methods and algorithms of software quality control (software).											
48	Web Development	Features of IP protocols versions 4 and 6. IP tunnels. Designing a site. Principles of construction of hypertext information systems. Client web technologies: HTML, CSS, JavaScript, HTML5, Ajax, JQuery, XML; JavaScript scripting language, jQuery. Programming in PHP, PHP7. Framework Yii, Laravel. SQL query language. Create MySQL database. PostgreSQL DBMS.	5		v	v				v		v	