

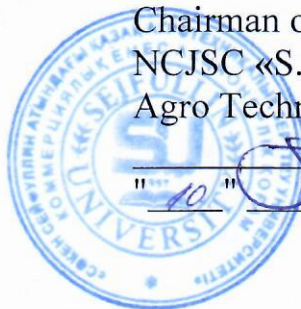
Ministry of Agriculture of the Republic of Kazakhstan  
S. Seifullin Kazakh Agro Technical Research University

Considered  
at the meeting of the Academic  
council of the university  
protocol № 16  
" 29 " 05 2023

APPROVED

Chairman of the Board - Rector  
NCJSC «S. Seifullin Kazakh  
Agro Technical Research University»

Tireuov K.M.  
" 10 " 08 2023 y.



**EDUCATIONAL PROGRAM**  
**(innovative)**  
**6B06104 - «DevOps Engineering»**

Code and classification of the field of education:	<b>6B06 Information and Communication Technology</b>
Code and classification of training areas:	<b>6B061 Information and Communication Technology</b>
Code in the International Standard Classification of Education	<b>0610</b>
Degree/qualification awarded:	<b>Bachelor in Information and Communication Technology the EP 6B06104 - DevOps Engineering»</b>

Study period: **4 years**

Astana 2023

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The team of authors was approved by the order of the NCJSC «S. Seifullin Kazakh Agro Technical Research University», № 374-H of "18" November 2023y.

Educational program 6B06104 - «DevOps Engineering» considered at the meeting of the Department "Information Systems" №9 of "11" May 2023 y.

Approved by the Faculty of the CSaPE Council protocol №12 of "19" May 2023 y.

Educational program passport 6B06104 – «DevOps engineering» is included in the unified platform of higher education dated 08.10.2023y.

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## **1 Description of the educational program**

### **1.1 Purpose of education program**

EP "DevOps engineering" aims to meet the needs of society in qualified personnel in the field of software development and operation using and applying modern methods and technologies of DevOps.

The profession of DevOps-engineer is included in the Atlas of new professions and competences demanded in the labour market of RK. The proposed educational program project facilitates acquisition of quality professional skills by trainees, which will ensure employment and high wages.

**The aim of Educational program «DevOps Engineering»** is to train specialists with knowledge of modern technologies in IT industry, capable of synchronizing all stages of software product creation, as well as automation of deployment and maintenance through the use of DevOps-technology.

**Objectives of the DevOps Engineering educational program:**

- Formation of skills to effectively apply DevOps approach in software development and operation, accelerate the process of software release, improve its quality and reliability, as well as ensure data security and protection.

- Training students to work on different platforms with different programming languages, to automate workloads between multiple cloud providers, to provide internal and external support on multiple platforms.

- building theoretical and practical knowledge to learn the basic concepts and methodologies of DevOps, developing and configuring infrastructure using tools and platforms used in DevOps, modern practices and techniques, testing applications using different methodologies.

### **1.2 Learning outcomes**

**RO 1.** Identify the language tool for problem solving and process information using programming language and application tools, as well as the willingness to work in a team, to use professional documentation in English.

**RO 2.** Present IT projects, demonstrate entrepreneurial skills, adhere to a culture of academic integrity, critically evaluate and interpret information in the areas of ICT, environment, economics and law.

**RO 3.** Apply the mathematical apparatus of ICT to construct algorithms for its analysis, transformation and processing and to optimize information processes in various application domains and be able to use the basic laws of science in professional practice.

**RO 4.** To understand the problems of creating algorithms for problem solving and describing them using programming languages, to orient in different programming environments, to know the control structures of scripting languages and also apply methods of analysis of the applied field at the conceptual, logical, mathematical and algorithmic levels

**RO 5.** understand agile software development methodologies, demonstrate knowledge of working with databases, present ideas of continuous integration and continuous software delivery and also use modern technical means and information



technologies

**RO 6.** Understand the basics OS, automation of system configuration and deployment, principles of cloud services, choose virtualization and containerization technologies, networking technologies and utilities.

**RO 7.** Perform the formulation and solution of artificial intelligence tasks, including decision support tasks, use knowledge engineering methods, capabilities of artificial intelligence systems in applications designed for decision support systems.

**RO 8.** Apply modern, effective methods of IT project management, project manager skills, design and develop an IS in compliance with IT security principles.

**RO 9.** Apply modern technologies and methods of data collection, methods of their processing and analysis, including the use of intelligent information and analytical systems, in solving management and research tasks.

**RO 10.** Implement analytical and technological solutions in the field of software (system, applied and instrumental) and computer information processing, as well as possess methods of teaching mathematical and algorithmic modeling of educational tasks of a scientific and technical nature.

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

Areas of professional activity in which graduates who have mastered the educational program can carry out professional activities in the design, development, implementation and operation of computer facilities and information systems and their lifecycle management.

The revision of functional and process paradigms in IT product development may require the involvement of professionals in the field of aggregation and process rationalization.

These circumstances determine the relevance of developing and enhancing an educational program for training generalists (DevOps engineers) at the undergraduate level.

"DevOps engineering" is the subject of professional activity of specialists in implementing and scaling DevOps methodology, synchronizing all stages and elements of software products creation process from code writing phase to testing and release stage.

EP "DevOps Engineering" in the direction of 6B061 Information and Communication Technologies is aimed at meeting the needs of society for qualified personnel in the field of IT-industry, Web-development and software.

The competitive advantages of a DevOps Engineering graduate are:

- Performance verification and refactoring of software code;
- requirements development and design of software and IT project management.

Specificity, uniqueness of implementation of the educational program "DevOps Engineering":



- EP is implemented with the use of dual training and elements of distance learning technologies;
- practical training is implemented using the resources of the Centre of technological competence in the field of digitalization of AIC KATIU named after S. Seifullin, as well as specialized enterprises, with which an agreement on practical training is concluded.
- a set of professional certifications is provided during the training process.

### **3 Competence model (portrait) of a graduate**

#### **3.1 Areas of professional activity**

Spheres of professional activity of graduates of OP «DevOps-engineer» on direction 6B061 Information and Communication Technologies:

- the sphere of industrial software production;
- sphere of material production (industry, agriculture, forestry, construction, etc.)
- non-production sphere (health care, education, housing and utilities, trade, etc.)

#### **3.2 Types of professional activity**

Types of professional activities of graduates of the program «DevOps-engineer» in the field of 6B061 Information and Communication Technologies:

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

#### **3.3 General education competencies**

Upon successful completion of this program, the learner will have the following general education competences:

- 1) assesses the surrounding reality on the basis of worldview positions formed by the knowledge of the fundamentals of philosophy, which ensure scientific comprehension and study of the natural and social world by methods of scientific



and philosophical cognition;

2) interprets the content and specific features of mythological, religious and scientific worldviews;

3) argues his/her own assessment of everything happening in the social and industrial spheres;

4) expresses civic position on the basis of deep understanding and scientific analysis of main stages, regularities and peculiarity of 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 spheres 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 particular science as well as of the whole socio-political cluster;

9) develops own moral and civic position;

10) operates with social, business, cultural, legal and ethical norms of Kazakhstani society

11) demonstrates personal and professional competitiveness

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

13) makes a choice of methodology and analysis

14) summarizes the results of the study

15) synthesizes new knowledge and presents it in the form of humanitarian socially significant product

16) starts oral and written communication in Kazakh, Russian and foreign languages to solve problems of interpersonal, intercultural and industrial (professional) communication

17) carries out use of language and speech means on the basis of system of grammatical knowledge; analyzes information according to situation of communication

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

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

20) constructs a personal lifelong learning trajectory for self-development and career advancement, is oriented towards a healthy lifestyle to ensure full social and professional activities through methods and means of physical education;

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

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

23) possesses skills of quantitative and qualitative analysis of social



phenomena, processes and problems.

### **3.4 Core competencies**

Upon successful completion of this program, the learner will possess the following core competencies:

- 1) demonstrate knowledge and understanding in the field of study, based on advanced knowledge in the field of study;
- 2) apply knowledge and understanding at a professional level, formulate arguments and solve problems in the field of study;
- 3) collect and interpret information to form judgements taking into account social, ethical and scientific considerations;
- 4) apply theoretical and practical knowledge to solve practical and professional problems in the field of study;
- 5) study skills required to independently pursue further studies in the field of study;
- 6) know the methods of scientific research and academic writing and apply them in the field of study;
- 7) apply knowledge and understanding of facts, phenomena, theories and complex dependencies between them in the field of study;
- 8) understand the meaning of the principles and culture of academic integrity.

### **3.5 Professional Competencies**

Upon successful completion of this program, the learner will possess the following professional competencies:

**Design:**

- The ability to develop requirements, technical specifications and design software (conduct business process analysis and identify software requirements; develop technical specifications for software components and their interactions; design software based on developed requirements and technical specifications);
- ability to manage the implementation of DevOps projects.

***Production and technological:***

- the ability to perform administration of network devices and software of information and communication systems (administers subsystems of the organization's info-communication system; monitors and maintains the organization's info-communication system.);
- The skills of developing, debugging, upgrading and maintaining information systems software (performs software development (upgrades), including the choice of programming technology and tools; carries out software testing, including the development of testing strategy, management of the testing process and analysis of test results; performs work on maintaining the information system and/or its components);
- project virtualization, containerization and orchestration skills with the use of modern tools (deploys a project in a virtual environment; uses containerization in professional practice; applies modern DevOps tools in professional practice);



- the ability to distribute digital data processing (masters the current terminology in the areas of distributed computing, global area networks and cloud computing; designs, develops and administers systems built on cloud technologies; develops the technical documentation necessary for the design and development of systems built on cloud technologies).

*Operational:*

- Ability to prepare and use systems for their intended purpose, maintenance, storage and transport;

- The ability to handle tasks such as getting the system up and running and maintaining it in an operational state, using it for its intended purpose with the required efficiency, and acting as a support person in various modes of operation.

#### 4 Base of professional internships

Practical training is implemented with the use of resources of the chair «Information Systems», as well as specialized enterprises with which the contract on practical training is concluded.

Educational practice takes place on the basis of the chair «Information Systems» of the Kazakh Agricultural Research University named after S. Seifullin in the first year.

Work practice takes place on the bases of state or private organizations in IT department after the 2nd, 3rd courses and after the first term of the 4th course with the duration of 4-6 weeks.

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

№	Name	Telephone	Email	Website
1)	Astana IT, Astana, 31/2 Saryarka Ave.	+7 775 188 8007	info@astana-it.kz	http://astana-it.kz
2)	IT Holding Samgau; Astana, 5B, Imanbayeva str.	+7 717228 1815 +7 777003 3311	Info@samgau.com	http://samgau.com
3)	Oyul Kazakhstan Association of IT-companies, Astana, 6/5 Kabanbay Batyr Ave.	+7 717292 5552		http://itk.kz
4)	JSC National Infocommunication Holding Zerde, Astana, 1 Almaty str.	+7 717257 0778		http://zerde.gov.kz
5)	TransTeleCom JSC.13 Abai Avenue. Astana	+7 717260 0029		http://ttc.kz
6)	Computer Academy "Shag", 23, AliyaMoldagulova str.	+7 717 231 3328 +7 717 291 1458	astana@itstep.org	http://astana.itstep.kz

7)	Net.com" LLP, Astana, 22 Kazhymukan Munaitpasova str.	+7 717 247 8177		<a href="http://netcom.kz">http://netcom.kz</a>
8)	Corporate Business Systems, Astana, 3, Kabanbaybatyr Ave.	+7 727 262 2218		<a href="http://cbs.kz">http://cbs.kz</a>
9)	InesSoft LLP, 8 MukhtarAuezov Street, Astana	+7 717 272 8510		<a href="http://inessoft.kz">http://inessoft.kz</a>
10)	Expert-A Training Centre, Astana, 2/1 Bauyrzhan Momyshtuly Ave.	+7 771 909 4456 +7 717 262 5266	info@expert-a.kz	<a href="http://expert-a.kz">http://expert-a.kz</a>
11)	Somnium Astana LLP, 12/2 Kunayev str.	+7 7172 68-98-14;		
12)	AstanaInavation JSC			
13)	JSC Electronic Finance			
14)	National Information Technologies JSC Astana, 8 Orynbor Str., Astana	+7 7172 74-10-70; +7 7172 74-10-81;		
15)	Union of Farms of Kazakhstan Republican Association	87019996661; 87172509928; Ibraev Serik	ibrayev.sn@gmail.com	www.sfk.kz
16)	PLATONUS LLP	87055166919; 87172472525; Айдар Манас	ISPUSINOV@PLATONUS.KZ	PLATONUS.KZ
17)	GlobalServicesInternational, MukhitovAzat	87077555273;	maz@gse.kz	
18)	TerraPoint LLP	87015333406;	Aida_mullash eva@mail.ru	Муллашева Аида финансовый директор




## 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	<b>I semester</b>	<b>September 1 - December 15</b>
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	<b>II semester</b>	<b>January 29 to May 10</b>
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)

13	37	BS ES	Sub-CD	University courses (the relevant systems)	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000
13	37	BS ES	Sub-CD	University courses (the relevant systems)	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							



**Matrix for the attainability of the learning outcomes of an educational program through the disciplines.**

№	Name of discipline	Brief description of the discipline	Number of loans of credits	Formative learning outcomes									
				L O 1	L O 2	L O 3	L O 4	L O 5	L O 6	L O 7	L O 8	L O 9	LO 10
<b>General Education Cycle Higher Education Component/Optional Component</b>													
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 concep	5	+	+							+	
2.	Basics of anti-corruption culture	The course forms a system of knowledge on combating corruption, and the development on this basis of a civil position in relation to this phenomenon. As a result of mastering the discipline, students will be able to: navigate the legislation; analyze and apply legal acts in specific situations, follow moral	5		+								
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. 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.	5		+								
4.	Entrepreneurship	The discipline is focused on the formation of students' comprehensive understanding of entrepreneurship and the possibilities of organizing entrepreneurial activity. The content of the discipline characterizes the essence of	5		+								



		entrepreneurial activity, its types and functions, subjects of entrepreneurial activity and the business environment, and also reflects the features of the mechanism for creating your own business, business planning, financial and personnel support, characterizes the types of entrepreneurial risks and ways to prevent and minimize them.												
5.	Ecology and life safety fundamentals	The course forms practical skills in identifying dangerous and harmless natural conditions, in preventing the causes and conditions for the occurrence of dangerous situations, in protecting the population and the production facility from the possible consequences of dangerous situations. Features of labor protection for women and youth, supervision and control.	5		+									
<b>Cycle of core disciplines Higher education component</b>														
6.	Algorithms and data structure	The course deals with basic approaches to the analysis and design of algorithms and data structures. Asymptotic estimation of algorithm complexity, efficient algorithms for sorting and selection of ordinal statistics, data structures, methods of algorithm design, basic algorithms on graphs.	5		+				+					
7.	Computational methods on computers	Basic numerical methods for researching objects; theoretical foundations for the construction of methods for the numerical solution of algebraic and transcendental equations; Analysis of the results obtained in solving applied problems	5						+	+				+
8.	Cybersecurity and data protection	Information security standards. International standards for information exchange. The concept of threats, attacks. Global networks and information security. The concept of an information security perpetrator. Hackers. Types of hackers. Examples of hacker attacks. Viruses as a class of malicious software. Types of viruses and their classification. Protecting the information system from threats. Purpose and tasks in the field of information security at the state level.	5						+					+
9.	Mathematical logic and algorithm theory	The basic concepts and methods of mathematical logic and the theory of algorithms, with a focus on their use in practical computer science, including artificial	5						+	+				



		intelligence systems and computer technology; the formation of systematized knowledge in the field of mathematical logic, the development of logical thinking, logical culture.												
10.	Mathematical analysis	The basic concepts and methods of mathematical logic and the theory of algorithms, with a focus on their use in practical computer science, including artificial intelligence systems and computer technology; the formation of systematized knowledge in the field of mathematical logic, the development of logical thinking, logical culture.	4			+	+							
11.	Fundamentals of mathematical and computer modeling	Introduction Computer modelling. The concept of modelling, models. Types of modelling, types of models. Classification of models. Creating computer models of simple mechanical processes.	5			+	+							+
12.	Fundamentals of object-oriented programming	The main elements of the object model. Relationships between objects and classes. Basic principles of object-oriented programming. About the features of the .NET platform. Classes in C#. Basic concepts. Functional types in C#. Inheritance and late binding polymorphism. Virtual functions and abstract classes. Generalizations. Basic concepts	5	+			+							
13.	Basics of programming	This discipline outlines the basics of algorithm development and program implementation using object-oriented tools. Examples are demonstrated by means of the C++ language	5	+			+							
14.	Basics of database technology	Purpose and basic principles of architecture of database management systems. Theoretical foundations of relational databases. 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	3				+	+						
15.	Fundamentals of IT project management	Project initiation. Project planning. Development of the project timetable. Planning for project quality assurance. Planning project risks. Planning project human resources. Planning for communication and	5		+								+	



		configuration management on a project. Assessing the feasibility of the project. Identifying the risks of the project. Project management during the design phase. Implementation of the communication plan and user training. Project management in the development and implementation phase.													
16.	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 programmer activities in requirements analysis. Methodology for development of design working technical documentation. Management of content, time, cost and quality, human resources, risks in software development.	5				+	+							
17.	Probability theory and mathematical statistics	Formation of students' scientific understanding of the essence and properties of probability processes, probabilities describing them, random variables, distribution functions and statistical methods, mastering the practical skills of working with random variables and methods of their search and evaluation.	5				+	+							+
18.	Graph theory in computer science	Fundamental concepts and mathematical apparatus of graph theory. The main problems of graph theory and methods of their solution. The effective use of graph models for solving applied problems, the use of software interface development tools for the implementation of graph algorithms.	5				+	+							
19.	Software development technologies and standards	The main stages in the development of software development technology. Evolution of software life cycle models. Standards governing the software development process. Requirements development and external software engineering. Structural approach to software design. Design and programming of modules. Design and development of software interface. Testing, debugging and building software. Maintenance of software at the stage of operation. Software development management. Development and standardization of information technologies	5						+	+					
<b>Core Discipline Cycle Elective Component</b>															



20.	Technical english	Basic vocabulary of texts in the specialty. Extraction of general information from the adapted text of the specialty. Confirmation or refutation of information from adapted texts in the specialty. Stable phrases that are most often found in professional speech. Oral and written presentation of the content of the adapted text in the specialty. Official-business style of communication. Scientific style. Basics of abstracting, annotating. Business documentation	3	+	+								
21.	Synergetics - interdisciplinary scientific theory	Fractal geometry of nature. Linear and nonlinear fractals. Fractal dimension. The principle of self-similarity. The Mandelbrot set. Phase portrait of the instability of the object. Theory of probability and information. Information entropy. Theories of stability, chaos and catastrophes. Differential equations of nonlinear processes and their numerical solutions. The Lorentz dynamical system.			+								+
22.	Intelligent data analysis	Discipline NumPy functions of linear algebra, SciPy mathematical algorithms and functions for data processing and visualization, Matplotlib is a library for creating 2D graphs in Python, R and RStudio environments, data access operators, functions and arguments, loops and conditional operators, R DBMS , setting. Teaches statistical calculations and graphs in R.	5				+			+		+	
23.	Visual programming and data mining	Multidimensional representation of data. Methods and algorithms for solving basic data analysis problems: classification, clustering, etc. Practical application of Data Mining in industries. Data Mining methods and models. Statistical analysis and modelling techniques focused on finding patterns and relationships hidden in the data set.					+			+		+	
24.	Introduction to machine learning	Theoretical knowledge and Data management tasks, including data loading, data transformation, and preliminary data analysis and visualisation, an introduction to the main tasks and models of machine learning. Methods for evaluating the quality of performance of different machine learning models, understanding	5							+		+	



		the process of integrating machine learning models within tasks.											
25.	Introduction to artificial intelligence	Representation of knowledge in intelligent systems. Algorithms for logical inference based on knowledge. 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.				+				+			+
26.	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							+			+
27.	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.								+			+
28.	Fundamentals of big data processing technology	Introduction to Big Data. Technologies for collecting and storing big data. Big data processing and analysis technologies in modern IT infrastructure: The lifecycle of Big Data analysis, standards.	5			+	+						+
29.	Methods and systems of big data processing	Introduction, distributed file systems. The MapReduce calculation model. SQL over BigData. Hive. Beyond MapReduce. Spark. Machine learning on big data. Streaming data processing. Key-value of storage in big data.				+	+						+



30.	Physics for computer science	Introduction to the discipline. Fundamentals of the theory of electrical conductivity of metals and semiconductors. The element base of modern computers, Harvard and Princeton computer architectures, generalized structure of the system unit. The device of semiconductor storage devices and external storage devices on magnetic, magneto-optical and optical media. I/O interfaces, organization of computer interaction.	3		+	+								
31.	Physics	The discipline studies the basic physical phenomena, fundamental laws and concepts, as well as methods of physical research. Considers techniques and methods for solving typical problems from various fields of physics, introduces modern scientific equipment, forms the skills of conducting an experiment, the ability to highlight specific physical content in applied problems of a future specialty			+	+								
32.	Design of software systems and complexes	The industry of industrial development of software systems. Architecture of software systems. Architectural structures and representations. Modular structures. Distribution structures. Variants of software system architectures. The life cycle of software systems. PS design strategies. Design of software systems. Setting requirements for the PS. Development of technical specifications for the design of software systems. Requirements analysis and development of external specifications. Structural design.	5					+	+					+
33.	Design and architecture of software systems	A complex of parallel running programs. Layered architecture. Means of program interaction. Methods and means of information security software systems. Standards and profiles in the field of software systems. Methodological foundations of software systems design. Requirements analysis. Ascending and descending methods of software development. Interface design. Software models with structural and object-oriented approach. Documenting software systems. Computer-aided design and documentation of software products.						+	+					+



34.	Introduction to parallel programming	The discipline studies basic information about parallel computers. Performance analysis. The first steps in the direction of parallel programming. Scalable algorithmic methods. Streaming programming. MPI standard and other local-level languages. The ZPL language and other global-level languages. Assessment of the current state of the issue.	5				+			+		+	
35.	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					+			+		+	
36.	Internet application development	Technologies of using web programming languages in client applications; technologies of application Node.JS in server applications; use of web development tools; the use of modern web technologies for creating Internet applications. Layouts on CMS (Tilda, WordPress, Bitrix, Opencard). SEO principles.	5			+		+	+				
37.	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.		+		+		+	+				
38.	Databases for DevOps	Databases and database management systems. Functional composition. Classification of database architectures. System directories. Data models. Multi-user services. NoSQL class database management systems. The difference is SQL vs. NoSQL. The NoSQL model. Types of systems. Storage and access to complex data structures	5			+	+	+					
39.	Company database management systems (Oracle)	Relational data model. Basic operations of relational algebra: selection, projection, Cartesian product. Data models. Technology and principles of database design. Modeling of the subject area. Principles of organization of Oracle DBMS.				+	+	+					



		Organization of external memory. The level of direct data management in external memory. Database design in Oracle DBMS. The main components of the Oracle database. Client-server data organization models												
<b>Cycle of major disciplines Higher education component</b>														
40.	Systems and network administration	Techniques for managing network devices, network protocols, network operating systems, directory services, network services. Management of system file resources, resource access rights, printing devices, information backup and recovery systems, monitoring of network devices and services. Fundamentals of logical design, configuration and maintenance of computer networks.	5						+	+			+	
41.	Introduction to Software Engineering	The concept of a software product. The difference between a software product and a programme. Development of programming technology. Requirements for modern programming technology. The concept of software engineering. The concept of software product life cycle. Basic approaches to software development. Monumental and lightweight technologies. Basic concepts of the initial stages of a software project. Approaches to organizing a team of programmers. Basic MSF principles. Team organization. Organizing the software development process.	3				+	+						
42.	Software development methodologies	The complexity of software. The life cycle of software. Identifying the requirements for a software system. Review of software product design methodologies. Rapid software development techniques. Object-oriented design of a software system. Tools for information support for software projects and products (CALS) technology. Testing and debugging of software systems. Evaluation of software quality. Implementation and maintenance of software products.	4						+	+	+			



43.	Business process modelling	Fundamentals of business process modelling. Systemic understanding of business modelling technology, understanding the essence of business modelling based on the use of modern information technologies. Fundamentals of process approach in organization management, construction and analysis of business process models. Basic methodologies for modeling, analysis and improvement of business processes. Modern tools for modelling and analysis of business processes	5		+	+									+
44.	Operating systems for DevOps	The concept of OS. Hardware and software. The concept of OS. Hardware and software. Core of OS. Interrupt circuitry. Process control. Memory management. Concept of virtual memory. File system. Filesystem facilities. File system topology. I/O management system. Structural hardware and software features. Organizing local computer networks. The main hardware and software components. The topology of a LAN. The UNIX operating system. Its main features. Interprocess communication. Process control. System calls and APIs. Examples of UNIX implementations. SOLARIS, UNIX HP, FREE BSD, LINUX.	5					+	+						
45.	Fundamentals of information management	Principles, concepts and modern methods in the field of information resources management at all stages of the life cycle of information systems. Fundamentals of IS management in the process of creation, implementation and operation based on quality assessment of information products and services offered in the information market. Methods of using modern information management systems.	5		+							+			
46.	Basics of cloud computing	Introduction to Cloud Technologies. General information. Cloud computing now. Advantages of cloud computing. Network models of cloud services: SAAS, IAAS, PAAS, SAAS, PAAS, SAAS, DAAS	5					+	+						



47.	Basics of Software Testing	Basic concepts of testing. Criteria for selecting tests. Evaluation of the project's testing: metrics and methods of integral evaluation. Modular and integration testing. Types of testing. Features of industrial testing. Documentation and evaluation of industrial testing. Regression testing methods. Algorithm and software system for regression testing support.	5				+	+	+				+
48.	Scripting programming languages	Programming paradigms. Scripting programming languages. Basic basic constructions of script programming languages. Ruby programming language. Basics of metaprogramming. PERL programming language. Basics of OOP and web programming in PERL. Purpose and application of CSS. Syntax of CSS. JavaScript language. Basic constructs. Events.	5	+			+						
49.	Virtualisation and containerisation technologies	Definition of virtualisation and levels of implementation. Software and hardware virtualisation. Types and basic hypervisors. Paravirtualisation. Server virtualization. Virtualization platforms. The basics of modern containerization. Docker. Kubernetes. Virtualisation and containerisation management systems.	5					+	+				