Non-commercial joint-stock company
«Kazakh national agrarian research university»

AGREED
Deputy Chairman of the Board LTD
«SPC of Agricutural Enginering»
_____ D. Karmanov
«__»_____ 2024 y.

AGREED
Director of LTD «AuylTech»
_____ A. Adilsheyev
«__»_____ 2024 y.

APPROVED
Chairman of the Board –
Rector
_____ A.Kurishbaev
«__»_____2024 y.

EDUCATIONAL PROGRAM

«6B08703-Digital technologies in agro-industrial complexes»

Degree awarded: Bachelor of agriculture in the educational program «6B08703-Digital technologies in agro-industrial complexes»

ALMATY 2024

Approved at the meeting of the Department «Agricultural machinery and mechanical engineering»
Protocol № 6 , « 12 » 01 2024

Head of the department _____ Zh. Zhumagulov

Considered at meetings Academic committee of the Faculty of «Engineering - technical»
Protocol № 6 , « 26 » 01 2024

Chairman of the AC of the faculty _____ U. Ibishev

Reviewed by the Educational Methodological Council of the University and recommended to the Academic Council
Protocol № 4 , « 01 » 02 2024

Chairman of the EMS of the University _____ A. Abdyrov

The educational program was approved at the meeting of the Academic Council of KazNARU
Protocol № 9 , « 01 » 03 2024

Developers:

Dean of the Faculty	L. Aldibaeva
Head of department	Zh. Zhumagulov
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Student	S. Sariyev
Graduate of 2023	A. Yerzhan

Employers:

Deputy Chairman of the Board LTD «SPC of Agricutural Enginering»	D. Karmanov
Director of LTD «AuylTech»	A. Adilsheyev

Agreed:

Head of the Educational Program Design Office	Zh. Kussainova

Scope of application

It is intended for the implementation of bachelor's training in the educational program «6B08703-Digital technologies in the agro-industrial complex» in the NAO «Kazakh national agrarian research university».

Normative documents

«On Education» The Law of the Republic of Kazakhstan dated 27 July, 2007 No. 319-III;

Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 №2;

Classifier of training programs for personnel with higher and post-graduate education. Order of the Minister of Education and Science of the Republic of Kazakhstan of October 13, 2018 No. 569;

Standard Rules for the activities of educational organizations implementing educational programs of higher and (or) postgraduate education. Order of the Minister of Education and Science of the Republic of Kazakhstan of October 30, 2018 No. 595;

Rules of the organization of the educational process on credit technology of training. Order of the Minister of Education and Science of the Republic of Kazakhstan dated October 12, 2018 No. 563;

Algorithm of inclusion and exclusion of educational programs in the Register of educational programs of higher and postgraduate education. Order of the Minister of Education and Science of the Republic of Kazakhstan No. 665 dated December 4, 2018;

Professional standard. Appendix No. 72 to the order of the Deputy Chairman of the Board of the National chamber of entrepreneurs of the Republic of Kazakhstan "Atameken" dated 11.12.2018 No. 339

Appendix No. 15 to the order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" dated 26.12.2019 No. 263

1. Passport of the educational program

Code and classification of the field of education	6B08 Agriculture and bioresources
Code and classification of training areas	6B087 Land Management
Code and name of the educational program	«6B08703-Digital technologies in agro-industrial complexes»
Type of educational program	Innovative
The aim of the educational program	Mastering students' knowledge of digital and information and communication technologies, approaches to use in practice to solve professional tasks in the agro-industrial sphere, in the field of technical support of crop production and animal husbandry based on the principles of precision farming and smart farm
ISCED level	6
NQR level	6
SQF level	6
Application number to the license on the direction of staff training	KZ89LAA00031870 05 August 2021 №004
Accreditation of the EP Name of the accreditation agency Validity of accreditation	
Awarded academic degree	Bachelor of Agriculture with a degree in «6B08703-Digital technologies in agro-industrial complexes»
Learning outcomes	Table 2
List of specialist positions	- head of the machine yard in all types of agricultural formations; - Head of a mechanical repair shop in all types of agricultural formations, motor transport enterprises and technical service stations; - engineer for the mechanization of labor-intensive control and management processes, digitalization in all types of agricultural formations; - Engineer for the operation of the machine and tractor fleet in all types of agricultural formations and technical service enterprises; - employee in agricultural educational institutions; - Researcher in research organizations in the field of agricultural technology and technology
Area of professional activity	Head of the machine yard in all types of agricultural formations; - Head of a mechanical repair shop in all types of agricultural formations, motor transport enterprises and technical service stations; - engineer for the mechanization of labor-intensive control and management processes, digitalization in all types of agricultural formations; - Engineer for the operation of the machine and tractor fleet in all types of agricultural formations and technical service enterprises; - employee in agricultural educational institutions; - Researcher in research organizations in the field of

	- organization of work on the introduction and maintenance of mechanization and automation equipment at livestock farms and complexes; - design of machines, equipment and their complexes, mechanized technologies in plant growing and animal husbandry.
Object of professional activity	-government bodies associated with the organization using digital technology in the agro-industrial complex (ministries, akimats, as well as their regional structures and divisions); - consulting companies in the field of monitoring using digital technology in production, processing, transportation, storage, sale, accounting and movement of agricultural products, accounting of land, forest and water resources, the use of agricultural machinery; - infrastructure facilities, the activities of which are based on digital technology in the agro-industrial complex; - educational institutions that train specialists in digital technology; - research organizations involved in solving problems of digital technology in the agro-industrial complex .
Functions of professional activity	- government bodies associated with the organization using digital technology in the agro-industrial complex (ministries, akimats, as well as their regional structures and divisions); - consulting companies in the field of monitoring using digital technology in production, processing, transportation, storage, sale, accounting and movement of agricultural products, accounting of land, forest and water resources, the use of agricultural machinery; - infrastructure facilities, the activities of which are based on digital technology in the agro-industrial complex; - educational institutions that train specialists in digital technology; - research organizations involved in solving problems of digital technology in the agro-industrial complex
Professional activities	1Estimated: - assessment of the level of digital technology in various industries and in the agro-industrial complex in general; - based on the analysis based on the real state of the use of IT technology; - assessment of material and staffing, as well as reasonable forecasting of the development of digital technology in the agro-industrial complex using advanced experience; - have the skills to identify and assess promising directions for the development of digital technology at agro-industrial enterprises.

	of production, storage and processing of agricultural products using digital technology; - collect and analyze materials to assess the effectiveness of the functioning of agricultural formations using digital technology. 2. Constructive: - the use of modern control systems for the machine-tractor unit, the technological process in the agro-industrial complex; - management of production and technical operation of agricultural machinery based on digital technology; - formation and improvement of sales channels for services and goods; - the use of quality management systems for the production activities of agricultural enterprises in order to improve the quality of products; - research work to assess the quality, energy and economic indicators of the developed units, machines and complexes. 3. Information technology: - collection of information from various objects of the agro-industrial complex, processing of the received primary information through the implementation of analytical and communication skills; - design and development of various components of information systems; - installation, configuration and administration of the network infrastructure of information systems; - design and administration of information systems databases; - support of information, software, technical, organizational and legal support of information systems and their elements; - development of requirements and specifications of individual components of objects of professional activity based on the analysis of user requests, models of the subject area and the capabilities of technical means; - designing the architecture of information systems components; - design of the human-machine interface of hardware and software systems; - design of mathematical, linguistic, informational, software and technical support of information systems based on modern methods, design tools and technologies, including using computer-aided design systems.
Have skills	- management of agricultural machinery, adjustment of technological equipment of enterprises for the production and processing of products of the industry and agricultural services using digital technology; - application of computer equipment and technology in the development of projects of agricultural enterprises and service centers;

	products of the production cycle of the enterprise using digital technology; - design, installation, commissioning, repair and operation of digitalization systems.

2. Results of training in the following disciplines

Code	Learning outcomes
LO1	Demonstrate knowledge and understanding of the history of the development of national ideas, understanding the operation of economic laws, apply the norms on labor protection, the environment, the rules of moral development, writing essays, business letters, scientific articles, understand the importance of the principles and culture of academic integrity
LO2	Understanding the basic foundations in the field of natural science disciplines that contribute to the formation of a highly educated person with a broad outlook and a culture of thinking. Search, store, process and analyze information from various sources and databases using information, computer and network technologies
LO3	Apply knowledge and understanding at the professional level when solving problems using images obtained by the method of parallel projection; apply the rules of the unified system of design documentation, as well as read, execute and detail general drawings using computer programs.
LO4	Formulate regulations, use the laws and methods of theoretical and applied mechanics, electrical engineering, electronics and processor technology, the basics of automation and automation in the agro-industrial complex in solving theoretical and practical problems.
LO5	Collect and interpret information for forming judgments of electronic mapping systems and programming microcomputers of unmanned aerial vehicles, for forming ethical and scientific considerations.
LO6	Apply theoretical and practical knowledge to solve educational, practical and professional tasks on the use of tractors, machinery and equipment in the agro-industrial complex, digitalization of information technology in automation systems, technical operation of machinery and equipment
LO7	Have the skills of training in digitalization of technology and technical means in crop production and animal husbandry, agrotechnical service in the agro-industrial complex
LO8	Know the methods of scientific research of digital information processing, in the development and application of information technology in automation systems
LO9	Apply knowledge and understanding of information security facts on the development and construction of robots and systems, the creation of an innovative model of economic analysis
LO10	Understand the importance of the principles of building modeling systems of production processes and business process automation

3. Curriculum of the educational program

CC/UC/OC	Code of discipline	Name of the discipline, forming competencies	in academic credits	Volume in hours							Distribution of credits by course and semester								Department	Type of lesson 2
				in academic hours	Classroom				Extracurricular		1 year		2 year		3 year		4 year			
					Lectures	Practical classes	Laboratory classes	Other (practice)	IWST	IWS	1	2	3	4	5	6	7	8		
2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	23
GES	**General education subjects cycle**		**56**	**1680**	**84**	**636**			**240**	**720**	**17**	**20**	**12**	**7**						
	Module. Humanities and language																			
CC	HK 1101	History of Kazakhstan (SE)	5	150	15	35			25	75	5								29	State exam
CC	Phil 2102	Philosophy	5	150	15	35			25	75			5						29	Exam
CC	FL 1103	Foreign Language	10	300		100			50	150	5	5							14	Exam
CC	K(R)L 1104	Kazakh (Russian) Language	10	300		100			50	150	5	5							15	Exam
	Module. Professional and communicative																			
CC	ICT 2105	Information and Communication Technologies (in English)	5	150	15	35			25	75			5						9	Exam
OC	LAC 2108	Law and anti-corruption culture	5	150	15	35			25	75				5						

	Ekon 2108	Economy																	3 2 17 8	Exam
	Ekol 2108	Ecology																		
	LS 2108	Life safety																		
	Module. Socio-political knowledge and a healthy lifestyle																			
CC	SPKM (SPCP) 1106	Social and political knowledge module (Social Studies, Political Studies, Cultural Studies, Psychology)	8	240	24	56			40	120		8							29 6	Exam
CC	PT 1107	Physical Training	8	240		240					2	2	2	2					30	Exam
CS	**Core subjects cycle**		**112**	**3360**	**291**	**407**	**272**	**150**	**48 5**	**1755**	**14**	**9**	**18**	**23**	**21**	**17**	**10**			
Module 1 ural science training and business ethics			**22**	**660**	**66**	**102**	**52**		**11 0**	**330**	**9**	**7**	**6**							
UC	Mat 1201	Mathematics	5	150	15	35			25	75	5								9	Exam
UC	Fiz 1204	Physics	7	210	21	21	28		35	105		7							9	Exam
OC	TAM 2207	Theoretical and applied mechanics	6	180	18	18	24		30	90			6						7	Exam
	EM 2207	Engineering Mechanics																		
OC	BK 1203	Business correspondence	4	120	12	28			20	60	4								2	Exam
	BE 1203	Business ethics																		

Module 2 General engineering training			**18**	**540**	**48**	**88**	**24**	**20**	**80**	**280**	**5**	**2**		**11**						
UC	EG 1202	Engineering Graphics	5	150	15	35			25	75	5								7	Exam
OC	CG3DM 2209	Computer graphics and 3D modeling	6	180	18	18	24		30	90				6					7	Exam
	TDG 2209	Three-dimensional graphics																		
OC	GSDT 2210	Graphical system design tools	5	150	15	35			25	75				5					9	Exam
	ADS 2210	Automatic design systems																		
UC	EP 1205	Educational practice	2	60				20		40		2							7	Differential test
Module 3 lectrical engineering and automation			**18**	**540**	**54**	**54**	**72**		**90**	**270**			**12**	**6**						
UC	EE 2206	Electrical Engineering	6	180	18	18	24		30	90			6						10	Exam
OC	EMT 2208	Electronics and microprocessor technology	6	180	18	18	24		30	90			6						10	Exam
	MSPI 2208	Microprocessor systems in the power industry																		
OC	FAAAIC 2211	Fundamentals of automation and automation in the agro industrial complex	6	180	18	18	24		30	90				6					9	Exam
	ATTPAIC 2211	Automation of typical technological processes of the agro-industrial complex																		

Module 4 Geoinformation systems			**16**	**480**	**30**	**50**	**20**	**60**	**50**	**270**				**6**	**10**					
OC	GIS 3215	Geographic information systems	5	150	15	35			25	75					5				9	Exam
	ECS 3215	Electronic cartographic systems																		
OC	UAV 3216	Unmanned aerial vehicles	5	150	15	15	20		25	75					5				9	Exam
	MPUAV 3216	Microcomputer programming of unmanned aerial vehicles																		
UC	PP 2212	Production practice	6	180				60		120				6					8	Differential test
Module 5 nformation technologies in automation ems and technical operation of machines			**15**	**450**	**45**	**65**	**40**		**75**	**225**						**10**	**5**			
UC	ITAS 3217	Information technologies in automation systems	5	150	15	15	20		25	75						5			**9**	Exam
OC	TOMEF 3218	Technical operation of machinery and equipment in farms	5	150	15	15	20		25	75						5			8	Exam
	DMRA MSF 3218	Diagnostics, maintenance and repair of agricultural machinery in small farms																		
OC	IMEA 4221	Innovative models of economic analysis	5	150	15	35			25	75							5		2	Exam
	DAE 4221	Digitalization of the agribusiness economy																		

Module 6 Innovative agricultural machinery and software modeling tools			**23**	**690**	**48**	**48**	**64**	**70**	**80**	**380**					**11**	**7**	**5**			Exam
UC	IAM 3213	Innovative agricultural machinery	5	150	15	15	20		25	75					5				5	Exam
UC	AMAH 3214	Agrotechnological machines in animal husbandry	6	180	18	18	24		30	90					6				8	Exam
OC	STSM 4220	Software tools for system modeling	5	150	15	15	20		25	75							5		9	Exam
	DIP 4220	Digital information processing																		
UC	PP 3219	Production practice	7	210				70		140						7			8	Differential test
ПД	**Cycle of core disciplines**		**62**	**1860**	**153**	**169**	**248**	**50**	**255**	**985**					**10**	**14**	**20**	**18**		
Module 7 tors, machine use and digitalization in agriculture			**20**	**600**	**60**	**60**	**80**		**100**	**300**					**10**	**10**				
UC	MTC 3301	Modern tractors and cars	5	150	15	15	20		25	75					5				5	Exam
UC	MU 3302	Machine usage	5	150	15	15	20		25	75					5				5	Exam
UC	DTTMCP 3303	Digitalization of technologies and technical means in crop production	5	150	15	15	20		25	75						5			8	Exam
UC	DTTMAH 3304	Digitalization of technologies and technical means in animal husbandry	5	150	15	15	20		25	75						5			8	Exam

Module 8 Robotics and design automation			**19**	**570**	**42**	**58**	**40**	**50**	**70**	**310**						**4**	**15**			
OC	IS 3305	Information security	4	120	12	28			20	60						4			9	Exam
	CNC 3305	Computer network and communications																		
OC	RRD 4306	Robotics and robotic devices	5	150	15	15	20		25	75							5		9	Exam
	IRM 4306	Industrial robots and manipulators																		
OC	ADAE 4307	Automation of design of agricultural enterprises	5	150	15	15	20		25	75							5		9	Exam
	STAIC 4307	Smart technologies in the agro-industrial complex																		
UC	PP 4311	Production practice	5	150				50		100							5		8	8
Module 9 otechnical service and system modeling			**23**	**690**	**51**	**51**	**128**		**85**	**375**							**5**	**18**		
OC	MSPAIC 4308	Modeling of systems and processes in the agro industrial complex	5	150	15	15	20		25	75							5		9	9
	MTPPAIC 4308	Modeling of technological processes and production of agroindustrial complex																		
OC	ASAIC 4309	Agrotechnical service in the agro-industrial complex	6	180	18	18	24		30	90								6	5	5
	TSM 4309	Technical service of machines																		

OC	DIS 4310	Designing intelligent systems	6	180	18	18	24		30	90								6	9	9
	ABP 4310	Automation of business processes																		
UC	PDP 4312	Pregraduate practice	6	180			60	60		120								6	8	Differential test
Final module			**12**	**360**				**120**		**240**								**12**		
		Final certification	12	360				120		240								12		
Total credits			**242**	**7260**	**528**	**1212**	**460**	**380**	**980**	**3700**	**31**	**29**	**30**	**30**	**31**	**31**	**30**	**30**		

[1]**Notes:**

Department number	Abbreviated name	The name of the department
1	IAAR	Accounting
2	MOA	Management and organization of agribusiness
3	TL	The legal
4	WRR	Water resources and reclamation
5	MU	«Machinery using» named after I.V. Sakharov
6	IAAR	Vocation training
7	MDAM	Mechanics and designing agricultural machinery
8	AET	Agrarian equipment and technology
9	ITMP	Information technology, mathematics and physics
10	ESA	Energy saving and automation
11	LRaC	Land resources and cadastre
12	WRHM	Wood resources and hunting maintaining
13	PPaQ	Plant Protection and Quarantine
14	FT	Professional training
15	KaRL	Kazakh and Russian languages
16	SSAC	Soil Science and Agricultural Chemistry
17	EC	Ecology
18	FVNG	Fruit, vegetable and nuts growing
19	AG	Agronomy
20	BS	Biological safety
21	CVM	Clinical veterinary medicine
22	OSaBR	Obstetrics, surgery and biotechnology of reproduction of animals
23	MV	Microbiology and virology
24	VsEaH	Veterinary sanitary examination and hygiene
25	TSFP	Technology and safety of food products
26	APFF	Apiculture, poultry farming and fisheries
27	PTLP	Production technology of livestock products
28	PMB	Physiology, morphology and biochemistry of a name of academician N.U.Bazanova
29	HKaCNK	The history of Kazakhstan and the culture of the peoples of Kazakhstan
30	Phys	Physical education and sport
31	MD	Military Department

4. Modules Competency Map

Codes	Module	Educational competence	Learning outcomes
MC1	**Module. Humanities and language**	aimed at the formation of fundamental source and historiographic materials, as well as for the achievement of modern historical science of Kazakhstan; to determine the role of the history of Kazakhstan in the system of humanitarian knowledge; on revealing the specifics of the object and subject of history of Kazakhstan for the analysis of topical problems of the modern stage of development; on creation of scientifically grounded concept of history of Kazakhstan based on integral and objective coverage of the main stages of ethnogenesis of the Kazakh people, evolution of forms of statehood and civilization in the Great Steppe; on systematization of knowledge of the main events of the modern history of Kazakhstan.	- demonstrate knowledge and understanding of the main stages of development of the history of Kazakhstan - correlate the phenomena and events of the historical past with the general paradigm of world-historical development of human society through critical analysis; - possess the skills of analytical and axiological analysis in the study of historical processes and phenomena of modern Kazakhstan - be able to comprehend objectively and comprehensively the immanent features of the modern Kazakhstan model of development - to systematize and give a critical assessment of historical phenomena and processes in the history of Kazakhstan.
MC2		form a system of general competencies that ensure the socio-cultural development of the personality of the future specialist based on the formation of his ideological, civic and moral positions;	- to evaluate the surrounding reality on the basis of ideological positions, formed by the knowledge of the fundamentals of philosophy, which provide scientific understanding and study of the natural and social world by methods of scientific and philosophical knowledge; - to interpret the content and specific features of the mythological, religious and scientific worldview; - to give assessment to everything happening in the social and industrial spheres;
MC3		develop the ability to interpersonal social and professional communication in the state, Russian and foreign languages;	- implement the use of language and speech tools based on a system of grammatical knowledge; analyze information in accordance with the situation of communication; - to carry out the use of linguistic and speech means based on the system of grammatical knowledge; analyze information in accordance with the communication situation;
MC4	**Module. Professional and communicati**	The development of information literacy through the mastery and the use of modern information and communication technologies in	- evaluate the actvities and actions of communication participants. - to use in personal activities various types of information and

			resources, cloud and mobile services for searching, storing, processing, protecting and distributing information;
MC5		Have an intolerant attitude toward corrupt behavior, respectful of legislation and law.	- analyze events and actions from the point of view of the area of legal regulation and be able to refer to the necessary regulatory acts; - to be guided in the current legislation; using the law, to protect their rights and interests, - to carry out professional activities on the basis of a developed legal awareness, legal thinking and legal culture; - to acquire a sufficient level of legal awareness; - be able to assess the facts and phenomena of professional activity from an ethical point of view; - apply moral rules and norms of behavior in specific life situations
MC6		Be competent to analyze and obtain information in accordance with the basic knowledge of the economy; use the basics of economic knowledge in various fields;able to apply this knowledge in solving situational and practical problems.	- to know the fundamental problems of the functioning of the economy, the mechanism of action and manifestation of economic laws, as well as the main features of the leading schools and areas of economic science; - to be aware of economic terms and categories, use them in their educational activities; - to understand and know the main events of the world and domestic economic history, the course of ongoing reforms in the light of the strategy "Kazakhstan - 2050", development trends in the field of modern business; - to distinguish and compare the behavior of market agents in different types of market structures; - to explain the interaction of economic agents in macroeconomic markets; - to compare the impact of macroeconomic policies in different countries; - to argue their own views on modern macroeconomic phenomena; - to use the knowledge gained in practice to assess the results of economic reforms in Kazakhstan

MC7		To be competent in the application of methods for the implementation of low-waste production and the assessment of the environmental efficiency of economic activity.	- know the contents of the basic terms in the field of ecology, environmental management; modern global and regional environmental problems and their solutions; - be able to apply environmental knowledge to solve and predict possible environmental problems; - apply methods for the implementation of low-waste production and assess the environmental performance of economic activity. - establish causal relationships between phenomena occurring in nature and society, - apply environmental knowledge to solve and predict possible environmental problems.
MC8		Contribute to the ability to apply this knowledge to address the issues of safety and reliability of operation of machinery and equipment and knowledge of the issues of social protection of workers.	- to know the main legislative acts on industrial safety, labor protection, environmental protection and civil protection; - apply the knowledge gained to address the safety and reliability of the operation of machinery and equipment; - ability to evaluate machinery and process equipment in terms of exposure to abnormal situations.
MC9	**Module. Socio-political knowledge and a healthy lifestyle**	form the skills of self-development and education throughout life;	-to assess situations in various spheres of interpersonal, social and professional communication, taking into account the basic knowledge of sociology, political science, cultural studies and psychology; - to synthesize knowledge of these sciences as a modern product of integrative processes; - to use scientific methods and approaches of research of a specific science, as well as the entire socio-political cluster; - develop their own moral and civic position; - operate with the social, business, cultural, legal and ethical norms of Kazakhstan society; - demonstrate personal and professional competitiveness; - to put into practice knowledge in the field of social sciences and humanities, having international

			and analysis; - summarize the results of the study; - to synthesize new knowledge and present it in the form of humanitarian socially significant products;
MC10		form a personality capable of mobility in the modern world, critical thinking and physical self-improvement.	- to build a personal educational trajectory throughout life for self-development and career growth, focus on a healthy lifestyle to ensure full social and professional activities through methods and means of physical culture.
		Basic competencies	**Learning outcomes**
MC11	**Module 1 Natural science training and business ethics**	Understanding in the construction, schematization of mechanical phenomena, by presenting specific mechanical problems in an abstract form; in the use of mathematical methods and the laws of physics in solving engineering problems.	Know the basics of vector and linear algebra, analytical geometry, differential equations, mathematical applications of operational calculus, properties of forces applied to a solid and their equilibrium conditions, kinematic parameters of a moving point and a solid and methods for determining them, mechanical movements of material bodies depending on the forces. Be able to use the basic laws of physics, theoretical mechanics, apply methods of mathematical analysis and mathematical physics in engineering problems; methods of mathematical modeling of engineering problems, knowledge of a material point, an absolutely solid body, a mechanical system, types of motion and equilibrium conditions; general theorems of dynamics, have skills in working with software products.
MC12	**Module 2 General engineering training**	Understanding in the construction of images, the display of various spatial models and shapes on the apparatus of two, three-sided complex drawing; graphical solutions to technical problems using automated digital systems.	Know the laws of formation of flat and spatial forms, the ways of constructing their images, the general rules of the unified system of design documentation. Be able to build images and spatial models on a drawing and using computer programs. Have the skills to solve metric and positional problems of descriptive geometry on modern automated computer graphics programs.
MC13	**Module 3. Electrical engineering and Automation.**	Understanding in the construction and design of automatic control systems of technological processes of agricultural production, the construction and design of electronic devices built on the basis of	Know the basic laws of electrical circuits, methods for calculating electrical circuits of direct and sinusoidal current, concepts, definitions and terminology of automation; basic principles of

		semiconductor devices and integrated circuits, microprocessors.	construction of automatic control systems of technological processes of agricultural production, analytical methods for describing the properties of elements and automatic control systems, basic technical characteristics of automation tools, methods of designing automatic control systems of technological equipment of agricultural production, device, principle of operation, parameters and characteristics of semiconductor units and integrated circuits, the principle of construction, operation and design of electronic devices, built on the basis of semiconductor devices and integrated circuits, microprocessors, parameters and characteristics of electronic devices, the principle of calculation of the main electronic circuits and devices, professionally solve engineering problems for the maintenance of electronic equipment. Be able to calculate the simplest circuits of direct and sinusoidal current, to make functional and structural schemes of automation of agricultural control objects, to select and calculate the technical means of automation used in control systems, to determine their main characteristics taking into account the specifics of agricultural production, to make a mathematical description of elements and systems in static and dynamic modes of operation, to understand electronic circuits, to determine the parameters of electronic elements by symbols and reference books, build and calculate devices made on these elements.
MC14	**Module 4. Geoinformation systems.**	Understanding in the use of mathematical models for the implementation of geoanalysis; in the programming of microcontrollers of unmanned aerial vehicles.	Know the principles of creating electronic maps and databases using GIS; basic models of data structures; principles of organizing intelligent and expert systems. use of methods of thematic mapping and geocoding, development of intelligent tools for solving problems of information processing and management of expert systems. Be able to solve practical problems in programming services, background services; search databases and create spatial queries; organize data

			structures, design databases and expert systems.
MC15	**Module 5 Information technologies in automation systems and technical operation of machines**	Understanding of modern information technologies in the agro-industrial complex, the theoretical foundations of the use of information technologies, the main trends and directions of development of the information support system of the agro-industrial complex.	Know the place and role of information technologies in automation systems; typical mathematical schemes of system modeling. Be able to use computer technology, information technology to solve the problems of professional activity; use technologies for collecting, placing, storing, accumulating, converting, and transmitting data in professionally oriented information systems.
MC16	**Module 6 Innovative agricultural machinery and software modeling tools**	Understanding in the implementation of preparation for work, the use of machines and equipment in the process of monitoring, navigation and regulation of technological parameters of processes in crop production, animal husbandry and the organization of agrotechnical services using digital technology; in solving professional problems through modern information and communication technologies	Know the device, the principle of operation and the rules of preparation for the operation of control systems and automation of process control in professional activities. Know the instruction and technological map for the use of devices and systems for monitoring and automating the control of the technological process. Know the general patterns of development of digitalization in the agricultural sectors. Be able to use control systems and automation of process control in professional activities. Be able to develop a strategic plan for the development of digital technologies in enterprises.
		Professional competencies	**Learning outcomes**
MC17	**Module 7 Tractors, machine use and digitalizatio n in agriculture**	Understanding the production and technical operation, repair of machines and aggregates, conducting economic analysis and statistics in the operation of the machine fleet and technical service using digital technology.	Know the basics of operating technology and rules for the production of mechanized work; the basics of calculating the tractor's traction force, drawing up the unit's stroke equation, determining the unit's resistance force; basic concepts and definitions for the technical operation of machinery and equipment; technologies and technical means of diagnostics and maintenance; types of commodity flow in agriculture and their movement. Know the features of the correct use of agricultural machinery, the basics of designing intensive technology of mechanized production and the formation of a machine and tractor fleet; agrotechnical and technical and operational requirements for machine and tractor units; rules and methods

			digital technology. Be able to make an agricultural unit, its preparation and adjustment, develop agrotechnological and technical and operational requirements for the machine unit; organize work on the diagnosis, maintenance and repair of agricultural machinery; recognize the types of agricultural goods. Be able to set the rate of production, the rate of fuel consumption and the rate of time for servicing the unit; assess the technical condition of machines and equipment; regulate the flow of agricultural goods using digital technology.
MC18	**Module 8 Robotics and design automation**	Understanding in the application of the legislative and regulatory framework, organization and conduct of control, development and preparation of technical and project documentation; assessment of the level of security of information systems and the organization of information protection. Understanding in the use of application programs for the calculation of units, aggregates and systems of transport and technological means and their technological equipment, the use of application programs for design calculations of units, aggregates and systems of technical means of the agro-industrial complex.	Know the main provisions of the regulatory acts of the Republic of Kazakhstan in the field of labor protection, the system of labor protection management at work; about production processes; methods and means of information protection in the implementation of information processes of input, output, transmission, processing and storage of information. Be able to solve specific engineering tasks for the prevention of industrial injuries, master the use of methods and means of protection against dangerous and harmful factors; anticipate and timely prevent possible hazards and hazards in the workplace; apply protection systems against viruses and unauthorized access to the PC. Be able to use knowledge and skills in the field of occupational safety, culture of thinking and presentation of the results of their professional activities; on the use of information security technologies to optimize the functioning of information systems. Know the basics of computer-aided design of agricultural production; the principles and structure of the construction of the main production processes; design of production automation systems; the procedure for computer-aided design of agricultural production; principles and rules for the implementation of layouts and layouts of workshops; the basic principles of building computer-aided design

			methods for developing models of design objects; methods for presenting graphic information, methodology for solving optimization problems; fundamentals of technical, linguistic, mathematical, software and information support of computer-aided design systems. Be able to calculate the composition and quantity of the main equipment in the shop; calculate the total area of the shop and its size; select equipment and automation tools from catalogs; use automated calculation systems for parameters and design of transport and technological means on a computer; use modern means of information technology and machine graphics.
MC19	**Module 9 Agrotechnical service and system modeling**	Understanding the assessment of the current state of development of robotics and programming; in the construction of formal languages and grammars, in the development of intelligent systems.	Know the principles of designing the mechanics of robots, as well as various ways of mathematical description of their actuators and mechanisms of motion transmission; technological aspects of the development of intelligent systems. Be able to design and configure the drives used in robots and robotic devices, use modern software tools for the design of intelligent systems

5. Summary table showing the amount of credits mastered by the modules of the educational program

Course of Study	Semester	The number of studied disciplines			Number of academic credits						Total in academic hours	Military training	Amount	
		MC	UC	CC	Theoretical training	Educational practice	Internship	Undergraduate practice	Final examination	Total			Examination	Differential Test
I	1	4	2	1	31	–	–	–	–	31	930	–	7	
	2	4	1	-	27	2	–	–	–	29	870	–	5	1
II	3	3	1	2	30	–	–	–	–	30	900	–	6	
	4	1	-	4	24	–	6	–	–	30	900	–	5	1
III	5	–	4	2	31	–	–	–	–	31	930	–	6	
	6	–	3	1	24	–	7	–	–	31	930	–	4	1
IV	7	–	-	5	25	–	5	–	–	30	900	–	5	1
	8	–	-	2	12	–	–	6	12	30	900	–	2	1
Total		**12**	**11**	**17**	**204**	**2**	**18**	**6**	**12**	**242**	**7260**	**588**	**40**	**5**

Appendix to the educational program

Application 1

Practice base

№	Name of companies, enterprises, organizations	Contacts, phone, e-mail
1	LLP SPC «Agricultural Engineering»	050005, Almaty, Raiymbek ave. 312, Number.:8(727)2479600; fax:8(727)2479607 e-mail: kazniimech@yandex.kz
2	LLP «Amiran-Agro»	Almaty region., Talgar district. number.:8(72774)42301,fax:8(727)3074822 e-mail: amiran_almaty@mail.ru
3	LLP «Baiserke-Agro»	Almaty region, Ili district, Baiserke Konayev st, 1. Number.:87019916120, 87018813379 e-mail: bajserke-agro.all.biz
4	CE «Mamed»	Almaty region., Karasai districe. Number.:8(727)3728617, 87016664751 e-mail: kalit50@mail.ru
5	TOO «Engineering innovation A-A»	0500000 Almaty, Dosmukhamedov st. 11/32 Number.:8(327)3174061; fax: 8(727)2380721 e-mail: isi-aa@mail.ru
6	TOO «Almaz-trans»	010000 Almaty, Radostovets st.120 Number.: 8(7272)961313

Application 2

Information about the disciplines

№	Name of the discipline	Brief course description	Number of credits	Formed competencies (codes)
The cycle of general education disciplines (University component / Optional component)				
1	History of Kazakhstan (SE)	The course is aimed at shaping the concept of modern history of the Fatherland among students, based on a holistic and objective coverage of the problems of the ethnogenesis of the Kazakh people, the evolution of forms of statehood and civilization on the territory of the Great Steppe and the totality of the most significant historical facts and events. Systematization of historical knowledge about the main events of modern history, forming a scientific worldview and citizenship. Creation of an ideological and spiritual basis for the consolidation of a multi-ethnic and multi-confessional Kazakhstan society	5	CC1-LO1
2	Philosophy	The course aims to form students` concepts of philosophy as a special form of knowledge of the world, its main sections, problems and methods, as well as skills of self-analysis and moral self-regulation, the development of research abilities and the formation of intellectual and creative potential. Special attention is paid to the problems of preserving national identity, the assimilation of such key ideological concepts as justice, dignity and freedom, and the role of philosophy in modernizing public consciousness and solving global problems of modernity.	5	CC2-, LO1
3	Foreign language	Learning a foreign language sets tasks for the development of foreign language communicative competence in the totality of its components: **Speech competence** - the development of communication skills in four main types of speech activity; **Language competence** - mastering new language means (phonetic, spelling, lexical, grammar); **Socio-cultural competence** - the formation of the ability to represent your country, its culture; **Educational and cognitive competence** - familiarity with the methods available to learners and methods of independent study of languages and cultures	10	CC3- LO1

4	Kazakh (Russian) language	Discipline is intended for the development of the linguistic identity of the student who is able to carry out cognitive and communicative activities in the Russian language in the areas of interpersonal, social, professional, intercultural communication in the context of the implementation of state programs of trilingualism and spiritual modernization of national consciousness. Discipline implies the successful mastery of the types of speech activity in accordance with the level training.	10	CC3- LO1
5	Information and communication technology (in English)	Formation of the ability to critically evaluate and analyze processes, methods of searching, storing and processing information, ways of collecting and transmitting information through digital technologies. Mastering the conceptual fundamentals of computer systems, operating systems and networks. Formation of knowledge about the concepts of development of network and web applications, information security tools.	5	CC1, CC2-LO2
	Social and political knowledge module (Social Studies, Political Studies, Cultural Studies, Psychology)			
6	Sociology	studies society, revealing the internal mechanisms of its structure and development of its structures(structural elements: social communities, institutions, organizations and groups); patterns of social actions and mass behavior of people, as well as the relationship between the individual and society sociology explains social phenomena, collects and summarizes information about them.	2	CC2- LO1, LO2
7	Political Science	the science of politics, the laws of the emergence of political phenomena (institutions, relations, processes), the ways and forms of their functioning and development, the methods of managing political processes, political consciousness, culture, etc.	2	CC2- LO1, LO2
8	Cultural studies	the teachings about culture, its history, essence, laws of functioning and development, which can be found in the works of scientists who present various ways of understanding the phenomenon of culture. In addition, the cultural sciences study the system of cultural institutions through which the upbringing and education of a person is carried out and which produce, store and transmit cultural	2	CC2- LO1, LO2

9	Psychology	Psychology is a science that aims to study the mechanisms of the functioning of the human psyche. It examines the patterns of people's behavior in various situations, and the thoughts, feelings, and experiences that arise. Psychology is something that helps us to know ourselves more deeply, to understand our problems and their causes, to realize our shortcomings and strengths. Its study contributes to the development of moral qualities and morals in a person.	2	CC2- LO1, LO2
10	Physical Training	The discipline covers a range of issues related to physical culture as a part of universal culture, a healthy lifestyle, its main components, the socio-biological basis of adaptation of the human body to physical and mental activity, preparation for independent physical culture and sports, age-related physiology, self-control of the physical condition, the psychophysical basis of physical culture and sports, hygiene.	8	CC6- LO1, LO2
	Cycle of general education disciplines Elective component			
11	Law and anti-corruption culture	The purpose of studying the discipline "Law and anti-corruption culture" is to increase public and individual legal awareness and legal culture of students, as well as the formation of a system of knowledge and citizenship on combating corruption as an antisocial phenomenon, comprehensive knowledge about the essence and factors of corruption, its various manifestations; to develop a legal culture of the individual, contributing to combating corruption; skills and skills of critical analysis of corruption phenomena.	5	CC7- LO1
	Economy	Formation of a complex of knowledge in the field of economy and foreign economic policy; on the basic laws governing economic processes; on the problems of inflation, unemployment.	5	CC7- LO1
	Ecology	Formation of knowledge about the negative factors of the human environment, the consequences of the impact, the principles of their identification and protection of people, methods of research to improve the stability of the objects, emergency forecasting and the development of models determining the readiness to eliminate the consequences of accidents, disasters and	5	CC8- LO1
	Life safety	Forms a professional culture of safety, which is understood as the willingness and ability of an individual to use in professional	5	CC9- LO1, LO2

		skills and abilities to ensure safety in the field of professional activity.		
Cycle of basic disciplines (University component / Component of choice)				
9	Mathematics	The mathematics course is the main foundation of a specialists mathematical education. The sections linear algebra, vector algebra, analytical geometry and elements of mathematical analysis contain modern methods of analysis and are focused on the application of mathematical methods in applied problems.	5	CC10, LO2
10	Physics	Formation of an in-depth understanding of the structure of matter, the nature of the phenomena occurring in it, which determines the development of natural science and scientific and technological progress. The relationship of physics with other natural sciences and related disciplines. The role of physics in the creation and development of new branches of technology and new technologies. The influence of technology on the development of physics. Methods of physical research: experience, hypothesis, experiment, theory.	7	CC10, LO2. LO4
11	Theoretical and applied mechanics	Basic concepts and axioms of mechanics; methods for transforming systems of forces; conditions for the equilibrium of solids under the action of forces; methods for setting the motion of a point, determining its speed and acceleration; translational, rotational and plane motion of a body, complex motion of a point; basic problems of point dynamics; geometry of the masses of a mechanical system; general theorems of dynamics.	6	CC10, LO4
	Engineering mechanics	Engineering mechanics is a branch of mechanics, that is, the science of mechanical motion and mechanical interactions of material bodies. Engineering mechanics outlines the basic laws and principles of mechanics and studies the general properties of motion of mechanical systems	6	CC10, LO4
12	Business ethics	The study of the discipline will allow the student to: - master the basic knowledge of ethical standards in the field of business relations; - to form the students' concepts of the ethics of the service behavior and actions of the manager; - to implement in specific practical activities knowledge about the values and norms of business ethics; - to solve ethical problems of business life and bear moral responsibility for them.	4	CC10, LO1
	Business correspondence	General requirements and features of business correspondence. Business letter in	4	CC10,

		methodological bases of correspondence in Kazakhstan. Rules for the design of a business letter. Business letter forms. Letters on general issues. The structure of a business letter. Informative and convincing business letter. Types of writing. The specifics of written genres. The system of organizational and distribution documentation. Types and features of foreign trade partners. Business etiquette and protocols.		
13	Engineering graphics	«Engineering graphics» is the formation of students' competencies that ensure the development of spatial imagination and constructive-geometric thinking, the ability to analyze and synthesize spatial forms and relationships based on graphical models of space, practically realized in the form of drawings of specific spatial objects and dependencies.	5	CC11, LO3
14	Computer graphics and 3D modeling	Forms students worldviews in computer graphics and systematic mastery of students knowledge in the field of automating the execution of design graphic and text documentation, creating, processing and displaying digital graphic images, as well as instilling in students the skills of using computer-aided design systems for solving design problems.	6	CC11, LO3
	3D graphics	A set of methods and means of practical solution of engineering problems using computer equipment and applied information technologies, to create models of varying degrees of complexity, among which a special place is occupied by computer-aided design systems.	6	CC11, LO3
15	Graphical system design tools	Conduction. Creating an image: Lines. Create, format, and edit text. Objects. Fills. Outline of polygons. Effects. Clones, step-by-step transitions, and halos. Transparency and curly cropping. The Photoshop window. Working with selected areas. Working with the layer. Filters. Fonts. Contours. Masks. Loading the color and line types.	5	CC11, LO3
	Automatic design systems	The purpose of the study is to form students' knowledge, skills and skills in database design, as well as methodologies and methods of structural analysis and design used to describe and analyze a wide range of complex systems. The course will outline the main stages of the development of control systems, consider the composition, structure, principles of the implementation of information support for control	5	CC11, LO9, LO10

		tools for the implementation of information support for control systems.		
16	Educational practice	In the course of practical training, students solve problems related to the study of the basics of production and technological processes; get acquainted with machine-building equipment, tools, tools and equipment, organize work at the enterprise, and also acquire practical skills in mechanical, welding, and metalwork-Assembly areas.	2	CC11, LO2, LO3
17	Electrical engineering	The course is aimed at forming students knowledge of the laws and methods of calculating electrical circuits of electrical devices and power systems, the ability to calculate and analyze the parameters of currents and voltages in the established modes of linear circuits of electrical circuits	6	CC12, LO4
18	Electronics and microprocessor technology	Elements of electronic circuits, semiconductor diodes, bipolar and field-effect transistors, their characteristics and parameters, operational amplifiers, optoelectronic devices, analog electronic circuits, electronic amplifiers, architecture of microprocessor systems, microprocessors, analog-to-digital and digital-to-analog signal converters, programmable microcontrollers.	6	CC12, LO4
	Microprocessor systems in the power industry	The main electric power objects for which the use of microprocessor control systems (MSS) is relevant; functional and structural schemes of objects and systems; principles of digital information processing; principles of construction of microprocessor information processing devices and programmable logic controllers; typical configurations of microprocessor control systems and data processing systems used in electric power facilities; structure and principles of organization software for microprocessor-based information processing devices and programmable logic controllers	6	CC12, LO4
19	Fundamentals of automation and automation in the agro industrial complex	The main sources and indicators of technical and economic efficiency of automation. Characteristics of objects of automation of agricultural production. Characteristics of technological processes. Structure and principles of technological process management. Features of automation of agricultural production. Typical technical solutions for automation and technological processes in the agro-industrial complex	6	CC12, LO4, LO6
	Automation of typical technological	The discipline studies the methods of analysis and synthesis of automatic systems;	6	CC12, LO4, LO6

	industrial complex	systems, their role and functions in various technological systems; the types of automatic devices used, their design and principle of operation.		
20	Geographic information systems	General concepts of GIS. Classification of GIS. Software and information support. GIS data structure and models. Conversion of the source data. Surface and digital model. Visualization methods and tools. Electronic maps and atlases. Three-dimensional visualization. Working with attribute data.	5	CC13, LO5
	Electronic cartographic systems	The course covers the main types and features of electronic maps, electronic map display systems, international and national requirements for electronic cartography, the principles of the system, the global positioning system GPS, automatic identification of objects.	5	CC13, LO5
21	Unmanned aerial vehicles	Unmanned aerial vehicles: unguided, automatic, remotely piloted, tiltrotor aircraft with rotary screws. Classification of UAVs by parameters: mass, time, range and altitude. Classes of devices: "micro", "mini", medium ("midi"), heavy. Satellite navigation receivers (GPS or GLONASS). Orientation and overload angles: gyroscopes and accelerometers. Digital signal processors. Tactical and technical. Characteristics of the UAV. The use of UAVs in various fields.	5	CC13, LO5
	Microcomputer programming of unmanned aerial vehicles	Programming of microcomputers of unmanned aerial vehicles The device and organization of the microprocessor. Memory organization. The structure of the program in C++. Management commands. Working with Glass. Interrupts. Shift commands, string forwarding, and flag register control. Macros. Programming of single-board microcomputers. programming principles in the integrated Arduino IDE environment.	5	CC13, LO5
22	Production practice	Teach practical skills in the organization and technology of mechanized work in crop and animal husbandry, study the technology of production of the main crops for the region, identification and Troubleshooting of machines.	6	CC13, LO4, LO5
23	Information technologies in automation systems	Teaching students the basics of information technologies, as well as methods and means of automation of technological processes, the principles of building modern systems for collecting, analyzing and processing information, the principles of building industrial networks, the device of controllers and interaction interfaces, devices and sensors for measuring technological	5	CC14, LO2, LO6, LO8

		systems.		
24	Technical operation of machinery and equipment in farms	General concepts and definitions. Basic principles that affect the technical condition of machines during operation Basic organizational principles of maintenance of machines and equipment. Features of maintenance of machinery and equipment in the conditions of peasant (farm) farms. Elimination of technical malfunctions of machines and equipment that occur during operation Technical diagnostics of machines Organization and technology of maintenance and diagnostics of the machine fleet. Organization and technology of machine storage Provision of the machine fleet with fuel, lubricants and other operational materials	5	CC14, LO6
	Diagnostics, maintenance and repair of agricultural machinery in small farms	General patterns of changes in the technical condition of machines. Determination of wear limits. the planned preventive principle of the maintenance system of machines. Fixed assets used in the maintenance of machinery and equipment. Fixed assets used in the elimination of technical malfunctions of machinery and equipment. Technology for diagnosing the main types of machines and equipment. the main tools used in the diagnosis of machines. Features of storage of agricultural machinery. Types and methods of storage of machinery and equipment.	5	CC14, LO6
25	Innovative models of economic analysis	The subject and objectives of financial analysis. Methods and techniques of economic analysis. Types of economic analysis. Management and financial analysis. Economic and mathematical models of financial analysis of an enterprise's innovation strategy. The model of strategic cost analysis of enterprises. Comprehensive assessment of the innovative activity of agricultural enterprises. Innovative approaches to the study of the problem of financial stability of the enterprise.	5	CC14, LO9
	Digitalization of the agribusiness economy	The role and necessity of digitization of the agricultural economy. Distinguishing features of numbers from the traditional economy. Economic efficiency of the impact of digitalization on labor productivity in agriculture. E-commerce and competition. Use of innovation clusters. Strategies for the development of digitalization in the economy of the agro-industrial complex.	5	CC14, LO6

		Organization of economic analysis of agricultural enterprises. Organization of the use of resources in agricultural enterprises. Organization of agricultural production. Organization of financial resources. Creating business plans and investment projects using digitalization.		
26	Innovative agricultural machinery	Discipline envisages the studies of devices, principle of work of machines and instruments for treatment of soil; for sowing and landing; for top-dressing; for defence of plants; for the care of sowing; for cleaning up of herbares and silo cultures; for cleaning up of ear, leguminous and other cultures; machines, aggregates, complexes послеуборочный treatments and storages of harvest.	5	CC15, LO5, LO7
27	Agrotechnological machines in animal husbandry	Agrotechnological machines of animal husbandry studies the purpose, device, working processes and regulation of basic models of technological machines of animal husbandry, possible malfunctions of these machines, methods of their detection and elimination, methods of justification and calculation of the main parameters and modes of operation of working bodies and mechanisms of machines, units (complex), the basis of their safe operation.	6	CC15, LO6, LO7
28	Software tools for system modeling	Introduction to MATLAB. Working with arrays. Creating and using m-files. Plotting graphs. Loop, branch, and switch operators. Solving differential equations and their systems in MATLAB. General characteristics of Simulink. Creating a model. Components of the main Simulink library. Signals in Simulink and their attributes. White noise generator. The source of the time signal. A block for reading data from a file and workspace. Recording devices. The block for stopping the simulation. Oscilloscopes. Digital display.	5	CC15, LO5, LO10
	Digital information processing	The objectives of the discipline are the development of modern technologies for information processing and analysis by students; the development of effective methods of information processing using modern computers; the formation of an integral system of knowledge in the field of creation, accumulation, processing and use of information resources; the acquisition of methodological foundations and practical skills of information processing.	5	CC15, LO8

		organization of mechanized works in crop and livestock, operation and maintenance of tractors, combines and machines for mechanization of livestock, learn how to make machine-tractor units, prepare units for mechanized works, identify and eliminate faults in machines.		LO7, LO8
Cycle profiling discipline (University component/ Component of choice)				
30	Modern tractors and cars	The design of modern tractors and cars, engines, electrical equipment, chassis, hydraulic, working and auxiliary equipment. Fundamentals of the theory and calculation of the tractor and the car - traction balance of the tractor and the car, the energy balance of the tractor, traction dynamics of the tractor and the car, the handling and stability of the tractor and the car.	5	CC16, LO6
31	Machine usage	The discipline considers the use of modern and advanced agricultural machinery, advanced forms of organization of the use of machinery, the use of agricultural machinery as a system of organizational, technical, technological and other activities carried out in the operation of the fleet of machines, the value of the effective use of tractors, agricultural machinery and equipment in market conditions in agriculture.	5	CC16, LO6
32	Digitalization of technologies and technical means in crop production	General principles of the use of digitalization of technologies and technical means in crop production. The use of digitalization of technologies and technical means in the cultivation and harvesting of grain crops. The use of digitalization of technology and technical means in the cultivation and harvesting of row crops. The use of digitalization of technology and technical means in the cultivation and harvesting of perennial grasses. Prospects for the development of the application of digitalization of technologies and technical means in crop production.	5	CC16, LO5, LO7
33	Digitalization of technologies and technical means in animal husbandry	The current state of application of digital technologies in the management of animal husbandry processes Management of processes and systems of digital technologies in dairy farming. Management of animal feeding processes and systems: automated pasture systems, feed dispensers, feed feeders, feed trimmers and integrated robotic feeding systems; Management of milking processes and systems: robot milkers, integrated robotic milking systems and herd management; Management of stall	5	CC16, LO7

		manure cleaners, autonomous manure cleaners. Smart Farm process and System management»		
34	Information security	Teaching students to systematically study the processes, methods and means of implementing data protection, acquiring practical skills in information protection for the design and operation of information systems. Know how to protect the PC, use the system to protect against viruses and unauthorized access to the PC. About features of objects of information protection, their classification, means and methods of information protection for implementation of information processes of input, output, transmission, processing and storage of information	4	CC17, LO9
	Computer network and communications	In the course of studying this discipline, it is planned to study the architecture and principles of operation of local and global computer networks; study the reference model of their interaction, trends in the development of network architecture, technical means of network software and information support of networks, classification of computer networks, technical, information and software of networks, organization of the device and functioning of networks; study of protocols of the upper levels of network exchange and types of communication.	4	CC17, LO2
35	Robotics and robotic devices	The discipline studies modern computer methods of automated calculation and design of robot parts and robotic systems, elements and structures and assemblies, methods of performing finite-element analysis in a computer-aided design environment.	5	CC17, LO9
	Industrial robots and manipulators	Methods and means of robotization of technological processes are studied; types of mechatronic and robotic systems, methods and algorithms for controlling them; mathematical description of manipulators; methods for solving problems of kinematics and dynamics of manipulators; development of finite automata for robot control problems	5	CC17, LO9
36	Automation of design of agricultural enterprises	Generalized technical structure of the automatic control system. Executive mechanisms, the main types, properties and features of control. Structures for implementing standard control algorithms. Features of the implementation of a relay-	5	CC17, LO4, LO6

		actuator. The relationship between the parameters of the relay-pulse controller and the PI algorithm. Analysis of operation when changing the input signal and feedback parameters. Select the pulse duration. Select the speed of the actuator. Implementation of the PID law based on a relay-pulse controller.		
	Smart technologies in the agro-industrial complex	The discipline considers geoinformation technologies, unmanned technologies, data mining technologies, crop yield forecasting and modeling based on intelligent decision support systems that integrate data from various sources.	5	CC17, LO7
37	Production practice	To teach practical skills in technology and organization of mechanized works in crop and livestock, operation and maintenance of tractors, combines and machines for mechanization of livestock, to study the production technology of the main crops for this zone, to learn how to make machine-tractor units, to prepare units for mechanized works, to identify and eliminate malfunctions in machines.	5	CC17, LO6, LO8
38	Modeling of systems and processes in the agro industrial complex	The theoretical foundations of the methods of mathematical modeling of systems and processes in the agro-industrial complex are considered, the substantiation of economically effective planned and forecast programs for the development of agro-industrial enterprises that meet the interests of resource conservation and increase the competitiveness of goods and services in the context of the transition to a market economic system is given. Mathematical modeling of technological processes based on system analysis.	5	CC18, LO6, LO10
	Modeling of technological processes and production of agroindustrial complex	General concepts of mathematical modeling of processes in the agro-industrial complex. Classification of mathematical models. Foundations of set theory and graph theory. General formulation and types of decision-making problems. Foundations of the theory of queuing. Foundations of the theory of queuing. Mathematical models of the simplest queuing systems. Probabilistic model of equipment operation. Operational scheduling of technological systems. Probabilistic model for optimizing the operation of technological systems.	5	CC18, LO6, LO10

	in the agro-industrial complex	Agricultural service organization systems. Formation of a network of enterprises that perform agricultural services. Machine partnerships, unions, machine-technology stations, mechanization cooperatives, specialized cooperatives for the mechanization of private entrepreneurs and private enterprises. The role and place of agricultural service in maintaining machines and tools in working condition. Creation of leasing companies, joint dealer offices, service for the restoration of used equipment, supply and sales and credit cooperatives.		LO7
	Technical service of machines	Services for production and technical and repair and maintenance of machines. Organization of repairs and maintenance in the conditions of technical service. Formation of a network of enterprises that perform technical services. Planning and organization of technical service of machines.	6	CC18, LO7
40	Designing intelligent systems	Knowledge engineering. Intelligent systems and technologies in knowledge engineering. Architecture of intelligent systems. Logic programming. Organization of a dialogue between a person and an intellectual system. Development of subject-oriented intellectual projects. Working with the main objects, processes and phenomena related to intelligent systems and using the methods of their scientific research. Modern intelligent systems and technologies.	6	CC18, LO5, LO10
	Automation of business processes	Automated systems. Structure and classification of the system. Types of information systems. Methodology of information systems design. Modern information technologies. Stages of business process automation. Management of information systems.	6	CC18, LO8, LO10 LO10
41	Pregraduate practice	During the entire period of practice, the student is engaged in the selection, study and synthesis of materials about the production activities of the enterprise, scientific,technical, patent and educational literature, the study of existing and development of new technological processes, research and design work.	6	CC18, LO1- LO10