Ministry of Agriculture of the Republic of Kazakhstan
S.Seifullin Kazakh Agrotechnical University

Considered at the meeting of
the Academic Council of
the university
Protocol №15 from 30.05.2019.

APPROVED
Chairman of the Board
JSC «S.Seifullin Kazakh agrotechnical University»
_____ A.K. Kurishbayev
«_____» _____ 2019

EDUCATIONAL PROGRAM

«Mechanical engineering»

Code and classification of the field of education:
8D07 - Engineering, Machining and Construction branches

Code and classification of training areas:
8D071 - Engineering and Engineering affair

Code in International Standard Classification of Education: 0710

Qualification: PhD / Educational Program Mechanical engineering

Duration of study: 3 years (scientific and pedagogical direction)

Nur-Sultan 2019

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The team of authors approved by the order of JSC " S.Seifullin KATU"
№ № 932-H from 12.12.2018

Educational program "Mechanical Engineering"
reviewed at the meeting of the department Technological machines and equipment
protocol №09/2 from «09» 04. 2019,
approved by the Faculty Council
protocol №09 from «13» 05. 2019.

Content

1 Passport of the educational program

1.1 Purpose of the educational program

The main objective of the educational program "Mechanical Engineering" (OP) is preparing competitive PhD doctors of scientific and pedagogical direction, possessing modern competencies and skills, techniques and technologies that contribute to the solution of issues arising in industrial enterprises, specialized in research and educational organizations by providing deep theoretical knowledge and practical experience in the field of technological machines and equipment.

To achieve the above objectives of the OP formulated the following tasks:

1. Fulfillment of the social order of a society for the development and formation of demanded personnel in the labor market, owning the theoretical and practical bases for improving the technological processes of manufacturing and assembling industrial products;

2. Combining the competent scientific and pedagogical staff of the KATU, the participants of the GSTR RK and the NSS RK for the joint training of PhD doctors taking into account the needs of the real labor market and increasing the research orientation, i.e. Doctors of PhD with a high level of professional culture (including professional communication culture), having a civil position, able to formulate and solve modern scientific and practical problems, teach in universities, successfully carry out scientific, research and management activities;

3. Focusing attention on various groups of PhD doctors and their professional needs on the basis of providing them with flexible individual educational trajectories and forming students' motivation for professional improvement and self-realization;

4. Formation of readiness of doctors PhD for the organization and implementation of practice-oriented innovation and research activities;

5. Formation of current professional skills and competencies at PhDs, which contribute to solving theoretical and practical aspects of promising trends in industry and related sectors: technology for manufacturing parts, mechanisms and machines; technology of machining parts using advanced processing methods; technology assembly components and machines; technologies for repair and restoration of parts, as well as technology for hardening parts, mechanisms and machines; automation and robotization of industrial production;

6. Formation of the image of KATU, as a key educational and expert organization in the field of production of parts, mechanisms, machines and industrial products among scientific and educational institutions of the republic and Central Asia.

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

One of the main objectives of the Strategy "Kazakhstan-2050": the new political course of the established state is to include Kazakhstan among the 50 most competitive countries in the world through the application of innovative

technologies to improve the performance and quality of manufacturing products of the industrial sector. This task is realizable if there are highly scientific and highly professional personnel potentials, in particular in the field of “Mechanical Engineering”.

The study program was developed jointly with professors of the University of California, Davis (USA) and taking into account the recommendations of leading experts of advanced industrial enterprises, in accordance with the NFC and professional standards, agreed with the Dublin descriptors and the European Qualifications Framework, on the basis of the State Compulsory Higher Education Standard, doctoral studies approved by order of the Minister of Education and Science of the Republic Kazakhstan dated October 31, 2018 (No. 604), the classifier of specialties of higher and postgraduate education the formation of the Republic Kazakhstan, educational, program and methodological documentation, individual work plans for doctoral students and other documents approved in the prescribed manner.

EP "Mechanical Engineering" is designed on the basis of a modular system for studying disciplines and consists of 5 modules that form general cultural and professional competencies, including the study of disciplines and modules of database and PD, having an interdisciplinary and multidisciplinary nature, providing training at the interface of a number of knowledge areas. The study of the cycle of basic disciplines (BD) is aimed at the formation of a set of fundamental knowledge in general professional and managerial disciplines, and the cycle of the profiling disciplines (PD) is aimed at the formation of professional skills in the field of "Mechanical Engineering"

The total number of credits is 180 credits (5400 ac.h), of which:

1) the total number of credits for theoretical studies - 53 credits (1590 ac.h), including practice (pedagogical and research - 24 credits (720 ac.h);

2) research work, including the implementation of a doctoral dissertation - 115 credits (3450 ac.h);

3) doctoral dissertation design and defense - 12 credits (360 academic hours).

A feature of the EP is to consolidate the theoretical knowledge of classrooms during the experimental research on the basis of its own workshops within the university. To implement the "Mechanical Engineering", the department "Technological Machines and Equipment" has a modern material and technical base and scientific and experimental platform in the field of mechanical processing of parts, automation and production robotization (further platform), created within the framework of the State program of industrial and innovative development Kazakhstan for 2015-2019, as well as a highly qualified faculty.

The competitive advantages of this OP are the following:

- highly qualified faculty;
- high material and technical equipment of the OP;
- training is conducted in three languages (state, Russian and English);
- a close relationship with employers and graduates of educational programs;

- 100% provision of a hostel for living during the course of study;
- availability of a medical center, social pharmacy and store for students.

The platform (according to the recommendations of the scientists of Davis) includes the following experimental production workshops (educational resources), the functioning of which is the guarantor of the training of highly qualified specialists of modern time:

- Production and experimental workshop of metalworking and welding;
- Kazakhstan-Belarus Training and Production Center;
- Kazakh-Chinese Center for Agricultural Mechanization Pavilion;
- Laboratory "Robotics, Mechatronics and 3D Printing";
- Laboratory of Materials Science and TCM;
- Laboratory "Installation and operation of technological machines";
- Training workshops.

All audiences are equipped with digitalization systems of the educational process.

The presence of a modern laboratory and technical base of training classes and constantly updated research laboratories, highly qualified faculty members is the basis for the development of strong advanced knowledge by undergraduates, the ability to conduct research in promising high-tech areas in accordance with Industry 4.0 and 5.0 programs. The result of these works is to obtain meaningful results and scientific achievements that have an applied character. Scientific cooperation with leading universities in the United States and European countries will allow for the **transfer of new "smart" technologies and their adaptation** to domestic conditions.

In order to exchange scientific and pedagogical experience in cooperation with foreign universities, EP provides scientific internships and research practice, within the framework of academic mobility, both in universities, research institutes and industrial enterprises of Kazakhstan, and the possibility of its passing through doctoral students at the University of California at Davis.

The uniqueness of the EP lies in combining all the theoretical and practical aspects of the manufacture of competitive products through the application in the manufacture of innovative and advanced technologies for processing and manufacturing parts, mechanisms, assemblies, components and machines for agricultural purposes, in order to implement the program of import substitution and national security of the country in the field of industrial independence i.e. the transition from the mining cluster to the processing and production, and increasing the share of the percentage of Kazakhstan goods, as well as increasing the export potential.

The educational program was developed based on the analysis of the current and expected key professional competencies of PhD doctors **taking into account the needs of the actual and potential EP stakeholders**, and the direct participation of the stakeholders themselves. When analyzing the expected key professional competencies of graduate students by the foresight method, short-term (up to 5 years depth) and medium-term (5-10 years depth) prospects for improving

the industry's legislative and regulatory base, the emergence of new technologies, process equipment and measuring instruments, high-tech products recognized international systems and best practices.

The main **stakeholders of the EP** are:

- PTC
- Leading experts of industrial enterprises and associations of the agroindustry complex;
- Department of Technical and Innovative Development of the Ministry of Industrial-Innovative Development of the Republic of Kazakhstan;
- Machine-building enterprises of any profile;
- Design organizations of machine building;
- Research institutes and research and production centers.

3 Competency model (portrait) of the graduate

3.1 Professional activities

The field of professional activity of the Doctor of Philosophy (Phd) of the educational program "Mechanical Engineering" includes:

- all types of organizations of education and science;
- research and design organizations;
- production and psychological-pedagogical activity in organizations of secondary, higher and additional professional education of technical and agricultural areas, research, design organizations and production;
- research activities in the field of education and workplace in the field of advanced training of workers in accordance with the specialization;
- educational, management and planning activities in accordance with the qualifications of the doctor PhD.
- The doctor of this profile is prepared for activities in the field of material production, which includes a set of tools, methods and methods of human activity aimed at solving complex problems associated with the design, operation and repair of process equipment.

3.2 Types of professional activity

The objects of professional activity are**:**

- secondary and higher vocational schools;
- enterprises and organizations that train and retrain specialists;
- research, design organizations of the educational sector and research institutes;
- engineering plants producing technological equipment; enterprises and organizations that operate technological equipment: design, design and technological organizations; machine repair enterprises of technological equipment; branded and dealer centers of machine-building and repair plants of

technological equipment; marketing services; logistics systems, technological equipment management services, various technological equipment testing centers.

Subjects of professional activity are:

- technological machines and equipment; power equipment; running equipment; work equipment; drive systems for technological machines and equipment; traffic control systems; life support systems;
- equipment for the manufacture, testing and disposal of technological equipment machines;
- equipment for maintenance and repair of technological machines and equipments;
- instrumentation for the manufacture and operation of technological machines and equipment;
- equipment for automating workflows of technological machines and equipments;
- robotics.

The content of professional activity includes:

- research work;
- management activities;
- production and technological activities;
- information and project activities.
- organization and management of services of industrial enterprises;
- development of production-technological structures, service-operational, installation and commissioning and design units;
- the creation and improvement of technological machines and equipment.

The main activity direction of the doctor PhD 8D071 - "Engineering and Engineering" specialization "Mechanical Engineering" is:

- research work in the field of development and improvement of designs of technological machines;
- complex mechanization, robotization and automation of technological machines and equipment and technological processes;
- establishment and provision of optimal operation modes of technological machines and equipment;
- pedagogical work.

3.3 General educational competencies

1) possess the methodology of a systematic approach to the organization, modern approaches to management and analytical management methods, methods of diagnostics, analysis and problem solving, as well as methods of decision making and their implementation in practice;

2) competently solve practical management problems and implement these solutions, be prepared to perform management functions and be able to solve professional problems in the interests of the organization as a whole;

3) possess the knowledge, skills and abilities necessary for taking up a relevant managerial position and based on a deep understanding of the characteristics of a market economy and its capabilities, functions and economic role of the state, understanding environmental problems, awareness of the social responsibility of business and adherence to civilized ethical norms of its conduct:

4) to be able assess modern problems and prospects for the socio-economic development of Kazakhstan, to understand modern trends in the development of the world economy and globalization, to navigate in matters of international competition.

3.4 Basic competencies

1) demonstrate a systematic understanding of the field of study, mastering the skills and research methods used in this field;

2) demonstrate the ability to think, design, implement and adapt the essential research process with a scientific approach;

3) to contribute by own original research to the expansion of the boundaries of the scientific field, which deserves publication at the national or international level;

4) critically analyze, evaluate and synthesize new and complex ideas;

5) communicate their knowledge and achievements to colleagues, the scientific community and the general public;

6) to promote the advancement of the technological, social or cultural development of a society based on knowledge in the academic and professional context.

3.5 Professional competencies

Organizational and technological activities:

- development of design, technological, design-estimate documentation for the creation and repair of technological machines and equipment;
- organization of the team work of performers, consideration of different opinions and management decisions;
- trade-off decisions taking into account various requirements (cost, quality, deadlines and safety) for different types of planning and determining the optimal solutions;
- accounting for various types of costs in order to ensure the production of quality products.

Production and management activities:

- optimization of manufacturing technology of technological machines and equipment;
- quality control of technological processes, materials and finished products;
- the choice and effective use of materials, equipment and other means for the implementation of production processes;
- Metrological verification of measuring the indicators of product quality;

- carrying out measures for the standardization and certification of technological machines and equipment, the technology of their manufacture and repair;

- organization and management of services, enterprises related to the operation and maintenance of technological machines and equipment.

Project activities:

- defining the goals and objectives of the project, taking into account various factors when building the structure of their interrelations and identifying priority areas for solving problems;

- development and analysis of solutions to the problems of forecasting the consequences, planning and implementation of projects;

- development of projects of technological machines and equipment taking into account technological, design, aesthetic, economic and other parameters;

- use of information technology in the selection of materials, technological machines and equipment.

Typical tasks of professional activity are aimed at solving:

- tasks related to the improvement and improvement of their qualification level;

- technical and detailed design of units and parts of technological machines and equipment;

- testing of technological machines and equipment and its elements for reliability according to standard procedures;

- development of standard technological processes for the manufacture of blanks, parts, assembly units of technological machines and equipment;

- production management at the level of production sites of enterprises of technological machines and equipment;

- technological support of existing production;

- technical design of automatic control means of technological machines and equipment based on standard solutions;

- tests of automation equipment according to standard procedures;

- development of vibration isolation systems for technological machines and equipment and noise protection;

- analysis of the reliability and durability of technological machines and equipment.

4 Base professional practice (all types of practices)

The practice is carried out in order to develop practical skills of scientific, scientific, pedagogical and professional activities.

The educational program of scientific and pedagogical doctoral studies includes: pedagogical and research practice.

In the period of teaching practice, doctoral students, if necessary, are invited to conduct classes in undergraduate and graduate programs.

The research practice of the doctoral candidate is carried out with the purpose of studying the latest theoretical, methodological and technological

achievements of domestic and foreign science, as well as consolidating practical skills, applying modern methods of scientific research, processing and interpreting experimental data in the dissertation research.

The content of research practice is determined by the theme of the doctoral dissertation.

Base practice doctoral student:

1. JSC S.Seifullin KATU
2. «KazSRIMEA» LLP, Akkol, Akmola region;
3. JSC «Kazakhstan Agro-Innovation Corporation » , Kokshetau;
4. LLP «Production Innovation Company», ASTANA
5. «Yutariya Ltd», Astana
6. LLP «Spetstekhnika», Aktobe;
7. LLP «KazTechInnovations», Almaty;
8. LLP «Semaz», Semey;
9. LLP «Kazmedpribor holding», Shymkent;
10. LLP «KazInTeh-IRC», Astana;
11. LLP «AktauOilMash», Aktau;
12. LLP «Altyn diirmen» , Almaty.
13. SRI of the Agro-Industrial Sector of the Republic of Kazakhstan
14. Public and private enterprises for the design, manufacture, assembly, repair and maintenance of technological machines and agro-industrial equipment, repair, engineering plants, etc.
15. Universities of the Republic of Kazakhstan
16. Abroad universities.

5 The structure of the educational program of doctoral studies in the scientific and pedagogical direction

№	The name of the cycles of disciplines and activities	Total complexity	
		in academic hours	in academic credits
1	2	3	4
1.	**Educational component**	**1590**	**53**
1.1	The cycle of basic disciplines (BD)		
	University component		
1)	Technical foreign language	150	5
2)	Pedagogic practice	90	3
	Optional Component		
3)	(Mechanical Performance of Materials)	150	5
4)	Engineering Experimentation & Uncertainty Analysis	150	5
5)	Theory and Design of Control Systems	120	4
1.2	The cycle of the main disciplines (PD)		
	University component		
1)	Mechatronics and Robotics	150	5
2)	Dynamics of processes in mechanical systems	150	5
3)	Research practice	630	21
2	**Scientific-research work**	**3450**	**115**
1)	Doctoral student scientific-research work, including internship and doctoral dissertation		
3	**Additional types of training**		
4	**Final examination**	**360**	**12**
1)	Writing and defending a doctoral dissertation	360	12
	Total	**5400**	**180**

Appendix 1. Academic calendar***

Академический календарь на 2019-2022 учебные года ПРОГРАММА по области образования 8D071 - ИНЖЕНЕРИЯ И ИНЖЕНЕРНОЕ ДЕЛО

Курс	Сентябрь				Октябрь					Ноябрь				Декабрь				Январь					Февраль				Март				Апрель					Май				Июнь				Июль				Август			
	1	*2*	*3*	*4*	*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*
	2	9	16	23	30	7	14	21	28	4	11	18	25	2	9	16	23	30	6	13	20	27	3	10	17	24	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24
	6	13	20	27	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28	6	13	20	27	3	10	17	24	1	8	15	22	30	5	12	19	26	3	10	17	24	31	7	14	21	28
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*								*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*				*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*											

направления подготовки "Механическая инженерия"

I	ПН	ПН	ПН	·/Н	·/Н	·/Н	·/Н	·/Н	·/Н	·/Н	·/Н	·/Н	·/Н	С	С	К	К	К	·/Н	·/Н	·/Н	·/Н	·/Н	·/Н	·/Н	·/Н	·/Н	·/Н	С	С	К	К	Пп/Н	Пп/Н	Пп/Н	Пп/Н	Пп/Н	Пп/Н	Пп/Н	Пп/Н	Пп/Н	Пп/Н	Пп/Н	К	К	К	К	К	К	К	К	К	К
II	К	К	К	К	К	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	К	К	К	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	К	К	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	ПИ/Н	К	К	К	К	К	К	К	К	К	К	К	К
III	К	К	К	К	К	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	К	К	К	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	К	К	Н/вдд	Н/вдд	Н/вдд	Н/вдд	Н/вдд	Н/вдд	Н/вдд	Н/вдд	Н/вдд	//	//	//										

ПН - презентационная неделя
ПИ - исследовательская практика
К - каникулы
● - теоретическое обучение
Пп - педагогическая практика
РК - рубежный контроль
Н - научно-исследовательская работа докторанта
С - сессия экзаменационная
ВДД - выполнение докторской диссертации
Л - летний семестр
// - защита докторской диссертации

Праздничные дни:

30 августа - День Конституции
8 марта - Международный женский день
21 августа - Курбан Айт
21, 22, 23 марта - Наурыз мейрамы
1 декабря - День Первого Президента
1 мая - Праздник единства народа Казахстана
16, 17 декабря - День независимости
7 мая - День защитника Отечества
1, 2 января - Новый год
9 мая - День Победы
7 января - Рождество Христово
6 июля - День столицы

Всего недель:

теоретическое обучение — 20 недель
экзаменационная сессия - 4 недель
каникулы зимние - 3-5 недель
каникулы летние — 5-11 недель
летний семестр - 6 недель

*** Considered and approved at the beginning of the school year

Appendix 2 Working curriculum

Appendix 3 Description of the disciplines of compulsory and university components
Basic information about the discipline:

1. Basic information about the discipline:	
Name of the discipline	Technical foreign language
2. Amount of credits	5
3. Prerequisites:	Foreign language (professional)
4. Post requisites:	Knowledge gained in the development of foreign language disciplines, and necessary when writing articles in foreign publications and doing a doctoral dissertation.
5. Competences:	As a result of studying the discipline "Technical Foreign Language" a doctoral candidate must acquire the knowledge, skills, and abilities: Know the functional and stylistic characteristics of the scientific presentation of the material in the studied foreign language; general scientific terminology and terminological sublanguage of the corresponding specialty in a foreign language; basics of the scientific style of oral and written speech by profile (thesis, monographs, presentation articles, discussions); basics of business communication in the framework of international cooperation (joint project, grand, conference, congress, symposium, seminar, meeting, etc.); To be able to read freely the authentic literature on the relevant field of knowledge in a foreign language and to process the information extracted from foreign sources in the form of translation, abstract, annotation; distinguish between types and genres of reference and scientific literature; use etiquette forms of scientific communication; Write in writing your thoughts on topics related to scientific work (scientific article, abstracts, report, translation, reviewing and annotation); Have skills: - oral communication in monologue, dialogic and polylogical form in the specialty and scientific and public issues (report, message, presentation, round table, discussion, summing up, etc.); - written speech in the creative expression of one's own thoughts in various compositional and speech types with a predominance of reasoning and types of written discuss for scientific purposes (review, review, article, etc.); - a detailed and critical understanding of audio material for the use of audible scientific information for professional communication purposes; -identifications and comparisons of the sociocultural characteristics of the training of scientists at home and abroad, the achievements and level of research of large scientific centers in their chosen specialty; Have professional competencies in the framework of intercultural communication: professional communicative, cultural linguistic, discursive, sociocultural and professional scientific competencies.
6. Course author	Zhumadillaeva O. A. - c.t.s., senior teacher of the Department of Foreign Languages
7. Main literature	1. Дорожная карта развития трехъязычного образования на 2015-2020 годы [совместный приказ и.о. министра образования и науки Республики Казахстан от 5 ноября 2015 года № 622, министра культуры и спорта Республики Казахстан от 9 ноября 2015 года № 344 и министра по инвестициям и развитию Республики Казахстан

	от 13 ноября 2015 года № 1066] 2. Cambridge First Certificate in English.-Cambridge: Cambridge University Press.-2000: Examination papers from the University of Cambridge Local Examinations Syndicate.- Cambridge, 2000.-111c. 3. Крупаткин Я.Б. Читайте английские научные тексты/Я.Б. Крупаткин.-М.:Высшая школа, 1991. – 158 с. 4. Рейман Е.А. Обороты речи английской обзорной научной статьи/ Е.А. Рейман, Н.А. Константинова.-Л.:Наука, 2011.-226с. 5. Учебное пособие по техническому переводу/С.М. Айзенкоп и др. – Ростов -на-Дону: Феникс, 2001.-352с. 6. Основы публичной речи. Learning to Speak in Public:учебное пособие для ВУЗов/И.С. Тихонова, Т.С.Самохина, Е.Л. Фрейдина .- М.: Владос, 2008.-136с. 7. 6. Миньяр-Белоручева А.Н. Англо-русские обороты речи/ Миньяр-Белоручева А.Н.- М.: Флинта –Наука ,2009.-141 с 8. Рябцева Н.К. \научная речь на английском языке. Новый словарь справочник активного типа / Н.К. Рябцева.- М.: Флинта, 1999-600с. 9. Зильбераман Л.И. Пособие по обучению чтению английской научной литературы (структурно-тематический анализ текста)/ Л.И.Зильберман.- М.: Наука, 1981,-208с. 10. Михельсон Т.Н. Пособие по составлению рефератов на английском языке / Т.Н. Михельсон, Н.В.Успенская.- Л.: Наука,1980. – 283 с. 11. Маркушевская Л.П. Аннотирование и реферирование. Методические рекомендации для самостоятельной работы студентов /Л.П.Макрушевская. Ю.А.Цапаева. – СПб.: ГУ ИТМО,2008.-51с. 12. Pamela J. Sharpe TOEFL PBT (Paper-Bazed Test). 12th Edition. Barron, s Educational Series . Inc,2006-812 с. 13. 12. Broukal. Milada. The Heinle & Heinle TOEFL Test Assistant: Vocabularu: пособие по английскому языку / M Broukal. – М.: Астрель АСТ,2004,- 182с.

8. Content of the discipline

In accordance with the objectives of the foreign language training of doctoral students, the course content is different types of speech activity in the intended areas of professional and scientific communication specialist.

Thematic content of the course is implemented in two directions: oral and written communication in a foreign language.

Thematic content of oral communication:

- The role of science in the development of society: the achievements of science in the field of scientific interests in the countries of the studied language
- The subject of scientific research doctoral student;
- international cooperation in the scientific field, international scientific seminar (conference, congress, symposium, discussion) international visits (participation in exhibitions, internship abroad); participation in a joint project, project presentation

Forms of written communication:

- scientific translation
- scientific summarization and annotation;
- summary, abstract, report, article; - business correspondence

1. Basic information about the discipline:	
Name of the discipline	Mechatronics and Robotics
2. Amount of credits	5
3. Prerequisites:	"Computer science"; "Information Technology"; "Linear algebra and analytic geometry"; "Mathematical analysis"; "Physics"; "Engineering and Computer Graphics"
4. Post requisites:	The knowledge gained in the development of discipline is necessary when doing a doctoral dissertation
5. Competences:	In studying the discipline doctoral students should: - Apply deep scientific and mathematical knowledge in the field of analysis, synthesis and design to solve scientific and engineering problems of production and operation of mechatronic and robotic devices and systems, including their control systems; - To perceive, process, analyze and summarize scientific and technical information, advanced domestic and foreign experience in the field of theory, design, production and operation of mechatronic and robotic devices and systems, to participate in teams to develop and operate such devices and systems; - Apply this knowledge to solve engineering problems in the development, production and operation of modern mechatronic and robotic devices and systems (including intellectual ones) using world-class technologies, modern tooling and software; - Plan and conduct analytical, simulation and experimental studies for the design, production and operation of mechatronic and robotic tools and systems using advanced domestic and foreign experience, be able to critically evaluate the obtained theoretical and experimental data and draw conclusions; - Integrate knowledge in the field of analysis, design, production and operation of mechatronic and robotic devices and systems with knowledge from related fields.
6. Автор курса	Zhumagaliev E. U.– c.t.s., senior teacher of the department "Technological machines and equipment"
7. Main literature	1. Подураев Ю.В. Мехатроника: основы, методы, применение: учеб. Пособие для студентов вузов. – 2-е изд., стер. – М.: Машиностроение, 2015. -256 с. 2. Рульнов А.А. Автоматическое регулирование: учебник. - М.: ИНФРА-М, 2013. - 218 с. 3. Подураев Ю.В. Основы мехатроники: Учебн. пособие. –М.: МГТУ “СТАНКИН”, 2011 –80 с. 4. Юревич Е.И. Основы робототехники. – СПб.: БХВ-Петербург, 2015. – 416 с.
8. Content of the discipline Basics of mechatronics. Designing mechatronic modules. The use of mechatronic systems. Microprocessor technology. Computer control of mechatronic systems. Information devices and systems in mechatronics. Electromechanical and mechatronic systems. Designing mechatronic systems. Basics of robotics. Technology robotic production. Drives robots. Microprocessor control devices for robots and their software. Information devices and systems in robotics. Control robots and robotic systems. Modeling and research of robots and robotic systems. Methods of artificial intelligence. Design of robots and robotic systems.	
1. Basic information about the discipline:	

Name of the discipline	Dynamics of processes in mechanical systems
2. Amount of credits	5
3. Prerequisites:	The educational programs studied by the specialties of higher (bachelor degree) and postgraduate (master) education of the Republic of Kazakhstan corresponding to the qualifier of the specialty of doctoral studies PhD.
4. Post requisites:	The knowledge gained in the development of discipline is necessary when doing a doctoral dissertation
5. Competences:	1. Mastering theoretical methods for analyzing a dynamic model of processes in mechanical systems. 2. Knowledge of methods for constructing a dynamic model of the processes of a mechanical system and the ability to apply them to solve problems in engineering, the formation of professional competencies.
6. Course author	Mamyrbayeva I.K. – c.ph.m.s., senior teacher of the department Technical mechanics
7. Main literature	1. Владимиров В.С., Жаринов В.В. Уравнения математической физики. М.: Физматлит, 2000. 2. Лионс Ж.-Л. Некоторые методы решения нелинейных краевых задач. М.: Мир, 1972. 3. Михайлов В.П. Дифференциальные уравнения в частных производных. М.: Наука, 2004. 4. Пикулин В.П., Похожаев С.И. Практический курс по уравнениям математической физики. М.: Наука, 2006. 5. Понтрягин Л.С. Обыкновенные дифференциальные уравнения. М.: Наука, 2004 (и последующие издания). 6. Математическая теория оптимальных процессов /Л.С.Понтрягин, В.Г.Болтянский, Р.В.Гамкрелидзе, Е.Ф.Мищенко. М.: Наука, 1963 (и последующие издания). 7. Тихонов А.Н., Самарский А.А. Уравнения математической физики. М.: ГИТТЛ, 2008 (и последующие издания). 8. Трикоми Ф. Дифференциальные уравнения. М.: Изд-во иностр.лит., 2005. 9. Федорюк М.В. Обыкновенные дифференциальные уравнения. М.: Наука, 2003. 10. Филиппов А.Ф. Дифференциальные уравнения с разрывной правой частью. М.: Физматлит, 2007.
8. Content of the discipline Real object and dynamic model, basic stages of dynamic calculation, mathematical model, drawing up differential equations of motion, phase planes, application of applied computer programs for solving differential equations, dynamic models with variable parameters.	

Appendix 4 Description of elective disciplines

1. Basic information about the discipline:	
Name of the discipline	Mechanical characteristics of materials
2. Amount of credits	5
3. Prerequisites:	Bachelor in stress analysis and mechanical behavior of materials.
4. Post requisites:	The knowledge gained in the development of discipline is necessary when doing a doctoral dissertation

5. Компетенции:	know: the nature of elasticity, plasticity and destruction of materials; the nature of electrical, magnetic, and thermal properties of materials; main factors affecting the mechanical and physical properties of materials; principles of hardening materials; principles of creating materials with special physical properties. be able to: determine the standard physical and mechanical properties of materials; set tasks and draw up programs for comprehensive studies of the properties of materials and products; use the results of the study of mechanical and physical properties to assess the quality of materials and products, to simulate and optimize technological processes in order to obtain the specified performance properties of materials. To be proficient in: the use of technical means and integrated methods for measuring, controlling and testing the basic properties of materials and products from them, and their use in research and calculations
6. Автор курса	Grishin A.N. – c.t.s., docent of the department Technological machines and equipment
7.Основная литература	1. Шарая О.А., Куликов В.Ю., Шарый В.И. «Механические свойства материалов» Учебное пособие по курсу, КарГТУ, 2004 2. Шарая О.А., Куликов В.Ю., Шарый В.И., Атамбаев Ж.Н. «Механические свойства материалов». Методические указания к лабораторным работам по курсу КарГТУ, 2005 г. 3. Колмаков А.Г. Методы измерения твердости Интермет Инжиниринг, 2000. 4. Куксенова Л.И., Лаптева В.Г., Колмаков А.Г., Рыбакова Л.М. Методы испытаний на трение и износ М.: Интермет Инжиниринг, 2001. 5. Иванова В.С., Оксогоев А.А., Закиричная М.М., Пруцков М.Е. Оптимизация структуры машиностроительных материалов Металлургия машиностроения, № 6, 2002. – С. 18-29. 6. Кабалдин Ю.Г., Семашко Н.А., Евстигнеев А.И. Интеллектуальный подход к процессам разрушения и синтеза материалов Металлургия машиностроения. – 2002. - № 5.
8. Content of the discipline The occurrence, mechanisms and prediction of the phenomenon of fatigue and fracture. Using stress and strain to predict crack initiation. Using fracture mechanics to predict fracture and crack propagation. The effects of stress are concentration, manufacturing, load consistency, intermittent load, and Multi-axial load.	

1. Basic information about the discipline:	
Name of the discipline	Engineering experiments and uncertainty analysis
2. Amount of credits	5
3. Prerequisites:	The educational programs studied by the specialties of higher (bachelor degree) and postgraduate (master) education of the Republic of Kazakhstan corresponding to the qualifier of the specialty of doctoral studies PhD.
4. Post requisites:	The knowledge gained in the development of discipline is necessary when doing a doctoral dissertation
5. Competences:	know: theoretical aspects of experimental research and the basic principles of the preparation, planning, implementation and analysis of engineering experiment; features and stages of an active experiment,

	based on the goals and objectives of the study; the main causes and nature of experimental errors, methods of their analysis and reduction; fundamentals of the mathematical theory of planning a multifactor experiment, methods for optimizing and increasing the compactness of the experiment; the main problems and tasks arising during the planning and organization of the experiment, the terminology used in the discipline; understand the interdisciplinary nature of the planning and organization of the experiment, own a mathematical apparatus for statistical processing of experimental results, especially the planning of an experiment in dispersive and regression analysis, be able to: carry out preliminary preparations for the study and a priori analysis of the available information, plan and analyze the results of the experiment. apply the results and planning methods to solve practical problems in their field of research, choose the optimal experiment plan, apply modern mathematical software packages for processing the results of the experiment. own: - the skills of carrying out all the steps of a simple active (planned) experiment. Demonstrate ability and readiness: to apply the results of mastering the discipline in professional activities.
6. Course author	Khan V.A.
7. Main literature	1. Основы инженерного эксперимента: Учебное пособие / С.И. Лукьянов, А.Н. Панов, А.Е. Васильев. - М.: ИЦ РИОР: НИЦ ИНФРА-М, 2014. - 99 с. URL: http://znanium.com/catalog.php?bookinfo=431382 2. Планирование научного эксперимента: Учебник/В.А.Волосухин, А.И.Тищенко, 2-е изд. - М.: ИЦ РИОР, НИЦ ИНФРА-М, 2016. - 176 с. URL: http://znanium.com/catalog.php?bookinfo=516516 3. Бутырин, П. А. Автоматизация физических исследований и эксперимента: компьютерные измерения и виртуальные приборы на основе LabVIEW 7 [Электронный ресурс] / П. А. Бутырин, Т. А. Васьковская, В. В. Каратаев; Под. ред. П. А. Бутырина. - М.: ДМК Пресс, 2009. - 265 с. URL: http://znanium.com/catalog.php?bookinfo=409558 4. Учебники по математической статистике – http://www.matburo.ru/st_subject.php?p=ms; 2. Лекции по математической статистике – http://www.nsu.ru/mmf/tvims/chernova/ms/. 5. American Chemical Society - http://pubs.acs.org/ 6. Thomson Reuters Newsmaker - http://thomsonreuters.com/ 7. База данных международной издательской компании Springer - http://www.springer.com 8. Библиографическая и реферативная база данных Scopus - http://www.scopus.com
8. Content of the discipline Analysis of technical experiments with emphasis on measurement standards, data analysis, regressions and general and detailed uncertainty analysis, including statistical processing of experimental data intervals, the spread of precision errors, correlated bias approximations and the use of uncertainty processing programs.	

1. Basic information about the discipline:

Name of the discipline	Theory and design of control systems
2. Amount of credits	4
3. Prerequisites:	Automatic management of engineering systems
4. Post requisites:	The knowledge gained in the development of discipline is necessary when doing a doctoral dissertation
5. Competences:	have experience with specific systems of automated modeling and design; have skills in developing mathematical models of processes and control objects in the CAD environment; master the skills to develop and improve methods design of tools and control systems in the framework of CAD subsystems; have an idea of the trends and prospects for the development of information support systems for the process of designing tools and systems management; have experience with specific systems of automated modeling and design; have skills in developing mathematical models of processes and control objects in the CAD environment; master the skills to develop and improve methods design of tools and control systems in the framework of CAD subsystems; have an idea of the trends and prospects for the development of information support systems for the process of designing tools and control systems.
6. Course author	Mendalieva S.I.
7. Main literature	1. Солодовников В.В., Тумаркин В.И. Теория сложности и проектирование систем управления. Наука,1990. -С. 170. 2. Информационные системы и технологии управления: Учебник / Под ред. Г.А. Титоренко. - М.: ЮНИТИ, 2013. - 591 с. 3. Агравал, Г.П. Системы автоматического управления: теория, применение, моделирование в MATLAB: Учебное пособие / Г.П. Агравал. - СПб.: Лань, 2013. - 208 с. 4. Анохин, В.В. Системы управления. Инжиниринг качества / В.В. Анохин, А.А. Варжапетян, А.Г. Варжапетян и др. - М.: Вузовская книга, 2012. - 320 с. 5. Антамошин, А.Н. Интеллектуальные системы управления организационно-техническими системами / А.Н. Антамошин, О.В. Близнова, А.В. Бобов, Большак . - М.: РиС, 2016. - 160 с. 6. Анучин, А.С. Системы управления электроприводов / А.С. Анучин. - Вологда: Инфра-Инженерия, 2015. - 373 с. 7. Варжапетян, А.Г. Системы управления: Исследование и компьютерное проектирование: Учебное пособие / А.Г. Варжапетян, В.В. Глущенко. - М.: Вуз. книга, 2012. - 328 с. 8. Сосонкин, В.Л. Системы числового программного управления / В.Л. Сосонкин, Г.М. Мартинов. - М.: Логос, 2005. - 296 с. 9. Суэмацу, Е. Микрокомпьютерные системы управления. Первое знакомство / Е. Суэмацу. - М.: Додэка XXI, 2008. - 256 с.
8. Content of the discipline Feedback principles: Benefits and cost of feedback. Analysis and design of control systems based on classical and modern approaches with an emphasis on applications to mechanical systems.	

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